

THE PROCESSES AND OUTCOMES OF PROFESSIONAL
LEARNING IN AN INNOVATIVE SCHOOL: THE
CONSTRUCTION OF AN EXPLANATORY MODEL

Thesis submitted by

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Abstract

Science and mathematics education in Australian senior secondary years is experiencing declining enrolments, negative student attitudes, a shortage of qualified teachers and a curriculum that lacks relevance to contemporary life (Masters, 2006, Smith, 2003, Tytler, 2007). Such evidence calls for transformation in secondary science and mathematics education and acknowledges that teachers' professional learning is central to achieving required transformation. Fulton Senior Secondary School¹ is a purpose built school designed to respond to the perceived crisis in teaching and learning of science and mathematics in the final years of schooling. It is also the site in which this qualitative interpretive case study was conducted. The purpose of the research was to investigate the processes and outcomes of teachers' professional learning in a setting that was designed to promote innovation and reform.

The research, conducted over a period of six years, used grounded theory methods to answer questions about what supported and sustained teachers' learning, and what were the outcomes of this learning for teachers, students and the school. To achieve an authentic account of the teachers' lived experiences, I positioned myself as an insider-researcher, working intensely and thoughtfully with staff at Fulton over a period of six years. The study revealed the nature of the interactions between contextual conditions, organisational elements and relationships factors that influenced teachers' professional learning. An explanatory model of professional learning was developed as an outcome of the theorising process. This identified the importance of alignments between: teachers' capacities, characteristics and sense of personal agency; and specific contextual conditions, organisational elements and relationship factors. Successful alignments were identified as affordances² for teachers' learning and formed the basis of the explanatory model. In essence, the contextual conditions, organisational elements and relationship factors of Fulton provided the architecture of an explanatory model of professional learning. The teachers acted as explorers of this architecture.

The research revealed that teachers brought existing beliefs and practices to Fulton, but through incidental and intentional learning, these beliefs and practices were expanded and often changed. Teachers developed deep understanding of many factors associated with effective pedagogy including: learning and learning processes; new science and mathematics content;

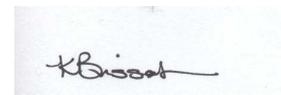
¹ Fulton Senior Secondary School is a pseudonym for an innovative Australian high school catering for students from years 10 – 12.

² An affordance is generated when environmental conditions enable the actors using the environment to achieve a desired goal.

effective curriculum design; and authentic assessment processes. The teachers were open to challenges and recognised their roles as learners in achieving the vision of the school. Their outcomes varied, but each teacher's learning influenced both the students and the school as a learning organisation. There was considerable evidence that the investment in teachers as learners was pivotal to achieving the vision of transforming science and mathematics education in the senior secondary years at this school.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

A rectangular box containing a handwritten signature in black ink. The signature appears to be 'K. Bissaker'.

.....
Kerry Bissaker 17/9/2009

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This research has been a significant journey and the outcomes are a reflection of the commitment of the teachers and leadership team at [Fulton] to learning and seeking to improve models of schooling not just for students at the school but for all those interested in reshaping schools with future perspectives in mind. The teachers and leadership team have supported and encouraged my research and acted as critical friends and co-researchers. I especially thank the teachers who acted as case studies and in particular, Jayne. Her commitment and enthusiasm helped to maintain my own and the opportunity to work closely with her was an absolute privilege.

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Dedication

This thesis is dedicated to my family – my greatest teachers.

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1. Introduction

“Educational change depends on what teachers do and think. It’s as simple and complex as that.”

Fullan (1991, p.117)

This research was situated in the context of Fulton³ Senior Secondary School, an innovative school designed to significantly change the teaching and learning of science and mathematics in the final three years of high school. The school explicitly recognised teachers’ learning as fundamental to achieving its reform agenda and the purpose of the thesis was to identify the processes designed to support teachers’ learning and the outcomes of the learning for the teachers in particular but also students and the school. Developing a deep understanding of the processes and outcomes of teachers’ learning was foundational to the development of an explanatory model of teachers’ learning in the innovative context and provided insight into factors of importance in generating and sustaining a changed model of science and mathematics education in senior secondary school.

The research outlined in the thesis was important and timely as several Australian government sponsored reports (Goodrum, Hackling & Rennie, 2000, Masters, 2006, Smith, 2003, Tytler, 2007) revealed that science and mathematics education in the post-compulsory years of schooling was in crisis with enrolments in some Year 12 topics declining by up to 40% over the period 1978 to 2002 (Masters, 2006, Dekkers & DeLaeter, 2001). Tytler (2007) suggested the ‘four main elements to the crisis in science education were:

- evidence of students developing increasingly negative attitudes to science over the secondary school years;
- decreasing participation in post-compulsory science subjects, especially the ‘enabling’ sciences of physics, chemistry, and higher mathematics;
- a shortage of science qualified people in the skilled workforce;
- a shortage of qualified science teachers (p.7).

In Tytler’s report there is a call “for a significant ‘re-imagining’ of science education as opposed to the mere refinement of curriculum and assessment” (p.1) and a claim that this ‘re-imagining’ would require a significant focus on the role of the teacher and how to develop teachers’ knowledge, pedagogical practices and dispositions to re-engage students with the

³ Fulton is a pseudonym used to identify the school at the centre of the research.

disciplines of science and mathematics. The school at the centre of the research was specifically designed to develop and deliver a 're-imagined' curriculum that reflected the recent knowledge explosion in science and to re-engage students in learning across the science and mathematics disciplines. Fullan (1991) said what teachers "do and think" as they learn about new content and use new pedagogical approaches is fundamental to achieving educational change. Therefore understanding what teachers thought and did as they engaged in learning and working in the innovative school was fundamental to understanding their influence on the changes envisioned at the school. The research employed an interpretive case study method to document the processes and outcomes of teachers' learning, with an emphasis on teachers' learning processes and outcomes that were directed to achieving the kinds of changes in science education that Tytler called for.

Fullan's proposition that educational change is dependent on what teachers do and think suggests that without changes in teachers' beliefs and actions life in classrooms will continue in existing forms; it's as simple as that. However, the processes that support changes in teachers' beliefs and actions are complex and involve a number of competing and interacting factors. These factors go beyond time and money to engage in professional learning to include political and social perspectives on teachers' work. Teachers work in a changing society and economy where significant growth in and access to knowledge and communication has generated new demands and opportunities for students as future citizens. Hargreaves (2003) highlighted, "we are living in a defining moment of educational history when the world in which teachers do their work is changing profoundly...whoever enters teaching and however they approach their work will shape the profession and what is able to be achieved with our children for the next thirty years" (p. xvii). Such perspectives situate teachers as important catalysts of educational change in a society that has already changed. The creation of Fulton explicitly acknowledged changes in the scientific and technological world and that teachers were pivotal to bridging the gap between students' schooling and their real world.

An increasing number of Australian researchers also acknowledged teachers as the change agents for improving outcomes for students. Aubusson et. al. (2007), Ingvarson, (2001, 2003, 2005), Ingvarson & Semple, (2006), Hattie, (2002), Meiers & Ingvarson, (2005) Rowe (2007) to name a few, all suggested that teachers and the teaching that occurs in classrooms influences outcomes for students. These researchers focused closely on the processes that supported teachers in developing new practices and the role teachers played in achieving school-level changes. All called for ongoing research in the area. The Australian Federal Government through its Teachers for the 21st Century initiative provided significant funds for teachers' professional learning citing research that "confirms [the] value of professional

development in raising educational standards” (DETYA, 2000, p.1). Funding through the Australian Government Quality Teacher Project supported and identified models of teacher learning from which other schools could learn. The research provided an excellent opportunity to contribute to the knowledge of teachers’ professional learning and its relationship to educational change and, in particular, the role teachers’ professional learning plays in the ‘re-imagining’ of science and mathematics education in the senior secondary years of schooling.

Fulton Senior Secondary School (Fulton), the site of the research, had been uniquely designed to support a renaissance in the teaching and learning of science and mathematics. As Tytler (2007) reported, “there is clear evidence that the curriculum and classroom practice is failing to excite the interest of many if not most young people at a time when science is the driving force behind so many developments and issues in contemporary society” (p. 15). Rice (2004) added, “biotechnology, information technology and now nanotechnology have captured the imagination of the world, and nations are making huge investments in these areas publicly and privately ...How can schools and education systems operate in ways that keep pace with these?” (p.1). Traditional science and mathematics curricula and traditional ways of teaching science and mathematics, particularly in the senior years of schooling, needed changing (Ainley, 2004). Fulton aimed to do this through:

- creating a learning environment design that varied significantly from traditional schools,
- designing a curriculum that is interdisciplinary and focuses on the new sciences,
- developing partnerships with university and industry, and
- investing in teachers’ learning to promote these changes.

Fulton is described as a school that:

Responds to current and future interests and needs of its students by establishing models of excellence in science and mathematics education; provides a learning culture for its students that develops deep inquiry in scientific studies in partnership with university and industry scientists and educators; prepares young people to be creative, critical, informed and motivated contributors responding to professional, personal and social issues; and, is an agency for change and enhancement of science and mathematics education...nationally and internationally (School Promotional Document, 2004, p.2).

Achieving such a mission had significant implications for teachers in this school. Teachers would no longer engage in teaching a single discipline area in closed classrooms for short lesson periods. Instead they would engage in designing and teaching an interdisciplinary curriculum in collaboration with other teachers and academics. They would work in a technology-rich, open-space environment and access professional learning opportunities and support that are not

evident in more traditional secondary schools. The role of teacher in the school would require new ways of working and thinking for the desired outcomes of the school to be achieved.

The teachers appointed to Fulton applied and were selected for employment indicating their strong interest in working in an organisation that was designed to do things differently. Selection on merit also indicated that the leaders of the school considered the teachers to be well suited to working in innovative ways. Teachers were well aware of the expectations to work in different ways and for the need to change patterns of thinking and working to achieve the desired outcomes of Fulton.

A purpose-built school with selected staff would appear to be the best scenario for positive outcomes. However, van den Berg (2002) said:

Educational developments are, by their very nature, quite complex. They can bring unexpected problems with them. More than ever, teachers see themselves exposed to unpredictable and unexpected environmental influences and risks...New methods of working and expectations...do not [always] correspond to the opinions of teachers with regards to what constitutes 'good teaching'. (p.579)

Elmore (1996) also argued that school reform will not affect the "core of educational practice: how teachers understand the nature of knowledge and the student's role in learning, how these ideas are manifested in teaching, student grouping practices, teachers' responsibilities for groups of students, processes for assessing student learning and communicating it to others" (cited in Sparks, 2002, p.2-4). Fulton changed many of the 'core educational practices' to which Elmore referred. Year 10 and 11 students were not segregated into year levels but completed their learning in interdisciplinary Central Studies together, teachers were tutors of a small group of students who met daily for the three years of their schooling, all teachers worked in teams to teach the Central Studies and the teaching environment provided access to the latest technology to support student and teacher learning. The educational scenario of Fulton changed in many ways the traditional notion of senior secondary schooling and it was not just incremental change (Quinn, 1996). Therefore my research provided an excellent opportunity to consider whether Elmore's contention that school reform does not change teachers' core educational practices and beliefs about "the nature of knowledge and students' role in learning" and whether the complexity of working in such changed conditions resulted in teachers holding on to their inner 'source' (Scharmer, 2009) and sense of professional identity.

Quinn (1996) argued that, "deep change differs from incremental change in that it requires new ways of thinking and behaving...it is change that is major in scope, discontinuous with the past, and generally irreversible" (p.3). At Fulton the building, curriculum and timetable had all been changed but without changes in teachers' beliefs and practices the vision for the school would not be achieved. This generated a number of questions to be considered in the

research process including how teachers' learning was supported, what was prioritised by teachers in relation to their learning and, what processes the teachers reported as being supportive of changes in their beliefs and practices.

1.1 Aim of the thesis

The aim of the thesis was to investigate the processes and outcomes associated with teachers' professional learning in a setting that was designed to promote innovation and reform in the teaching and learning of science and mathematics. The research focused on teachers' descriptions and explanations of how they learned and what the outcomes of their learning was for themselves, students and the school as a learning organisation. The analysis of teachers' descriptions of learning processes and the outcomes of the learning served as the foundation for generating an explanatory model of teachers' learning at Fulton. The explanatory model sought to represent the contextual, organisational and relational complexities associated with teachers' learning in a school seeking to influence science and mathematics secondary education in the 21st century. Finally, the thesis also aimed to analyse how the explanatory model reflected and contributed to the existing literature on teachers' professional learning and processes for enhancing the qualities of existing science and mathematics teachers.

Teachers' learning is a significant issue for educational researchers. Wideen (1992) noted the importance of teachers' learning in promoting change at the school level stating that "no major reform in our school system will occur without the frontline people who will eventually make it work: the teachers" (p.153). Such a statement suggested that teachers' learning is fundamental to school level reform and in turn school level reform is fundamental to system level reform (Hargreaves, 2006). In essence Wideen claimed that system level reform will fail at the school level if teachers do not engage with the reform by making changes in practices. Fulton was designed as a major educational reform and teachers were critical to the success or failure of the reform.

In reality Fulton was more than just a reform, it was an innovation in the field of science and mathematics secondary education. Smith (2006) suggested, "innovation often arises from a perceived crisis or hitherto intractable problem, its methods are closer to that of experimentation, and its outcomes often include an element of the unexpected" (p.2). Smith goes on to describe innovation as a "kind of wager, where a favourable outcome is hoped for but not guaranteed" (p.2). Fulton was a 'kind of wager' where much money had been invested in ultimately increasing the number of students who would study science and mathematics in the senior secondary years and that these students would then go on to boost the numbers of students studying in science and mathematics related fields in the tertiary sector. Although it

was not possible in the scope of this thesis to determine the outcomes of this vision consideration of the links between teachers' learning and outcomes for students is discussed.

Smith (2006) provided parameters for defining innovation highlighting that:

- Innovation is a process, i.e. not an invention, nor an object per se, even if later it acquires an 'object-like' status
- The process is both dynamic and social, involving negotiations to enrol new actors whilst maintaining existing actors within an innovation
- The raw materials of the innovation are ideas, practices and actors, aligned and reformed in novel ways
- The purpose is to overcome a perceived crisis, problem or issue
- The innovation is site-specific; it is strictly relative in its newness. The alignment of 'ideas, practices and actors' is novel only to a specific location, context and time. (p.4)

These parameters captured well the essence of Fulton and served as evidence for the school being described as innovative. Teachers were the major actors supporting innovation at Fulton, the raw material came from their existing beliefs and practices which were subsequently shaped by the process of engaging with new ideas and practices. New actors including new teachers, students, academics, and other visiting professionals, all contributed to the 'dynamic and social process' of teachers' learning and an aim of the thesis was to capture this in an explanatory model of professional learning. However, as Hargreaves, Earl, Moore, and Manning (2001) noted, "Adopting an innovation or reform is relatively straightforward enough. Developing, supporting and sustaining it is a far more difficult matter" (p.115). The thesis focused on whether the explicit attention to teachers' learning resulted in a culture of innovation being sustained over time.

Fulton, the site of this research, had been designed specifically to create a learning community where all members viewed themselves as learners and had the opportunity to engage in authentic learning that led to deep understanding of and changes in approaches to teaching and learning (Beare, 2001). Given that the teachers in this school were paramount to leading innovation and reform it was important to determine how existing beliefs and practices about effective teaching and learning changed as a result of working in the innovative environment. Teachers' learning was not an incidental aim of the school rather it was critical to the innovation and reform process. The school stated that:

[Fulton] has a vision to provide a learning culture for its students that derives from a learning culture developed by its staff from their interaction with university and industry scientists and educators. (School policy statement, 2003)

The thesis aimed to determine how processes and outcomes of teachers' professional learning shaped the curriculum offered in the school, pedagogical practices, the learning culture of the school, and learning for students and the wider educational community.

Fulton aimed to be "a quality school that provides leadership of innovation and reform of the teaching and learning of science and mathematics" (Vision Statement, 2004). There was a mandate for change in teachers' roles and practices and therefore there was good reason to research the processes designed to support such outcomes. Learning and change in teachers' beliefs and practices were desired by both the school's vision and mission, and by the teachers who accepted positions at the school. Documenting the processes and outcomes provided evidence of the links between epistemologies (what is taken to be true) and ontologies (what is taken to be real) and ultimately axiologies (what is taken to be of value) in this site (Piantanida, Tananis, & Grubs, 2004). The use of grounded theory methods assisted in creating a "conceptual mosaic" (Piantanida et al., 2004), that served to explain the meaningful events, processes and relationships that teachers at Fulton described as learning and making a difference to their beliefs and practices.

1.2 A framework to guide the research

As Piantanida et al. (2004) suggested, "the creation of a conceptual mosaic is the core of the theorising process" (p.340). However, the theorising process of the researcher often commences with a review of the literature that is linked with the phenomenon to be investigated. Three themes emerging from the review of the literature and preliminary work at Fulton that guided the research design were; 1) aspects and processes of learning and pedagogy that support deep understanding, 2) models and theories of high quality professional learning, and 3) change processes. The research literature in these areas was reviewed to serve as a reference point for analysing teachers' descriptions and explanations of their learning, and to assess the characteristics and quality of the school's professional learning strategy in supporting teachers' learning.

The three themes used to shape the framework in this thesis could have been condensed to two, learning and effective professional development with change being embedded in both themes. Leo Buscaglia (cited in Guskey, 2000) said, "change is the end result of all true learning" (p. 242). Change in this thesis was not just concerned with the outcome of learning, (change as verb) it was also about working in change (change as noun). Working at Fulton meant working in changed conditions, teachers no longer taught within a specified discipline, they no longer worked in closed classrooms and they were required to work in collaborative ways with colleagues, university partners and students.

The literature on change (Darling-Hammond & Sykes, 1999, Hargreaves et al., 2001, Fullan, 2001, Loucks, Newlove & Hall, 1975 (cited in Hall & Hord, 2001)) argues that change is complex and demands intellectual and emotional work. To deny the emotional work associated with teaching and change is paramount to ignoring the foundations of teachers' professional identity (Hargreaves, 1997, 1998). Hargreaves et al. (2001) claimed that "change is rarely straightforward and certain kinds of change can be inordinately difficult to achieve" (p.115). Fullan (2001) stressed that if we are to support effective change we need to understand the process well. Given this tenet, change was included in its own right in the themes that guided the initial literature reviewed in the thesis. The three themes are now briefly introduced but are addressed in more detail in Chapter 2.

1.2.1 Teaching and learning that support deep understanding

Bransford, Brown, and Cocking (1999), stated that, "Learning is a basic, adaptive function of humans. More than any other species, people are designed to be flexible learners and active agents in acquiring knowledge and skills" (p. xi). The recognition that learning is an 'adaptive' function of humans was of interest in this thesis. The teachers commencing work at Fulton needed to adapt to new ways of working beyond the safety of individual classrooms. How this occurred was dependent on not only their individual characteristics, for example, their 'flexibility' but also on their sense of being an 'active agent' in the processes of adapting to new ways of working. However, conceptualising the process of effective learning outcomes for students and teachers at Fulton was complex as it was influenced by other variables such as the learning environment, the nature and relevance of the learning, and the pedagogy intended to support that learning.

The school was designed to promote high quality student engagement and enhanced learning outcomes in the senior years of schooling. However, the teachers in this school, as in many other schools, may view the enhanced learning outcomes as being student focused rather than also being teacher focused. Bransford et al. (1999) claimed that "...teachers are generally accustomed to feeling efficacious - to knowing that they can affect students' learning - and they are accustomed to being in control" (p. 183). Teachers see themselves as being responsible for the learning of others but often struggle with the notion of being learners themselves. Teachers as learners was a primary objective of the school's vision with an explicit strategy in place to engage all teachers in learning.

Fulton's professional development strategy was designed to support teachers' learning and features of the strategy were analysed to consider how it provided opportunities for teachers to develop their own deep understanding of new content, pedagogical approaches and processes

of their own learning. Teachers' learning at Fulton was contrasted with the research on aspects of learning that promoted deep understanding including learning by design or by chance, learning for understanding, learning and expert learners, stages in the learning process, and learning and reflection (see Chapter 2 for a more detailed discussion on these aspects).

Learning about new content was also paramount at Fulton as the school had a mandate to develop curriculum in the new sciences, for example, nanotechnology and biotechnology. The school employed staff who had expertise in specific disciplines and some staff had doctorates in the fields of mathematics, chemistry and biology. However, few teachers had extensive and deep knowledge in the new sciences and expertise in content knowledge has been identified by research as a factor in effective teaching (Bransford et al., 1999, Hattie, 2003, Wilson, 2003). Wilson (2003) said you can't have sound pedagogical content knowledge "without knowing a subject deeply and intimately, and you can't be a good teacher without it" (p.6). However, being an expert in an area of content does not guarantee an ability to be an expert teacher, particularly in an environment that differs significantly from the traditional classroom or in the case of some of these teachers' experiences, the research laboratories (Bransford et al., 1999). Darling-Hammond (1999) stated that teacher expertise is an important variable in enhancing learning outcomes for students; however, the expertise she describes was not in content areas but in the areas of teaching and learning. She specifically noted that "...teachers who know a lot about teaching and learning and who work in environments that allow them to know students well are the critical elements of successful learning" (p.8). Such research indicated that the professional learning strategy at Fulton needed to explicitly provide for learning opportunities in both content and pedagogy. However, it was possible that teachers believed they had sound pedagogical knowledge and wished to focus their learning on the new sciences. My research sought to determine if this was the case.

Shulman (1987) identified the need for teachers to have sound "pedagogical content knowledge" to promote effective learning outcomes for their students. He was supported by Wilson (2003) who contended that teachers should "know absolutely essential things about learning a subject...understanding the conceptual problems in the discipline" (p.6) and have the ability to address these well with students. Hattie (2003) also observed that expert teachers easily identified the important representations within a content area and provided guidance through the learning in a challenging yet supportive way. Such teachers exhibited fluency of pedagogical decision making that best suited the learning situation and individual student's needs. However, research that indicated teachers with sound 'pedagogical content knowledge' were significant to improved student learning outcomes was of interest given that teachers at Fulton were faced with teaching new science for which they did not have deep knowledge.

Through the research process I aimed to understand how such scenarios influenced teachers' approaches to learning and what the outcomes of teachers being novices in particular content were.

Defining the learning challenges that would be encountered by teachers working at Fulton could not be simplified to having effective 'pedagogical-content knowledge' (Shulman, 1987) and/or accessing support for development in this area; rather a more complex picture emerged. Schon, (1987) said:

...professionals work in very different ways, rather than inhabiting the 'high ground' of professional certainty, they have to work in the 'swampy lowlands' of everyday life, facing situations that are complex and messy, defying easy technical solutions: 'the problems of real world practice do not present themselves to practitioners as well-formed structures. Indeed they tend not to present themselves as problems at all but as messy indeterminate situations. (p.4)

The teachers at Fulton were working 'in change' where meeting the expectations of the school's vision and the learning needs of students were not easily defined. Teachers were faced with many 'messy indeterminate situations' that required new practices. However, existing beliefs and practices that had been developed from working in other teaching situations, sometimes for many years, might serve to inhibit teachers' abilities to achieve the school's vision. As van den Berg (2002) identified, "teachers...build their own opinions or meanings on the basis of their own experiences and knowledge of actual practice. In doing this teachers may adopt or reject the opinions of others" (p.580). This concept connected well with the observations of Wideen (1992), who also recognised, "no major reform in our school system will occur without the frontline people who will eventually make it work: the teachers" (p.153).

The concept of aspects of learning and pedagogy that support deep understanding provided an anchor point for theorising about teachers' descriptions and explanations of their own learning processes and subsequent pedagogical practices. The theorising process enabled me to generate an explanatory model of teachers' learning at Fulton. In this sense the epistemological perspective was reviewed through drawing on teachers' ontological perspectives. The outcome of the process aimed to reflect sufficient detail of the phenomena of teachers' learning in the context of Fulton so that it was recognisable as "truly conceivable experiences" (Piantanida et al., 2004).

1.2.2 Characteristics of professional learning that promote effective teacher learning

While the research focused specifically on the teachers' perceptions of their learning experiences within the school, the school as an organisation had significant influence on the learning opportunities available to teachers. The school was diligent in developing a strategy to

support teachers' professional learning by drawing on recent research in this area. The term professional development was initially used by the school as it was commonly used in the literature to describe opportunities for teachers to engage in ongoing learning with a view to improving their knowledge and practice. However, the term professional learning is used in the thesis as it more accurately reflected the holistic notion of teachers' as learners desired by the school. Fullan (2007) also suggested that "Professional development as a term and a strategy has run its course" (p.35). He contended that much professional development does little to change teachers' beliefs and practices and at times "diverts people's energy into thinking they are doing something valuable, and drains energy that should be directed at the hard work of changing school cultures that are deeply rooted in the past" (p.35). Fullan's reflection connected with my thesis and I was interested in how his perspectives were reflected in the processes and outcomes of teachers' learning at Fulton. A more detailed discussion of the variation between professional development and professional learning is found in Chapter 2. However, the term professional development is used often in the following paragraphs as a reflection of the literature reviewed.

Research from the past two decades presented a dichotomous view on optimal approaches to quality professional development, noting that many traditional models of professional development were considered fragmented and poorly coordinated (Guskey, 1995, Cohen and Spillane, 1992 cited in Sykes, 1999, Darling-Hammond & Richardson, 2009, Ingvarson, 2001). Often little thought had been given to the strategic application of knowledge and skills presented in professional development programs. Many professional development programs were presented as "one hit wonders" with a focus on the latest 'trend' (Hawley & Valli 1999).

Increasingly, it is recognised that there is no one 'perfect' approach to successful professional development because the content, process and contextual variables will differ across programs, styles of delivery and learning, and situation (Darling-Hammond & Richardson, 2009, Timperley et al., 2007). However, Hawley and Valli (1999) described eight characteristics of effective professional development that influenced the design of the professional learning strategy at Fulton. The characteristics included:

- teachers clearly identifying their learning needs
- driven fundamentally by goals and standards for student learning
- primarily school based and integrated with school operations
- processes that involve collaborative problem solving
- organisation based on the continuous and ongoing involvement of a cohesive group
- opportunities to develop theoretical understanding of new knowledge and skills

- integration of professional development within a comprehensive change process including the facilitation of student learning
- incorporating evaluation of multiple sources of outcomes for teachers, students and organisations. (p.138)

Fulton's professional development strategy aimed to embed many of these characteristics in their planning for teachers' learning (see Appendix A for details of the school's PD strategy). Key features of the Fulton strategy included teachers designing individual professional learning plans to suit their specific learning needs, a structured whole school professional development program centred on teams of teachers engaging in curriculum design and action research projects, and the promotion of teachers as leaders of learning for teachers beyond the school.

Understanding how teachers valued and engaged in professional learning opportunities provided by working at Fulton, and the outcomes of their learning, was critical to developing a deeper understanding of teachers' perceptions of their learning. Of particular interest was whether the teachers' accounts reflected the characteristics of effective professional development as described in the literature or whether other aspects of working in the innovative environment influenced changes in beliefs and practices.

1.2.3 Change processes and perspectives

Fulton was built for the purpose of 're-envisioning' the teaching of science and mathematics in the senior secondary years. To successfully change existing paradigms and practices in this field required shared commitment and congruence between the different stakeholders at the school. At Fulton, different stakeholders had different expectations; parents expected the school to support their children in achieving improved learning outcomes, leaders expected the school to develop new and innovative curriculum and pedagogical practices, academics expected teachers to incorporate the 'new sciences' in the curriculum while the state assessment authority expected the teachers would adhere to specific reporting processes. Stakeholders' expectations all connected to teachers' work and subsequent learning but it appeared clear that teachers would be expected to work in changed ways with some aspects of their work changing rapidly and others less so.

Guskey (2000) in reviewing outcomes of professional development suggested that "significant change in teachers' attitudes and beliefs occur primarily after they gain evidence of improvements in student learning" (p.139). The challenge for teachers (and the administration and leaders) in this school was that new ways of working were required before student learning outcomes could be determined. It was possible that these demands would result in teachers making strategic and/or surface level changes in practices while maintaining existing beliefs

about how students learn most effectively (Biggs, 2000, Guskey, 2000) and the research sought to determine if this was an outcomes of teachers' learning (and work) at Fulton.

The concept of significant change implies a major move away from pre-existing beliefs and practices. Research suggests that to achieve deep change, evidence of why the change is desired, time to engage with the change and clear goals of desired outcomes are required (Fullan, 2001, Guskey, 2000, Hall & Hord, 2001). The expectation of working in different, possibly untried ways, requires a belief that the changes will result in better outcomes. Guskey claimed that teachers rarely make changes in practices based on belief alone, but at Fulton this may be the case more often than not, given the focus on and expectation of being innovative.

An additional perspective on change is the concept of generative change described by Franke, Carpenter, Levi, and Fennema (2001). They suggested that teachers with significant experience do not view outcomes of professional learning experiences as making significant change to their beliefs and practices. However, Franke et al. said, "generativity refers to individuals' abilities to continue to add to their understandings. When individuals learn with understanding, they can apply their knowledge to new topics and solve new and unfamiliar problems" (p.655-656). Teachers' descriptions and explanations of factors, activities and situations that influenced and/or resulted in changes in their beliefs and practices provided insight into the outcomes of teachers' learning in the thesis.

Teachers are pragmatic (Atkinson & Claxton, 2000, Biggs, 2000, Bransford et al., 1999, Loughran, 2002) and hence discussion about, and development in, technical and practical aspects of teaching are often obvious focal points for professional learning and change. However, there is another level of development that required attention, particularly in the Fulton context. Brown and Jones (2001) proposed that teachers as professionals should view their roles from an evolutionary perspective and to support this "there is a need to build in a self-reflexive dimension which positions the evolving individual in their evolving professional situation" (p.35). The research sought to determine if the roles of the teachers in this school evolved as a result of their learning and changes in the beliefs about their professional identity and practices.

van den Berg (2002) highlighted the importance of considering institutions not from an organisational framework but from a 'micropolitical perspective' because:

Teachers' opinions and reactions to policies pertaining to their professional practice depends, in part, on their own personal meanings. That is, most changes deeply affect teachers: how they perceive themselves, how they present themselves, what they consider important – in short, their entire professional identity. In addition to this, it is typically assumed that the professionalism of teachers is largely shaped by the continual interaction between their beliefs, attitudes and emotions – on the one hand – and the social, cultural, and institutional

environment in which they function on the other hand. As a result of their interactions with the environment, teachers also construct specific meanings with regard to themselves and their profession. (p.582)

van den Berg's comments captured well an important element of this thesis, the changing nature of the teachers' professional beliefs and practices that occurred as a result of their learning and work at Fulton and the explanations they provided for these changes. The explanations formed the foundation of the explanatory model of how professional learning occurred in an innovative environment and its role in the outcomes for teachers, students and the school as innovative and reforming.

1.3 The research questions

I developed an initial framework to guide the research and theorising process. The core features of this framework are set out in Figure 1.1. The framework acknowledged that teachers' brought existing beliefs and practices to their positions at Fulton and that these would affect their engagement in, and outcomes of professional learning. Central in the framework was the professional learning strategy designed to provide teachers with opportunities to learn about new content, teaching and learning. Learning would take place in both intentional and incidental ways and the outcomes of teachers' learning would result in surface, strategic and/or generative changes in practices and beliefs. I anticipated a bi-directional flow between aspects of the framework prior to the data collection process as indicated by the double-headed arrows. I theorised that these interactions would create a generative model of professional learning but needed to define how and why this may be the case. The framework, developed from initial engagement with the literature and time in the field, assisted in generating the following research questions:

1. How was teachers' professional learning supported and sustained in the context of this innovative school?
2. What were the processes of teachers' learning in the context of an innovative school?
3. What were the outcomes of teachers' learning for teachers in this context?
4. What were the outcomes of teachers' learning for the school and its students?
5. What factors, activities or situations associated with working in this school led to changes in teachers' beliefs and practices?
6. How do the processes and outcomes of teachers' learning in this innovative context reflect and contribute to the literature on teachers' learning?

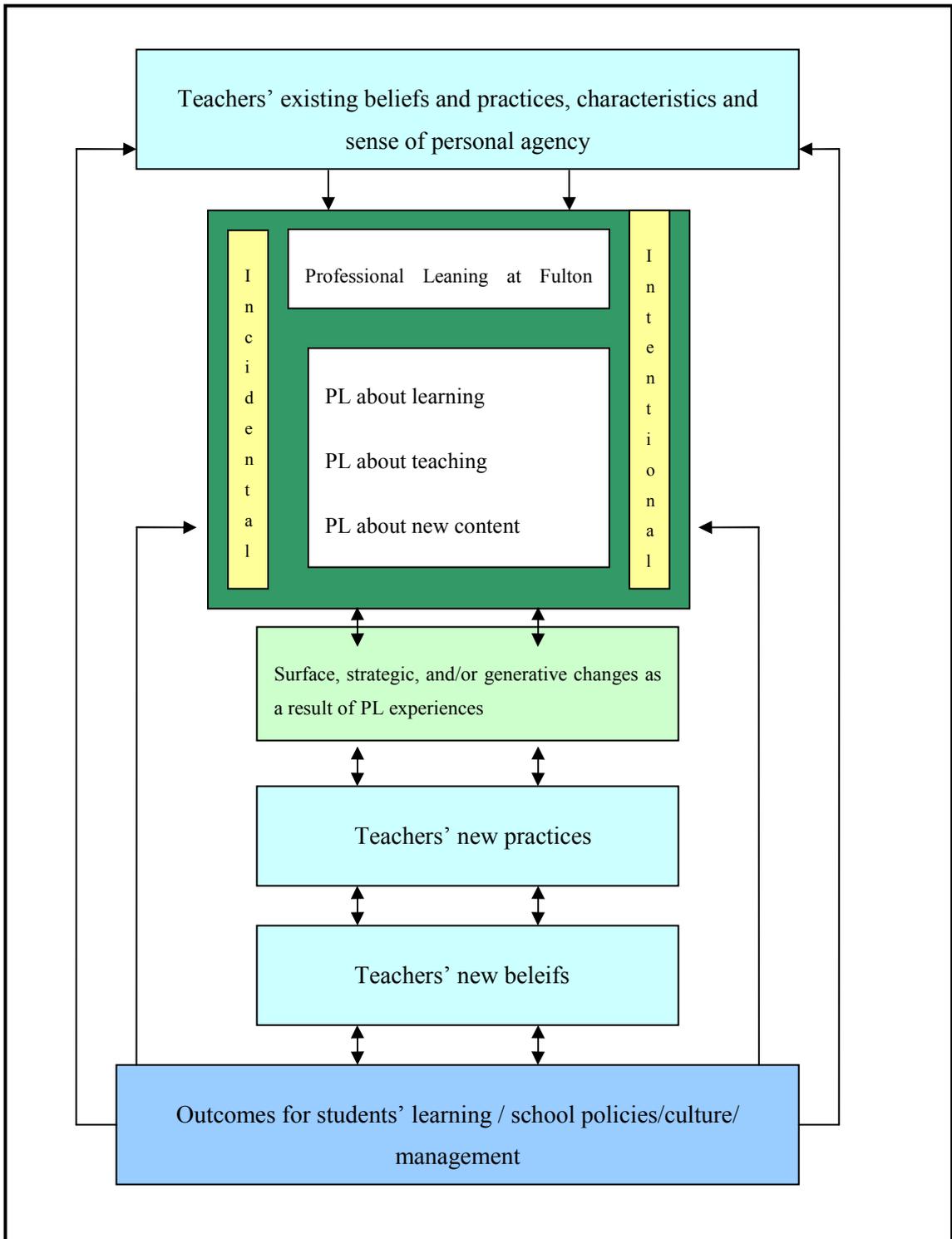


Figure 1.1 Framework for investigating professional learning at Fulton.

1.4 What is the potential contribution of this thesis?

The development of Fulton has been subject to much interest from local, national and international educational organisations. The school was the first of its kind in Australia and as such subject to close scrutiny from a number of stakeholders, including state and federal governments, education departments, teachers unions, higher education and research organisations, examinations boards, other high schools and, of course, the parents and students of the school community. The school has had over 5000 visitors since its inception in 2003. Given such strong interest in the development, management, activities and outcomes of the school, detailed documentation of the processes and resources required to support teachers' learning and the role teachers' learning played in achieving the school's vision provided an important contribution to outsiders' understanding of factors of significance in a unique and 'cutting edge' educational reform.

Loughran (2002) cited Dewey (1929) who argued that:

...educational practices themselves must be the source of the ultimate problems to be investigated if we are to build a science of education, so a focus on teacher research [and learning] is paramount as it is teachers who work in the crucible of educational practice from which the 'problems' are derived. (p.10)

The foundation teachers in this school were central to developing the educational practices of the school and this thesis documented how the teachers at Fulton made sense of working in an innovative environment, engaged in professional learning and the processes that generated changes in their beliefs and practices. Through this documentation the thesis contributed to the research in the area of teachers' learning, an area which Bransford et al. (1999) suggested "is relatively new as a research topic, so there is not a great deal of data on it" (p.183). Little, (2008, cited in Crow, 2008) also made note:

Most research, my own included, tends to identify existing instances of robust communities, but doesn't account very well how they got there. So professional learning communities are hot, they are increasingly organised, but they have been relatively weakly informed in terms of trajectory – how you would get started, what you would focus on? (p.54)

The longitudinal nature of the research provided an excellent opportunity to document how a robust learning community was generated and the actions, people and resources that contributed to and helped sustain it.

van den Berg (2002) added to the call for additional research into teachers' perceptions of factors that make a difference to their beliefs and practices. In doing so he suggested that there needs to be "an increased attention to individual teachers' interpretation of situations along with

increased attention to the interactions of such interpretations with the context in which teachers live and work” (p.617). van den Berg added that:

Despite the considerable body of literature now available on the professional development of teachers, relatively little research has been conducted on the development of teachers’ professional practices in relation to their beliefs, attitudes or emotions – in short teachers’ meanings with regard to their education practices have not been widely considered. (p589)

My research provided an opportunity for such documentation to occur.

Guskey (1992) also noted that “relatively few of today’s most popular education innovations have been thoroughly investigated” (p.5). Sparks (2002) agreed, suggesting that:

Staff development efforts are based on the educational fad du jour with little thought given to the congruence between teacher learning and the school’s goals for student learning. As a result, teachers’ energies are dissipated and time and money are invested to little effect. (p.9-4)

The comments of Guskey and Sparks supported the importance of detailed investigation and documentation of the processes and outcomes of teachers’ learning at Fulton. As a school engaged in significant educational innovation, understanding what supported or impeded changes in teachers’ beliefs and practices also served to evaluate progress towards the school achieving its vision. Generating an explanatory model of professional learning in an innovative school also added to the literature on elements of design and management of professional learning that promotes improved outcomes for teachers, students and the school.

Given that the research was conducted in a specific site the concept of transferability is questionable. However, Greene (1990) in discussing the concept of transferability in relation to interpretive research suggested that if the researcher constructs the thesis in such a way that it is accessible by potential users, the transferability is then in the hands of others. Greene stated:

The final judgement [about transferability]...is vested in the person seeking to make the transfer” (Lincoln & Guba, 1985, p.217). Such persons may be interested readers, others researchers or practitioners, lending multiple meanings to the transferability concept. In short, interpretive inquirers must provide for the possibility of transferability, but its actualization - in the form of scientific knowledge accumulation or enhanced practice – depends on the interests of the potential users. (p.237)

1.5 How is the thesis organised?

The thesis is presented in seven chapters. This chapter, Chapter 1, provides background information, introduces the major themes that situate the research and presents an initial framework for guiding the data collection and analyses processes. Chapter 1 concludes with the research questions and consideration of the potential contributions of the thesis. Chapter 2

reviews literature of relevance to the thesis. Chapter 3 discusses and justifies the research methods used in the thesis. Chapter 4 provides a detailed description of the contextual conditions, organisational elements and relationship factors that supported and sustained teachers' learning and subsequently featured in the explanatory model that emerged as a result of the research process. Chapter 5 presents the explanatory model of professional learning in action through five case studies in which teachers' stories of learning are mapped against the model. Chapter 6 focuses on the outcomes of the teachers' learning for teachers, and the influence of their learning on their beliefs and practices and outcomes for students and the school as a learning organisation. Chapter 7 concludes the thesis with discussion and reflection on outcomes of the research in relation to issues that emerged, the actual research process, contrasts with, and support for existing literature in professional learning, and recommendations for future research at Fulton and in other settings.

2. Literature Review: Preconceptions and sensitising concepts

“How do we perceive anything new? To address this question in a scholarly manner, one reads the experts across the ages in order to find out what they said and what rings true with us today. To address this question in an enquiring manner, one interrogates closely one’s own experiences, and juxtaposes that with what others have said” (Mason, 2002, p.230).

“...many grounded theorists emphasise the role of pre-existing theory in sensitising the researcher to orienting questions that need to be examined during research. The task of the grounded theorist is to allow deductions from pre-existing theory to suggest specific research problems and foci, but the researcher must not allow this pre-existing theory to constrain what is noticed” (Ezzy, 2002, p.12).

“...literature is a very important data source to support the writer’s contentions and central argument and must be carefully presented at appropriate places in the thesis” (Clare & Hamilton, 2003, p.27).

2.1 Introduction

Mason (2002, p.230) poses the question: “How do we perceive anything new?” In this thesis the process of perceiving something new occurred by initially consulting research in the broad areas of learning and pedagogy, professional learning and change, and making use of this literature and my initial experiences in the field to generate the research questions. The initial literature review sensitised me to key themes and ideas that served as core background knowledge to commence the research. However, the process of grounded theory requires the researcher to continually consult the literature as new issues emerge from time spent in the field. The process of constantly reflecting on the initial literature reviewed in relation to the data being collected, and the subsequent need to seek new literature to explain the stories emerging from the research, was at the heart of perceiving something new.

The task of searching the literature for an explanation of what is perceived in the field and its relationship to my own findings was well supported by ease of access via the internet to a rapidly expanding knowledge base. However, it is rare for any literature to be able to fully explain the complexities and true nature of a specific case and this is true for my research. There is no doubt that all the literature I reviewed throughout the process of the research made a significant contribution to the thesis although it is clear to me how the grounded theory approach shifted the focus from the initial literature reviewed to fields that had not initially been considered. Other researchers may have considered areas that I did not in the early sensitising

days but my choice of literature was indicative of my thinking and experiences prior to spending time in the field.

The shifts in focus provided evidence of new learning for me; learning generated by engaging in the grounded theory process. These shifts are best reflected in considering the evidence that influenced new ways of thinking but this then provided the challenge of how to present the literature review. Does one include upfront all the literature reviewed that contributed to the thesis or present it as the sensitising literature in one chapter followed by the literature that emerged as significant as it connects with the research findings? And what of the initial sensitising literature that failed to be represented in the research? Should one leave this out or make use of it to interrogate why such literature did not emerge as significant in the outcomes in the research?

All of these questions were carefully considered prior to writing the thesis. The outcome has been to organise the report in such a way that the reader gains a sense of the learning journey. Much of the initial literature reviewed has been maintained in this chapter to provide evidence of my early thinking. Some of this literature remained of value throughout the research though some did not and this is reflected on in the final chapter of the thesis. The present chapter also introduces some of the literature that emerged as significant throughout the research process. This has been included at the point where it became relevant to the emerging explanatory model of professional learning at Fulton but the reader is alerted to when this occurred.

2.2 Guiding themes in the initial literature review

Prior to and throughout the six year period of work on the thesis, considerable research has been generated in the areas of learning, pedagogy, professional development, and change. Indeed the literature in these areas is so extensive I needed to refine my review to the big ideas that were consistently acknowledged and of relevance to my initial time in the field. The literature reviewed that features in this thesis shaped the sensitising ideas that assisted in generating the research questions and was broadly categorised under the themes:

- Aspects of learning and pedagogy that support deep understanding.
- The characteristics of professional learning that promote effective teacher learning.
- Change: perspectives and processes.

As noted in the previous chapter the theme change could have been combined as an outcome of the other two theme but the literature in this field often stands alone and was therefore worthy of consideration in its own right. The use of the terms professional

development and professional learning was also discussed and as such both terms continue to feature in this chapter.

Working at Fulton demanded that teachers engage in deep learning as well as teaching, and that the learning they engaged in contribute to the effectiveness of the school in achieving its vision. Teachers were required to learn about new content, new curriculum designs, new resources for supporting students' learning, and how to support the learning of other teachers. How teachers develop deep knowledge in these areas is dependent on the quality of the processes designed to support learning together with the characteristics of the learner (Atkinson & Claxton, 2003, Darling-Hammond, 1999, Hargreaves, 2003). There is considerable research that identifies specific aspects of learning and pedagogical practices that are supportive of developing deep understanding in learners, be they teachers or students (Hattie, 2003, Marzano, 2003, Marzano, Pickering & Pollock, 2001) and a review of this literature was the starting point for considering whether similar findings were evident in supporting teachers as learners in the Fulton context.

2.3 Aspects of learning and pedagogy that support deep understanding

2.3.1 Reflections on learning

Stoll et al., (2003) captured the complexities associated with trying to define such questions as, 'What is learning?' and 'How does it happen?'. They reflected on the many theorists who have contributed to our current knowledge-base on learning including Plato, Descartes, Locke, Skinner, Piaget, Bruner, Dewey, and Vygotsky. Such researchers presented views of learning that ranged from the 'blank slate waiting to be filled', to the proposition that human learning is innate in nature but heavily influenced by social and cultural factors. Bransford et al., (1999) provide a more comprehensive review of the literature on learning in their text, 'How people learn', and specifically in relation to the field of schools and education (see this text for a more in depth review on learning).

Stoll et al., (2003) suggested that "learning is intellectual, social and emotional. It is linear and erratic. It happens by design and by chance" (p.24). Of further interest these authors noted that, "schools operate with a multiplicity of conceptions on the nature of learning, from knowledge of the stuff to fill waiting pupils' minds to a view that there is no reality beyond that which is constructed in the language of the members of society" (p.24). Such a view is consistent with my own initial observations of teachers at Fulton. However, this research sought to gather more formal responses from teachers regarding their beliefs about effective learning and how these beliefs were represented in their practices.

Biggs (1999) in attempting to summarise key theories that relate to teaching, learning and student activity suggested that while we can get excited about the differences between and relevance of such theories, teachers are pragmatic and tend to be more interested in how to improve their teaching rather than in theories of learning. This view is probably typical of many teachers but begs the question of whether effective teaching can occur without some theoretical basis for action. As Perkins (1992: cited in Stoll et al., 2003) claimed, “We do not have a knowledge gap about learning, we have a monumental use-of-knowledge gap” (p.22). The significant knowledge about learning has been added to in the last decade by research in the area of brain functioning leaving us with the question: What is relevant for teachers to know if they are to improve their understanding and practices about supporting effective learning outcomes for students? In relation to this thesis I was interested in whether, and if so how, the teachers at Fulton transitioned from “a monumental use-of-knowledge gap”. To answer such a question the research considered teachers’ existing knowledge about learning and whether the opportunities to engage in learning about learning at Fulton generated new knowledge and practices. Research questions that emerged from this initial thinking were:

- What were teachers’ beliefs about effective learning and pedagogy?
- What promoted changes in these beliefs?
- What were the outcomes of changes in beliefs?

In the early stages of the research, I focused on what aspects of learning the teachers at Fulton saw as influential to their pedagogy and content knowledge or were of interest to them given the new context in which they were working. The connections between my own experiences and some initial observations at the school directed me to the literature considered in the following sections.

2.3.2 Learning by chance or design (Intentional and incidental learning)

The term teachers’ learning was used in this research to represent the varied learning situations that teachers experienced in the Fulton context. Such experiences were often intentional and structured in nature while others were incidental. Intentional learning describes planned and purposeful activities. Incidental learning in this research is viewed as learning ‘incidents’ that are not specifically planned but have the potential to occur because the teachers involved made a strong connection to the ‘moment’. Good and Brophy’s (2002) definition of intentional and incidental learning is used to distinguish between the two broad categories. The distinction is described well by Westwood (2004):

Intentional learning operates in a situation where the learner is deliberately setting out to acquire some particular knowledge, skill or strategy, and is putting focused effort into the task. Incidental learning, on the other hand, occurs when an individual is not making a conscious effort to acquire information or skill but is

merely exposed by chance to some experience –such as passively observing the actions of another person, watching a film, or overhearing a conversation. (p.8)

This focus on discriminating between intentional and incidental learning was an important aspect in this research for two reasons. Firstly, as Westwood (2004) suggested, it is incidental learning that often has a powerful effect on developing beliefs and values. Incidental learning is also viewed as more desirable because it fits well with the constructivists' view that learning is more powerful when specifically linked to existing interests and concepts. Secondly, Fulton is specifically designed to provide a learning environment that is open and interactive. For example, there are no traditional classrooms as such; no teacher preparation rooms and no staff room for teachers to retreat to. Teachers and their teaching are highly visible in this school and therefore the opportunity for incidental learning is increased significantly. Additionally, the teachers at Fulton are required to design interdisciplinary curriculum together. This demands that staff plan and sometimes teach outside of their discipline. How this is supported is sometimes intentional, for example, through specific curriculum writing times and support for staff to attend conferences in specific content areas but incidental learning also occurs through teachers interacting with one another, observing each other teach, and problem solving specific issues together.

The aspect of intentional and incidental learning was at the forefront of my thinking in the early stages of the research and was to play an influential role in my observations. My interest in incidental learning opportunities found me 'noticing' when, where and how these occurred. I began to see learning opportunities occurring in many ways and in many situations. I was interested in how many of these learning opportunities were provided through the nature of the space the teachers were working and I noted growing research interest in the influence of the learning environments on learning (OECD, 2001). I was also interested in investigating whether the teachers viewed the environment as influential on their learning and if they acknowledged the learning as incidental or as learning at all.

As I continued to gather data and note the influence of the environment on teachers' learning at Fulton, I connected with the Reggio Emilia concepts of the environment being a "third teacher". I attended a week-long study tour to Reggio Emilia to learn about the philosophies and educational practices of the Reggio approach. I made connections on a number of levels between my research at Fulton and the essence of the Reggio approach. Although Reggio was focused on preschool children, their powerful and explicit focus on high quality learning, self-directed inquiry and the importance of the learning environment connected with several aspects of Fulton's philosophy. Loris Malaguzzi (n.d. cited in Palsha, 2002), the "father" of the Reggio philosophy stated:

There is a difference between a child who can be reduced or a child who can be amplified depending on the favourable or unfavourable aspects of his/her environment. The broader and more varied the range of offers, features, activities and relationships the broader the possibility for the child. (p.109)

I reflected that Malaguzzi's belief was not only true for children but also true for the teachers at Fulton. The school certainly provided the teachers with a very different teaching environment to that of a traditional secondary school and therefore how the environment influenced teachers' learning became a focus of my research.

While the role of the environment emerged as influential to learning as time progressed, there was also recognition that learning for understanding, whether intentionally or incidentally required the learner to play a critical role.

2.3.3 Learning for understanding

From the significant literature in the area of learning there comes a clear message - learning for understanding can only occur when the learner connects with the information made available; makes sense of it in a way that is relevant to them and connects it with their prior understandings of the world. If the information that the learner is presented with does not fit with the existing "schema" a problem situation occurs. It is this problem situation that has the potential to generate new learning and a new level of understanding (Atkinson & Claxton, 2000, Biggs, 1999, Bransford et al., 1999, Hargreaves, 2003, Stoll et al., 2003, Wiggins & McGighe, 1998). This concept reflects Piaget's (1952) notion of assimilation - where new information is easily connected with pre-existing understandings; and accommodation - where new information is in conflict with the learners' current schemas requiring the learner to change or transform their beliefs. The process of accommodation is much more challenging than assimilation (Stoll et al., 2003). New learning and levels of understanding may fade or develop depending on specific factors including the opportunity to apply the information in meaningful ways (see stages in learning below for more detail), the learner's level of motivation for "understanding" and the influences of people around the learner (Hopkins, 2001, Munro, 2003, Senge et al., 2000, Ritchart, 2005, Vygotsky, 1978).

Biggs (1999) said that learning should be viewed as more than the acquisition of knowledge, a concept he considered a surface approach to learning. He suggested that learning should promote a level of understanding that results in conceptual change - an outcome of a deep approach to learning. Biggs (1999) also claimed, "Really to understand is to have one's conception of phenomena changed" (p.36). It may be that to really learn, one's conception of phenomena is changed; to really understand, is the ability to use the conceptual information in different ways. To learn and to understand are different but often used interchangeably by

teachers. The focus in the debate about learning and understanding should be on how teachers can plan learning opportunities that promote multiple ways of understanding and how teachers can experience a range of learning opportunities that allow them to understand their work in different ways. Drago-Severson (2004) spoke of transformational learning noting that:

Informational learning – new skills and information – increases what a person knows, whereas transformational learning changes how a person knows... in other words, the adult has enhanced his or her capacities (cognitive, interpersonal, and intrapersonal) to manage the complexities of their work. (p.23)

How the process of transformational learning occurred for teachers at Fulton was of primary interest in this thesis.

Wiggins and McTighe (1998) in their text ‘Understanding by design’ suggest there are six facets of understanding that teachers should consider in planning for effective learning outcomes. Table 2.1 provides a summary of achievements at each facet level. I found it interesting that in reflecting on this table following the majority of the data collection, there did not appear to be much evidence of teachers talking about learning in these ways and therefore wondered whether this section of the literature review might be omitted in the final account. However, it struck me how relevant the different facets of understanding were to my own learning journey and how different elements of the research account reflected different facets of understanding. Some sections of the thesis were explanations and others interpreting, applying and taking new perspectives. I used this model to look again at teachers’ reflections and investigated whether different facets of understanding provided evidence of Drago-Severson’s notion of transformational learning and how such transformation influenced or connected to changes in teachers’ practices and beliefs (see chapter 5 for more details). In addition, the table provided an opportunity to consider what facets of learning were most evident in learning opportunities provided for the teachers, and whether this varied based on the particular type of learning opportunity or situation. For example, did learning through learning communities that developed over time allow for greater perspective and/or empathic understanding and self-knowledge? What facet of understanding was more evident as teachers developed content knowledge of the new sciences? And finally, how did the different facets of understanding influence teachers’ practices?

Table 2.1 Summary of Wiggins & McTighe’s Facets of Understanding (1998, p. 44).

FACET OF UNDERSTANDING	REPRESENTATION OF UNDERSTANDING
Explain	Provide thorough, supported and justifiable accounts of phenomena, facts and data.
Interpret	Tell meaningful stories; offer apt translations; provide a revealing historical or personal dimension to ideas and events; make it personal or accessible through images, anecdotes, analogies and models.
Apply	Effectively use and adapt what we know in diverse contexts.
Perspective	See and hear points of view through critical eyes and ears; see the big picture.
Empathize	Find value in what others might find odd, alien or implausible; perceive sensitively on the basis of prior direct experience.
Self-knowledge	Perceive the personal style, prejudices, projections and habits of mind that both shape and impede our understanding and why understanding is so hard.

Wiggins and McTighe’s six facets of understanding provided a useful tool in developing a more comprehensive sense of Biggs’s and Drago-Severson’s explanations of conceptual change or transformational learning. Each of the six facets of understanding could be expanded using a continuum from limited (surface approach) to extensive (deep approach) understanding. Biggs and Collis (1982) developed a Structure of the Observed Learning Outcomes (SOLO) taxonomy to describe the development of conceptual complexity. Biggs and Collis suggested there are two main changes as learners develop a deep understanding of a particular phenomenon. The changes may be “quantitative” as the amount of detail in the learner’s response increases or “qualitative” as the detail presented by the learner becomes integrated into a structural pattern or conceptual framework. They also suggested that the “quantitative stages of learning occurs first, then learning changes qualitatively” (1999, p. 37). The differences in these degrees of understanding have also been explored by Bransford et al. (1999) in their review of novice and expert learners (see below for further discussion).

In addition to surface and deep approaches to learning, Biggs presented strategic learning as a third approach. The three approaches were important to consider in relation to learning for understanding as in many situations learners are aware of the need for specific degrees of understanding. For example, in researching for an exam, a learner may take a strategic approach and focus on some key concepts in preference to reviewing all information. Whereas a learner who is required to ‘teach’ a particular concept in detail to others may take a deep approach to learning in an effort to ensure they are providing appropriate learning opportunities for others.

The concepts discussed in this section on learning for understanding are all relevant to teachers, particularly the teachers at Fulton as they are accountable for planning learning experiences that will generate deep understanding in the areas of mathematics and science for their students. Questions related to learning for understanding that are of interest to this research include:

- Do teachers' descriptions of effective learning include reference to issues associated with learning for understanding?
- If teachers are made aware of such issues, how is such learning transferred to their curriculum design and teaching practices? (A link to the monumental use-of-knowledge gap (Perkins, 1992))
- Are the features associated with learning for understanding evident in the school's professional development strategy and activities?

2.3.4 Learning and expert learners

Deep understanding in disciplines is often achieved by expert learners. Bransford et al., (1999) spent time analysing what it was that expert learners did that varied from novice learners. They found a critical difference related to the organisation of knowledge with expert learners organising new information around interrelated concepts. Further analysis of the strategies and processes employed by 'expert' learners to develop deep understanding identified that these learners:

- Recognised (noticed) meaningful patterns of information
- Organised knowledge in efficient ways
- Knew when, where and why to use relevant information
- Had fluent retrieval of critical information
- Had an ability to teach self and others in a coherent fashion and,
- Engaged in continuous reflection and the identification and pursuing of new learning goals. (p.20 – 33)

Bransford et al.'s description of learner behaviours, some observable and others not, was of interest to me in the early stages of the research as I wondered whether the staff presented as expert learners on arrival at the school or developed into expert learners through the opportunities provided for them. I also wondered how their sense of expertise in particular disciplines would influence their levels of engagement with the new sciences content and concepts of teaching and learning. I wondered whether the outcome of teachers' learning at Fulton would be a group of expert learners that in transforming their understandings of the new sciences and teaching and learning would be pivotal in sustaining the innovative culture of the

school. And what of teachers who did not present with the behaviours of an expert learner? How would they influence the culture of the school?

Although these were all overarching questions of great interest to my thinking, I also recognised the need to continue exploring specific knowledge about learning that may be of assistance in understanding the processes occurring for the teachers. Bransford et al., highlighted the concepts of fluent retrieval of critical information and the role of continuous reflection as being two key processes that support good learning. I wondered whether one behaviour may actually reduce the other. From my own experience and early observations in the school I noted experienced teachers with fluent retrieval of critical information tended to work in a very confident manner drawing on past success and proven approaches to teaching key content. Little time for reflection was apparent and yet this process is recognised as fundamental to changes in beliefs and practices (Atkinson & Claxton, 2000). The nature of the innovative curriculum at Fulton would position most teachers as novices in some aspects of their work and I wondered how this would support their understanding of the learning process. As Peery (2004) argued: “We must engage in activities that require us to reawaken our learning selves” (p.36). Would the challenges of working in a school that required innovation in curriculum and pedagogy provide the opportunity for teachers to reawaken their “learning selves” and through doing so deepen their understanding of learning processes experienced by their students as well?

2.3.5 Learned capabilities and knowledge categories

Ausubel (1968), Gagne, Briggs, and Wager (1992) and Anderson et al., (2001) contended that it is important for teachers to understand the concept of knowledge categories and learning capabilities. The major knowledge categories that these researchers define are declarative – “knowing what”, and procedural – “knowing how”. Gagne et al., (1992) in their text “Principles of instructional design” provided a very detailed account of five kinds of “learned capabilities” including; information learning, intellectual learning, motor learning, attitudinal learning and cognitive strategy learning. These authors suggested that the different “learned capabilities” may be developed more effectively through different types of instruction. They also suggested that core knowledge (information learning), being declarative in nature, is fundamentally important to understand at a deep level if one is to apply it (procedural knowledge/intellectual learning/cognitive strategy use) effectively. Biggs et al., (1992), Shulman (2002), and Westwood (2004) agree with Gagne et.al. suggesting that supporting the learning of declarative knowledge is often different from supporting the learning of procedural knowledge.

In many traditional school curricula much content is declarative in nature. Fulton was engaged in designing curriculum that was innovative and interdisciplinary. The focus was on

authentic learning tasks that link strongly with procedural knowledge. However, as discussed in the previous section on learning for understanding, qualitative thinking including the procedural knowledge activities of hypothesising, evaluating and generalising is often only successfully achieved when knowledge that is quantitative in nature, for example, describing, listing, identifying and combining, is in place; and this is particularly so in the disciplines of science and mathematics.

Anderson et al. (2001) revised Bloom's taxonomy of educational objectives and proposed that learning be viewed as a two dimensional matrix where the four categories of knowledge: 1) factual, 2) conceptual, 3) procedural and 4) metacognitive, are aligned with the six cognitive processes of: 1) remembering, 2) understanding, 3) applying, 4) analysing, 5) evaluating and 6) creating. These cognitive processes have a connection with stages in learning which are discussed in more detail in the following section. Anderson et al. also suggested that different knowledge categories may be best served by employing different cognitive processes and instructional strategies. The link between specific knowledge categories and choice of instructional strategy is often referred to as pedagogical content knowledge.

'Knowing what' and 'knowing how' is also connected to Shulman's (1999, 2002) research on pedagogical content knowledge. As noted in the introduction it may not be enough for teachers to be experts in their discipline; they also need to be experts in understanding how to teach the discipline content. Teachers need deep understanding about their learners but also about aspects of the discipline that may require specific types of instructional strategies and focus. Once again this is related to the concepts of declarative and procedural knowledge. However, Shulman suggested that some declarative knowledge is more challenging to understand than other declarative knowledge and in addition some teachers fail to "teach" procedural knowledge often assuming that processes of learning are innate in students in senior secondary years. This research initially planned to investigate teachers' understanding about different categories of knowledge and observe whether the use of such knowledge was evident in curriculum planning and teaching practices. Of additional interest was whether the school through its professional learning policy and planning prioritised such learning for its teachers. However, this level of detail was not clearly evident in the professional learning strategy developed at Fulton or in the teachers' responses to questions on learners and learning throughout the period of the research and consideration of why is discussed in chapter seven.

2.3.6 Stages in the learning process

Several models of learning clearly identify different stages in the process of effective learning. Gagne et al., (1992) present a hierarchy of stages that must occur prior to learning

being transferable to other situations. They note that without attention learning is not possible. Stoll et al. (2003) also identified the importance of attention suggesting that:

Attention is like psychic energy that can be controlled in order to engage in other mental events like remembering, thinking, feeling and ultimately learning. Once something enters consciousness, the human mind goes to work to organise it and connect it to what it already knows. This involves processing the information from memory or experience, checking the match between new information and prior knowledge, monitoring comprehension, reorganising ideas and coming to decisions about what the new information means and where it fits. All of this activity happens at lightning speed; generally the learner is completely unaware of the process. (p.25)

However, attention must be sustained to acquire new information and this ability to attend varies significantly for different learners. If new information is assimilated or accommodated, learners must be provided with opportunities to apply the new learning, preferably, in relevant ways. Application opportunities allow for practice in order to develop fluency of retrieval for application to other situations. Given that new learning becomes consolidated at a level where it can be fluently retrieved, there is the possibility of transferring this knowledge to other areas. In summary, the stages of learning according to Gagne et al. are:

- Attention
- Acquisition
- Application
- Practice
- Fluency
- Transferability

Movement through these stages depends on the characteristics of individual learners but also on the opportunities provided for the learners. The closer the learning opportunities are to the needs and level of development of the learner the more effective the learning outcomes. These stages are relevant to all learners no matter what age (Bransford et al., 1999, Gagne et al., 1992)

Moon (1999) developed a Map of Learning that links to Gagne et al.'s stages. The 'Map of Learning'(see Figure 2.1) was heavily influenced by several researchers including Kolb, Piaget, Bruner, Vygotsky, Marton, Ausubel, Entwistle, Biggs and Schon. She drew on constructivist theories of learning, notions of cognitive structure, content, stages in learning, and deep and surface approaches to learning in building the Map of Learning. Figure 2.1 highlights that learning identifies 'noticing' as the first stage in the learning process, a concept similar to Gagne et al.'s 'attention'. Noticing is followed by attempts to 'make sense' and 'meaning' of a new event or knowledge prior to 'working with the new meaning'. Figure 2.1 also highlights

that surface and deep level learning are possible outcomes depending on the stage reached and this reinforces Entwistle's (1988) and Biggs's (1999) concepts presented previously.

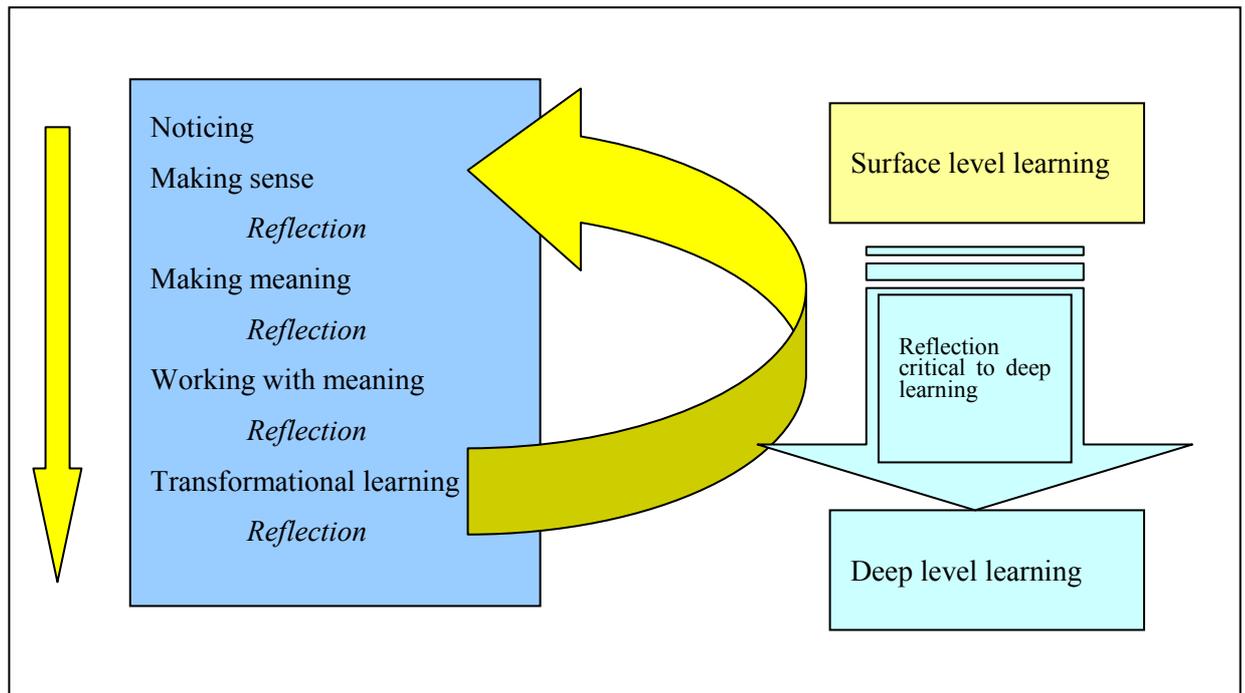


Figure 2.1 Adaptation of Moon's (1999) Map of Learning

The language used by Moon is very accessible by teachers and guides questions that can be used to reflect on learning and practice. For example, questions such as “What do I notice most as I engage in teaching?”, “How do I make sense of what I am noticing?”, “Does this fit with my current understanding of teaching?” and “How does any new meaning affect the way I work?” are questions easily understood by teachers and serve to generate self-reflexive practice or group discussion. It is important to note that the model acknowledged the critical role of reflection between the stages. Moon suggested that without time to reflect, learning is usually based on an intuitive response to what is noticed. In effect we are only drawing on knowledge from within to make sense and therefore the learning is considered surface level if it could be considered learning at all. It represents an initial response to a situation and allows us to draw on previous knowledge or successful practices. But to go beyond this level we need to engage in either self or collaborative reflection to make sense of what we did or were exposed to through the experience of acting or learning. In this way Moon suggested we are in a better position to work with new meaning and possibly transform our understandings. Although the model is represented in a linear fashion this is far from the reality of the model. There can be general movement back and forth between stages; indeed many learners may find themselves in the noticing and making sense phase because they are not provided with the opportunity or

resources to engage in reflection on their learning. The achievement of transformational learning can result in noticing something new and so the process is cyclical as well.

Moon's map proved to be useful tool for teachers at the school to reflect on in reference to their own development. It also served as a valuable tool for describing the research process for this thesis and its use is elaborated on in Chapter 3. Such a model provided a language, and a tool, with which to document and reflect on how learning occurred for teachers and what factors proved significant in the process. This in turn allowed teachers to "re-awaken their learning selves" (Peery, 2004, p.36) and consider how such knowledge influences their beliefs and practices.

I also found the work of Shulman (2002) relevant in understanding that for deep learning to occur, remembering or making sense were insufficient. Applying and working with meaning are minimal requirements for transformational learning to occur. Shulman's Table of Learning also presents a model that describes the stages or phases that occur as teachers acquire, construct and apply new learning. Shulman's Table of Learning is initially presented as:

- Engagement and Motivation
- Knowledge and Understanding
- Performance and Action
- Reflection and Critique
- Judgment and Design
- Commitment and Identity

However, Shulman suggested his table should also be viewed as flexible to represent the learning process as it occurs in different contexts and for describing the different actions of learners. For example, the Table of Learning may be represented in a cyclical way:

Commitment	Engagement
Judgment	Understanding
Reflection	Action

Shulman recommended we view taxonomies, models or tables of learning not because they may be theoretically valid or true but because they are practical, useful and conceptually robust (2002, p.10). And this point was of interest as I engaged in the research process and ultimately developed an explanatory model of teachers' learning at Fulton. In line with Shulman's thinking the value of the model would lie in its ability to reflect teachers' learning processes and in its ability to be practical, useful and conceptually robust.

2.3.7 Learning and reflection

A critical element in Moon's and Shulman's models was the role of reflection in generating deeper understanding. Reflection in learning is also highlighted in Kolb's model of Experiential Learning. Kolb (1984) introduced the notion of learning as an experiential cycle. He suggested it is our concrete experiences that generate responses. As we reflect on why and how we respond to concrete experiences, our thinking moves from the actual action to reflection-on-action. Kolb suggested that we reflect on new experiences prior to trying to conceptualise them, generally in abstract ways. If the conceptualising is successful we can use this new knowledge to engage in further experimentation that provides new experiences to reflect upon, and so the cycle continues. This notion related to the concept of accommodation discussed in an earlier section of this chapter and also to Moon's and Shulman's models, particularly when viewed in a cyclical form. The last decade has seen the emergence of reflective practice as a powerful form of professional learning. Sparks-Langer and Colton in the early nineties (cited in York-Barr, Sommers, Ghore, and Montie, 2001) suggested:

The shift towards an interest in reflective thinking has come about partly as a reaction to the overly technical and simplistic view of teaching that dominated the 1980s. Gradually, however, experts in supervision, staff development, and teacher education have begun to recognise that teaching is a complex, situation-specific dilemma ridden endeavour....Today, professional knowledge is seen as coming both from sources outside the teacher and from the teachers' own interpretations of everyday experience. (p.1)

This quote suggests teachers' personal experiences influence their interpretations of events which in turn plays a powerful role in their actions. What the quote fails to capture is that the act of reflection is closely tied to processes and theories of cognitive learning. It also fails to recognise that reflection in isolation may inhibit the opportunity for viewing things in new ways. Reflection as an interactive practice with other colleagues may be fundamental to changes in beliefs and practices and my research sought to investigate the role of reflective practice, individually or in collaboration with others, on teachers' learning at Fulton.

Donald Schon's (1983) work on reflection was of particular interest to my thinking about teachers' learning at Fulton. He described the differences between reflection-in-action and reflection-on-action. He said, "clearly, it is one thing to be able to reflect in action and quite another thing to reflect on our reflection-in-action so as to produce a good verbal description of it; and it is still another thing to be able to reflect on the resulting description [of action]" (p.49). Atkinson and Claxton (2000) also draw on the work of Schon in developing their model of thought processes in teaching. These thought processes (see Figure 2.2) provide a sense of the different "moments" for learning that can occur in teachers' work. The model also indicates that the different elements should all be valued and supported. The model links well with the

concepts guiding this research in that it recognises all three processes are important in building teachers' knowledge about teaching and learning and also as a tool for teachers to consider the different activities that can contribute to their own learning.

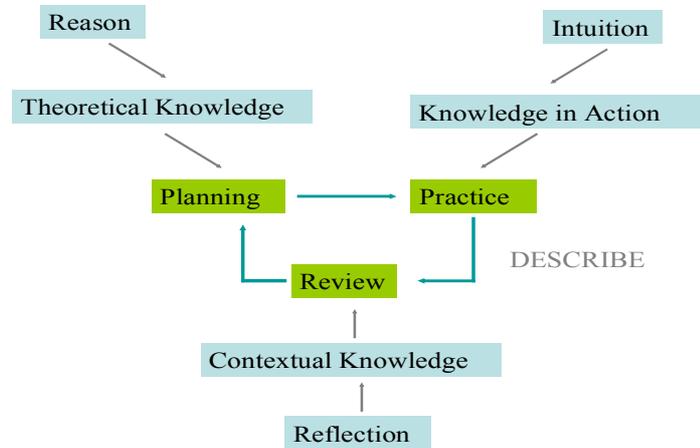


Figure 2.2 Thought Processes in Teaching (Atkinson & Claxton, 2000, p.7)

Moon's Map of Learning, Shulman's Table of Learning, and Atkinson and Claxton's model were all useful tools for capturing the processes and complexities of teachers' learning and to subsequently determine whether such models were also relevant to the development of the explanatory model of teachers' learning at Fulton.

An additional consideration in reviewing the literature for sensitising ideas was the link between types of learning and stages in learning and the role of pedagogical practices. Pedagogical practices were considered from two perspectives: teachers' understanding of the research on pedagogical practices that support effective learning outcomes and their personal experience of pedagogical practices that supported their professional learning. Both elements proved of interest in understanding teachers' learning in the Fulton context and therefore a review of the associated literature was included in the research process.

2.3.8 Pedagogical practices that support effective learning

Hattie (2003) in his meta-analysis of research on what influences student achievement found that the home, school, principal, peers, teachers and the students themselves all affected learning outcomes. However, Hattie noted that the relative effect of the different variables should be the focus of planning for improving student achievement. He stressed that focus should be on developing the pedagogical skills of our teachers as they account for 30% of the variance in student achievement. The school, principal, peers and home each accounted for between 5-10% with the student accounting for 50% of the variance. Hattie's meta-analysis

identified several influences and these together with the effect size of each influence are listed in Table 2.2 (for a full review of possible influences see Hattie, 2003).

Table 2.2 Influences and effect size of influence on student achievement. (Hattie 2003)

[Additional information in italics my insertions].

INFLUENCE	EFFECT SIZE	SOURCE OF INFLUENCE
Feedback	1.13	Teacher
Students' prior cognitive ability	1.04	Student
Instructional quality	1.00	Teacher
Direct instruction	.82	Teacher
Remediation/feedback	.65	Teacher
Students' disposition to learn	.61	Students
Class environment	.56	Teachers [student/school]
Challenge of goals	.52	Teachers
Peer tutoring	.50	Teacher [student/peer]
Mastery Learning	.50	Teacher [student]
Parent Involvement	.46	Home
Homework	.43	Teacher [student/home]
Teacher style	.42	Teacher
Questioning	.41	Teacher
Peer Effects	.38	Peers
Advanced organisers	.37	Teacher
Simulation and games	.34	Teacher
Computer assisted instruction	.31	Teacher
Testing	.30	Teacher
Aims & policy of the school	.24	School
Affective attributes of students	.24	Student
Physical attributes of students	.21	Student

In reviewing the influences identified by Hattie and their source it appeared that teachers should not be considered the only source of influence for some attributes – particularly aspects like homework. Teachers may be responsible for setting the homework but the successful completion of it is influenced by student effort and their home environment. Other aspects that may be influenced by sources beyond the teacher have been detailed in the table above.

Some of the influences are somewhat vague in nature. For example, what does instructional quality imply? How might instructional quality vary from teacher style? And so

forth. However, there appeared to be a consistent message that teachers using specific strategies were effective in improving students' learning outcomes.

Hattie and Jaeger (cited in Hattie, 2003) reviewed the literature on differences in the practices of expert and experienced teachers. They identified five major characteristics of expert teachers as being the ability to:

- Identify essential representations of their subject/s
- Guide learning through classroom interactions
- Monitor learning and provide feedback
- Attend to affective attributes
- Influence student outcomes (p.5).

Hattie and Jaeger found that experienced and expert teachers did not differ greatly in the amount of content knowledge they had but in their conceptualising of how to bring students to an understanding of this knowledge. Hattie (2003) observed that:

Experts possess knowledge that is more integrated, in that they combine new subject matter and content knowledge with prior knowledge; can relate current lesson content to other subjects in the curriculum; and make lessons uniquely their own by changing, combining, and adding to them according to their students' needs and their own goals. (p.3)

In doing so he identified 16 specific attributes that linked to the five major dimensions detailed above. In observing experienced and expert teachers in action in relation to the 16 attributes Hattie noted a difference in outcomes for students particularly in relation to the quality of learning. Seventy four percent of students with expert teachers achieved a level of thinking that was judged as "relational" or "extended abstract" according to the SOLO taxonomy (Biggs & Collis, 1982) whereas only 29% of students in classes with experienced teachers achieved this level.

The 16 attributes that Hattie identified as evident in the behaviour of expert teachers and their effects size are:

- Deep representations (0.88)
- Problem solving (0.79)
- Anticipate and plan (0.79)
- Better decision makers (0.68)
- Classroom climate (0.60)
- Multidimensional perspectives (0.42)
- Sensitivity to context (0.87)
- Feedback and monitoring learning (0.28)

- Test hypotheses (0.98)
- Automaticity (0.80)
- Respect for students (0.59)
- Passion (0.76)
- Engage in learning (0.57)
- Set challenging tasks (1.175)
- Positive influence on achievement (0.075)
- Enhance surface and deep learning (1.00)

Hattie identified that these 16 attributes could assist in classifying expert teachers. However, he also noted that three of the dimensions alone could be used 80% of the time in classifying expert teachers as separate from experienced teachers. These three dimensions are challenge, deep representation, and monitoring and feedback. In this research I was particularly interested to see if teachers exhibited the pedagogical practices identified in Hattie's research including those of challenge, deep representation and monitoring and feedback or if such skills developed through the teachers' engagement in professional learning at Fulton.

Hattie's research was also of interest to my initial thinking about teachers' own experiences of learning at Fulton. The identification of the three dimensions by Hattie connected with questions that emerged as I commenced my fieldwork including whether teachers themselves were open to challenges and feedback in their own learning and what process presented them with opportunities to engage in developing deep representational knowledge of new and innovative content. Inquiry into these areas became a focus of the research.

Marzano (2003) and Marzano, Pickering, and Pollock (2001) also identified nine instructional strategies, via a meta-analysis of the research on teacher effectiveness, that made a difference to student achievement. The nine instructional strategies can be linked with those identified by Hattie but are more specific in nature. The strategies and their effect size are:

- Identifying similarities and differences (1.61)
- Summarizing and note-taking (1.00)
- Reinforcing effort and providing recognition (0.80)
- Homework and practice (0.77)
- Nonlinguistic representations (0.75)
- Cooperative learning (0.73)
- Setting objectives and providing feedback (0.61)
- Generating and testing hypotheses (0.61)
- Questions, cues and advanced organisers (0.59)

This list of instructional strategies is more representative of pedagogical practices associated with classrooms rather than those associated with teachers' PL. However, several strategies are relevant to the literature reviewed on effective learning processes and therefore I considered these of value in deepening my own understanding of pedagogical practices that promote effective learning outcomes. Hattie called for more research to be conducted in classrooms; specifically in noting what practices teachers employed that resulted in effective learning outcomes for students. Such thinking linked directly to understanding the characteristics of professional development opportunities that promoted effective teacher learning, the second major theme of the literature review.

2.4 The characteristics of professional learning that promote effective teacher learning

“Acquiring sophisticated knowledge and developing a practice that is different to what teachers themselves experienced as students, requires learning opportunities for teachers that are more powerful than simply reading and talking about new pedagogical ideas (Ball & Cohen, 1996). Teachers learn best by researching, doing and reflecting, by collaborating with other teachers, by looking closely at students and their work, and by sharing what they see.” Shulman (1999, p.3)

Professional learning for teachers is clearly recognised as having an important role in promoting positive learning outcomes for students and raising educational standards (Darling-Hammond, 1999, Darling-Hammond & Richardson, 2009), DETYA, 2000, Fullan, 2007, Meiers, 2001, Meiers & Ingvarson, 2005, OECD, 2009, Sykes, 1999). Teachers' responsibility for raising educational standards is a significant demand as there are many variables that influence outcomes for students, as found in Hattie's (2003) research. Although the links between teachers' professional learning and improved outcomes for students requires further investigation (Meiers, 2001, Meiers & Ingvarson, 2005, Timperley et al, 2007) teachers' learning is still acknowledged as pivotal to reform. Yet research identifies that much professional 'development' is ineffective in changing teachers' beliefs and practices. Cole (2004) proposed that professional development was a great way to avoid change because “much of what is termed professional development develops no one” (p.2). The recent Teaching and Learning International Survey (TALIS) (OECD, 2009) found that “relatively few teachers participate in the kinds of professional development which they find has the largest impact on their work, namely qualification programmes and individual and collaborative research” (p.i). Therefore it was important to review the literature of effective professional development and identify how this was reflected in Fulton's professional learning strategy and the subsequent outcomes.

Wideen (1992), in the early nineties, drew attention to the importance of the teacher's role in improving student achievement noting that improved outcomes were linked with the teachers' own development. King and Newmann (2000) also said:

Since student outcomes and how teachers teach are profoundly influenced by the school in which the students and teachers work, the design of professional development itself should be grounded not only in a conception of how individual teachers learn, but also in a conception of how schools as organisations affect teachers' learning, teachers' practice, and student achievement. (p.577)

Wideen also claimed that there are still many questions that need answering in attempting to define what it is that supports teachers' learning including;

- How does teacher development come about?
- In what settings does it best occur?
- How does it relate to school improvement?
- What motivates teachers to engage in teacher development? (p.124)

All of these questions were directly investigated in this research and through answering them the development of an explanatory model of teachers' professional learning was supported.

Elmore (2000) suggested that teachers will only make transitions in their beliefs and practices if they have, "many opportunities to be exposed to ideas, to argue them to their own normative belief systems, to practice the behaviours that go with those values, to observe others practicing those behaviours, and, most importantly to be successful at practicing in the presence of others" (p.13), (that is, to be seen to be successful). Working at Fulton provided teachers with such opportunities, by chance and by design and the aim of the research was to document in detail how this occurred and contributed to an explanatory model of PL.

Research throughout the 1990s presented a dichotomous view on optimal approaches to quality professional development. Many traditional models of professional development were considered fragmented and poorly coordinated (Guskey, 1995, Cohen and Spillane, 1992 cited in Sykes, 1999). Often little thought has been given to the strategic application of knowledge and skills presented in professional development programs. Many professional development programs were presented as "one hit wonders" with a focus on the latest "trend" (Hawley and Valli 1999).

Increasingly, it is recognised that there is no one "perfect" approach to successful professional development because the content, process and contextual variables will differ across programs, styles of delivery and learning, and situation. However, Hawley and Valli

(1999) identified eight characteristics of effective professional development. These characteristics were:

- teachers clearly identifying their learning needs
- driven fundamentally by goals and standards for student learning
- primarily school based and integrated with school operations
- processes that involve collaborative problem solving
- organisation based on the continuous and ongoing involvement of a cohesive group
- opportunities to develop theoretical understanding of new knowledge and skills
- integration of professional development within a comprehensive change process including the facilitation of student learning
- incorporating evaluation of multiple sources of outcomes for teachers, students and organisations. (p.138)

Hawley and Valli's characteristics of effective professional development provided a framework to analyse both incidental and intentional professional learning experiences at Fulton and investigate whether the organisation and opportunities provided for the teachers were reflective of the characteristics.

Planning for teachers' learning was a priority of Fulton's leadership team well before the school officially opened. An assistant principal responsible for professional learning was appointed. She was active in developing policy and an organisational approach to the provision of high quality learning opportunities for all staff (see Appendix A for an iteration of the policy). In recognition of Hawley and Valli's characteristics, all teachers would engage in designing their own individual professional learning plans, and such plans would include a range of options that were specifically related to individual teachers' perceived professional learning needs (see Appendix B for an example of the personal PD plan). However, the school's PD policy also required all teachers to engage in action research teams that focused on specific aspects of the school's operations. Given the focus of the school on action research I considered the literature in this area in an effort to gain a deeper understanding of how the choice of such a professional development process might shape the teachers' learning opportunities and outcomes.

2.4.1 Action research

There is extensive literature on action research and its effectiveness in changing teachers' practice, for example, Carr & Kemmis (1986), Elliot (2003), Hopkins (2001), Mills (2000) and Stringer (2004). The use of action research as a model to support teachers' learning is purposeful, given the methodology's characteristic of focusing on problems intrinsic to a site or

collective group. The work of Hall and Hord (2001), discussed in more in detail in a forthcoming section on change, suggested that if the “concerns” of teachers formed the basis for teacher research then there is a greater likelihood that change will occur. Loughran, (2002) also provided support for the importance on focusing on practitioner research stating:

...as Dewey (1929) noted so long ago, educational practices themselves must be the source of the ultimate problems to be investigated if we are to build a science of education, so a focus on teacher research is paramount as it is teachers who work in the crucible of educational practice from which the “problems” are derived. (p.10)

Although action research has been used as a model for practitioner research for many decades it can be fraught with difficulties particularly in relation to its varying forms. My research provided an opportunity to reflect on the methodology itself investigating the application and outcomes of its use at Fulton and its role in an explanatory model of PL.

Carr and Kemmis (1986) applied the early work of Habermas in developing a framework to describe different perspectives of practitioner research. They considered action research from three perspectives, technical, practical, and critical or emancipatory. Technical research related to techniques of teaching that are available to everyone. However, the essence of technical research is scientific and positivist in nature and is of little value in developing “personal” practice and theory building. Practical research involved teachers in reflecting on their current situation and attending to specific aspects of their practice with a view to making some changes to this practice. Kemmis (1993) suggested that true emancipatory research requires “a concrete and practical expression of the aspiration to change the educational world for the better” (p.3), - as if there was an ideological educational world to strive for. Elliot (1991) recognised both the technical and practical approaches but suggested that rather than an emancipatory, an evolutionary approach is more appropriate. Brown and Jones (2001) summarise Elliot’s perspective suggesting:

The teacher cannot merely operate on the classroom situation with a view to changing it. The teacher is integral to that change - immersed in the very discourses which describe the change. In addressing specific professional concerns the teacher may choose to introduce theoretical perspectives, but for theory to be used in a meaningful way there is a need to build in a self-reflexive dimension which positions the evolving individual in their evolving professional situation. (p.35)

This quote links together several themes within this research, including that of change, learning through self-reflexive practice (reflective practice and/or action research) and the crucial role of the teachers in the evolution of Fulton. The vision of the school was to provide an exemplar of a teaching and learning community which engaged teachers in constant inquiry through action research that led to theory generation and new practices. As Brown and Jones (2001) suggested, “Theory generation is often an ideal to aim for. An alternative is to emphasize

and problematize the immediate; deciding on how to shape the next step from the one we are currently taking” (p36). This notion not only related to learning processes for teachers at Fulton but also to my own research process and both required significant engagement in reflective practice.

2.4.2 Reflective practice

Reflective practice has emerged as a popular form of professional development (Hawley & Valli, 2000, McRae et al., 2001) and this is not surprising given the importance of reflection in the learning process (see page 33 in this chapter). Moon (1999) also made explicit in her Map of Learning the role of reflection in moving from one stage of learning to another. York-Barr et al. (2001) provided an extensive review of the role and process of reflective practice and cite Bright (1996) who argued that reflective practice “...is the process which underlies all forms of high professional competence” (p. 166).

York-Barr et al. proposed that reflective practice can occur at different levels - individually, with partners, in small groups and teams, and from a school wide perspective. However, they argued that effective reflective practice at any level will provide evidence of the following behaviours:

- deliberate pauses
- open perspective
- thinking processes
- examination of beliefs, goals, and practices
- new insights and understanding
- actions that improve student learning (p.7).

Such behaviours recognised the need to shift from intuitive responses (Atkinson and Claxton, 2000) and reflection-in-action (Schon, 1983) to purposeful and planned reflection-on-action.

York-Barr et al. supported the notion that reflective practice has much potential to improve schools if it becomes a priority in individual and school wide professional development planning. They suggested that reflective practice improves schools for the following reasons:

- It creates the opportunity to continuously learn from and about education practice.
- Practitioners have a greater variety of perspectives to draw on in addressing the many challenges and complex dilemmas of practice.
- New knowledge and understandings that have immediate applications to practice are created.

- Efficacy increases as educators see the positive effects on their own context generated solutions.
- Professional educators themselves assume professional responsibility for learning and improvement.
- Strengthened relationships and connections among staff members emerge.
- Educators can build bridges between theory and practice.
- A reduction in external mandates may ultimately result when educators are viewed as effectively addressing many of the challenges of practice. (p.9)

Day (1998) also supported the role of reflective practice as a model of professional learning to be valued by schools. He asserted that:

Without routinely engaging in reflective practice it is unlikely that we will be able to understand the effects of our motivations, prejudices and aspirations upon the ways in which we create, manage, receive, sift and evaluate knowledge; and, as importantly, the ways in which we are influencing the lives, directions and achievements of those who we nurture and teach. (p.229)

Given that Fulton aimed to be “a quality school that provides leadership of innovation and reform of the teaching and learning of science and mathematics” ([Fulton] Policy & Vision Statement, 2004), engaging in reflective practice should emerge as a fundamental element of their professional learning model. In my research I was interested in how reflective practice was constructed and whether there was recognition of the potential for reflective practice to improve the school’s outcomes as suggested by York-Barr et al. and in addition, whether there was an intentional plan to develop teachers’ understanding of the processes of reflective practice or whether reflective practice was viewed as embedded within the practices and actions of the teachers and leaders in the school.

Reflective practice has the potential to strengthen relationships and connections among staff members (York-Barr et al., 2006). The notion of building relationships between staff members, most of who had not worked with each others previously was fundamental to the success of many of the school’s goals including the need to work in interdisciplinary teams to develop innovative curriculum. Members of these teams would also include university academics and therefore the notion of reflective practice needed to be considered from both a working-in-teams and school-wide perspective. Osterman and Kottkamp (1993, cited in York-Barr, p. 79) suggested that:

Reflective practice in a group setting is a high-risk process...In most organisations, problems are viewed as a sign of weakness...to break this conspiracy of silences requires new organisational norms. To engage in the reflective process, individuals

need to believe that discussion of problems will not be interpreted as incompetence or weakness. (pp.44-45)

Osterman and Kottkamp's insight was of particular interest to my research given the different roles played by the teachers at the school and the university academics. In essence the academics' roles were constructed as the experts in the new sciences while the teachers were recognised as experts in working with school-aged students. I was interested in how the interactions between the teachers and academics reflected or did not reflect the literature on reflective practice and whether the outcomes of the interactions would generate forms of learning communities given that these too, are recognised in the professional development literature as being significant in teachers' learning and improving outcomes for schools (McRae et al., 2001, Hargreaves, 2003, Wilson & Berne, 1999). At this point in reviewing the literature for sensitising ideas, I looked to the work on learning communities briefly to consider the role they may play in professional learning at Fulton.

2.4.3 Learning communities and learning organisations

Learning communities are closely aligned with reflective practice and often emerge as an outcome of a group of people spending time together engaging in reflective practice. There is significant literature in the area of learning communities (Day 1998, Fullan, 2001, Hargreaves, 2000, 2003, Hord, 1997, Lave & Wenger, 1991, Sergiovanni, 2000, Stoll et al., 2003, Wenger, 1998, Wheatley, 2002) with much support provided for the development of such communities being linked to improved professional learning for teachers. Wilson and Berne's (1999) research on highly effective professional development projects identified that teachers all talked of the need for learning with others and that the most effective projects were based on the notion of learning communities.

McRae et al. linked the terms learning communities and learning organisations highlighting implications for schools with the recognition that learning should be continuous, a daily event and situated within the workplace. They cited Retallick (1997) who made a distinction between professional development that involved attending workshops, seminars and off-site programs and site based learning involving daily opportunities to learn that are based on the current work of teachers. Retallick (1997) argued, "What is required is not so much a change of culture in schools, but a recognition by the teaching profession that professional learning can and does take place on-the-job and in the workplace of teachers when problems and difficulties are seen as learning opportunities" (p.23, cited in McRae et al., 2001). Fullan (2007) supported this concept and called for a distinction to be made between professional development and professional learning. He advocated that the term professional learning should replace development so that a renewed focus on the conditions for powerful learning is achieved. He

also argued that professional learning communities provided one of the best options for engaging teachers in learning as a daily event. Such notions were of specific interest to my research as they indicated teachers needed to recognise the potential for professional learning within their workplace. I was interested in investigating whether teachers felt that working at Fulton provided better quality professional learning opportunities than those provided by more traditional forms of off-site professional development.

Fulton explicitly promoted schools as learning organisations where everyone was considered a learner. The school aimed to support the elements Watkins and Marsick (1993) identified as imperative to successful learning organisations including:

- Creating continuous learning opportunities
- Promoting inquiry and dialogue
- Encouraging collaboration and team learning
- Establishing systems to capture and share learning
- Empowering people towards a collective vision
- Connecting the organisation to its environment. (p.11)

All of these elements featured in the promotional material used to describe Fulton and my research aimed to uncover how they occurred and what were the outcomes for those who were active participants in the learning community and organisation.

At this point in the literature review I was more focused on the literature associated with learning communities in preference to that of learning organisations. I am unsure why this was the case but my focus had been on what was occurring for individuals and teams of teachers and the leaning communities that appeared to emerge from these. It was not until later as the many facets of professional learning in the context of Fulton became evident that a more explicit focus on learning in organisations emerged. Such an outcome is highly reflective of the grounded theory process, and in keeping with the process as it emerged, a more detailed account of learning in organisations is included in Chapter 4 as it related to the explanatory model of professional learning that emerged.

2.5 Change: processes and perspectives

“I am so excited – inquiry oriented process science that I began teaching in the sixties has come into vogue again. This time it is [called] the constructivist approach to science” (Teacher comment cited in Hall and Hord, 2001, p.20)

“If we keep doing the same we will keep getting the same results”
John Maxwell (n.d. cited in Guskey, 2000)

These two quotes are worth some serious consideration as they reflect the “pendulum” nature of many “new” initiatives in education during the past decades. Hall and Hord (2001) capture the essence of change initiatives and innovations, and subsequent outcomes, in the following statement:

The abundant possibilities and continuing cycles/waves of changes in the types and levels of advocated changes have been confusing and frustrating for school practitioners. Committed to providing the best possible education to their students, they read and attend conferences and training institutes to learn about SBM, TQM, and a host of other new offerings. But they find it difficult to determine what to bring to the school that will fit its needs and that will be compatible with changes already underway in addition to those mandated by a higher authority. They also realise, since the historical record is so clear, that within a year or two, a new direction will be announced. (p.25)

New directions and new initiatives do not always mean changes in beliefs and practices will occur. As the opening quote in this chapter suggests, quite often a new initiative is no more than an old concept re-badged (possibly in language reflecting current philosophical trends), and it is understandable that often teachers engage in listening to the new initiatives, and then return to their classrooms, close the door and continue to work in the same ways as before, particularly when they are under duress and have no time to reflect on their current beliefs and practices in light of new information.

Teachers at Fulton were confronted with change at many different levels: new environment, new curriculum, new colleagues, new management structures and new students. Key actions to support teachers’ learning and subsequent change in beliefs and practices was provided through the structured Professional Development strategy but also through the many incidental learning opportunities that emerged through working in the school.

In preliminary investigations I was drawn to the following comment made by one teacher on her engagement in teacher research:

Another interesting point [is] that the teacher research is part of a group of three things that go together to make change: restructuring, reculturing and pedagogical change. We are very lucky at [Fulton] because the restructuring has been done for us. The reculturing is occurring because many of us have come to this school because we want a change in culture. We are now doing the pedagogical change that is necessary for us to work in this very different environment. This is very different to trying to make pedagogical change in my previous school. When you have to do restructuring and reculturing at the same time with people who are not ready to change it is very different. (Lisa⁴)

⁴ Lisa is a pseudonym for a teacher at Fulton who acted as a case study teacher in the research.

This comment captured the importance of the desire for change as being paramount to successful outcomes. It also captured the notion that too much change at once may actually restrict effective change. While this teacher valued the fact that much change has been dictated for the staff in this school thereby allowing her to concentrate on making pedagogical changes, for other staff these dictated changes may have impeded changes in beliefs and practices. Changes in the environment, management structures and curriculum do not necessarily result in changed teaching practices. Changes in practices are determined by the teachers and as Wideen (1992) noted this is where change will either result in different outcomes or merely more of the same. Fullan (2001) provided some key points to consider in understanding the change process, highlighting there are rarely any shortcuts to achieving deep change:

- The goal is not to innovate the most.
- It is not enough to have the best ideas.
- Appreciate the implementation dip.
- Redefine resistance.
- Reculturing is the name of the game.
- Never a checklist, always complexity. (p.34)

These points featured in Lisa's reflection about working at Fulton and also served as another perspective to be considered when analysing the data gathered in this research.

As with learning, change is multidimensional and it can be viewed from different perspectives (House, 1981, Hargreaves et al., 2001). Change is often described as a process rather than an event (Hall and Hord, 2001). However, Guskey, (2000) asserted that changes in behaviour proceeded changes in teachers' beliefs and that teachers would also look for changes in students' behaviours before they would they changed their beliefs about new practices and initiatives. Loucks et al., (1975, cited in Hall & Hord, 2001) recognised that varying behaviours can reflect different stages in the change process. The behaviours appear to relate to the technical aspect of teaching, for example, employing a specific strategy. Loucks et al. described the features of behaviour at different stages of the change process and these are detailed in Table 2.4.

The framework for analysing innovation adoption provided a useful tool for this research, particularly for describing stages in the change process, and also to predict what might evolve next. The framework linked well with Moon's Map of Learning, in fact it aligned closely with the representations of learning described by Moon (see page 31). More importantly for this research was to determine whether the support being provided through the school's PD strategy or the incidental learning opportunities that arose proved supportive of truly changing teachers' beliefs and practices.

Table 2.3 Levels of use: A framework for analysing innovation adoption.
(Loucks, S.F., Newlove, B.N. & Hall, G.E., 1975, p.171-175).

LEVEL OF USE	BEHAVIOURAL INDICES OF LEVEL
Non use	No action is being taken with respect to this innovation.
Orientation	The user is seeking out information about the innovation.
Preparation	The user is preparing to use the innovation.
Mechanical Use	The user is using the innovation in a poorly coordinated manner and is making user-oriented changes.
Routine	The user is making few or no changes and has an established pattern of use.
Refinement	The user is making changes to increase outcomes.
Integration	The user is making deliberate efforts to coordinate with others in using the innovation.
Renewal	The user is seeking more effective alternatives to the established use of this innovation.

In addition to monitoring the behaviours associated with the change process my research reflected on the types or level of changes that occurred. Biggs (1999) suggested that learning can occur at a surface, strategic or deep level of understanding. Practices that emerge depending on the learning that has occurred may reflect whether the learning and/or change in practice have been at a deep, surface or strategic level. For example, were changes in teachers' practices associated with the technicalities of teaching including pedagogical practices, or were changes aligned with a cultural perspective including redefining the nature of the schooling experience for teachers and students.

House (1981) described three different perspectives of educational change. He suggested change could be viewed from a technical, cultural and/or political perspective and the nature of the reform at Fulton provided an opportunity for many types of change to occur. Hargreaves et.al., (2001) added a fourth perspective, the postmodern. As Hargreaves et al. noted all four perspectives are generally evident in the processes of change. Technical change focuses upon developing new knowledge, skills and behaviours. Cultural change involves understanding the teachers' interpretations and responses to new ways of working and subsequently the impact teachers' thinking has on the culture of teaching and learning in the school. Change from a political perspective links specifically to power, and how it is exercised. Hargreaves et al. (2001) suggested attention must be paid to "the ways groups and their interests influence the innovation and reform process" (p.121). They also said, "the political perspective also raises questions about who is in charge of change and about whose agenda the change serves" (p121). This comment is of particular relevance as there will be significant demands placed on the teachers in this school to engage in new initiatives that are enforced rather than self-determined.

Finally, Fullan et al. described the postmodern perspective as being anchored in “uncertainty, complexity, and continuous change” (p.122). The challenge for the teachers in this school was to understand that change is a process, and while there will be a need to work in different ways, the desire to change several aspects almost immediately may result in chaos, frustration and a return to traditional ways of working if positive outcomes are not forthcoming. These four perspectives assisted in theorising about the processes and outcomes of teachers’ learning at Fulton.

Of interest in describing types of change is the concept of generative change as described by Franke et al. (2001). They suggested that teachers with significant experience do not view outcomes of professional learning experiences as making significant change to their beliefs and practices. However, Franke et al. suggest that “Generativity refers to individuals’ abilities to continue to add to their understandings. When individuals learn with understanding, they can apply their knowledge to new topics and solve new and unfamiliar problems” (p.655-656). Documenting the teachers’ interpretations and outcomes of their learning and change processes from these different change perspectives assisted in developing the explanatory model of professional learning at Fulton.

Another useful framework in sensitising my thinking about change in the Fulton context was the Leading Complex Change model developed Lippitt (2003). York-Barr et al.(2006) describe the model as a “deceptively simple framework” (p.210) that not only identified the elements in the change process but also likely outcomes if such elements failed to be considered. The five key elements to be addressed in planning for, managing and supporting change are vision, skills, incentives, resources and action plans. According to Lippitt, lack of vision will result in confusion, inappropriate skills and capabilities will result in anxiety, lack of incentives in only gradual change, limited resources in frustration, and the lack of an action plan in false starts. This appeared to be a particularly helpful model given its recognition of feelings associated with lack of attention to specific elements in the framework. In developing an understanding of the links between teachers’ learning and change outcomes I was interested in whether teachers used language associated with the outcomes identified in the Leading Complex Change model including frustrated, anxious, confused, false starts and so forth. I had certainly noticed that false starts occurred in several of the curriculum writing sessions and rather than viewing these as a lack of an action plan I had considered generating a range of ideas was possibly productive to a deeper understanding of connections between disciplines. However, on many occasions there emerged a sense of confusion and at times frustration in reaching consensus.

The Leading Complex Change model allowed me to consider whether teachers were clear about the purpose of developing innovative and interdisciplinary curriculum (as in vision) or whether the frustration of spending much time in curriculum writing emerged because this was not a familiar role and the incentive for the extra effort was not paramount. While the model appeared of use to analysing the teachers' responses and change outcomes it was important not to limit my thinking to the one model. The grounded theory process required me to keep an open mind about teachers' perspectives on changes in their own beliefs and practices and what they attributed these changes to.

2.6 Summary

The review of the literature in Chapter 2 represents the initial connections I made between teachers' professional learning from a theoretical perspective and from my early days in the field. The literature reviewed sensitised my thinking about an initial framework that could be used to guide the data collection and analysis. I felt that the three organising themes - processes of learning, teachers' professional learning and change processes and perspectives were all relevant to understanding the processes and outcomes of professional learning in an innovative school. I developed a framework of sensitising ideas as a starting point for describing and analysing data collected at Fulton. Figure 2.4 provides an overview of the sensitising ideas that guided the research process and it can be noted that both learning and change processes have been included along with recognition that teachers' prior knowledge and beliefs, characteristic and sense of personal agency are also influential in teachers' learning. The stages in Moon's (1999) Map of Learning have been included, as I believed it was a useful and simple model for describing the processes of teachers' learning. Loucks et al.'s (1975) analysis of innovation adoption was also included as it provided a tool for tracking change from a technical and cultural perspective.

The sensitising ideas framework also provided explicit recognition that learning could occur in both intentional and incidental ways and that teachers' learning is best supported by developing professional learning opportunities that are based on the characteristics of effective professional development as reported in the literature, for example, Hawley & Valli, (1999). Finally, the framework also considered the type of outcomes that may occur as a result of teachers' learning at Fulton including surface, strategic and deep change.

The sensitising ideas framework provided an insight into the big ideas that were at the forefront of my mind as I commenced my time in the field and in reviewing the literature. The literature certainly assisted in orientating me to the conceptual ideas and frameworks of other researchers

and as noted by Clare and Hamilton (2003) acted as a data source in its own right for which to compare and contrast the data being generated by my own research at Fulton.

The research questions (see Chapter 1, p. 14) remained central to my research but the literature review enabled the generation of more specific questions, particularly in relation to the key themes and these assisted in guiding initial data collection and analysis. These questions included:

Beliefs about learning and teaching

What were teachers' current beliefs about effective learning and pedagogy and how did these influence their engagement with professional learning opportunities?

What promoted changes in these beliefs?

What were the outcomes of changes in beliefs?

Intentional and incidental learning

Did teachers acknowledge the environment as influential on their learning?

Did they refer to incidental opportunities to learn at Fulton as "learning"?

How did the teachers respond to intentional learning opportunities and what were the outcomes of intentional learning?

What learning opportunities were described as most powerful by the teachers?

Learning for understanding

Did teachers' descriptions of effective learning include reference to concepts associated with learning for understanding?

What was the outcome of teachers developing knowledge about learning for understanding?
Did it influence their curriculum design and teaching practices?

Did teachers' use of language and actions reflect their knowledge of theories of learning?

Are the features associated with learning for understanding evident in the school's professional development strategy and activities?

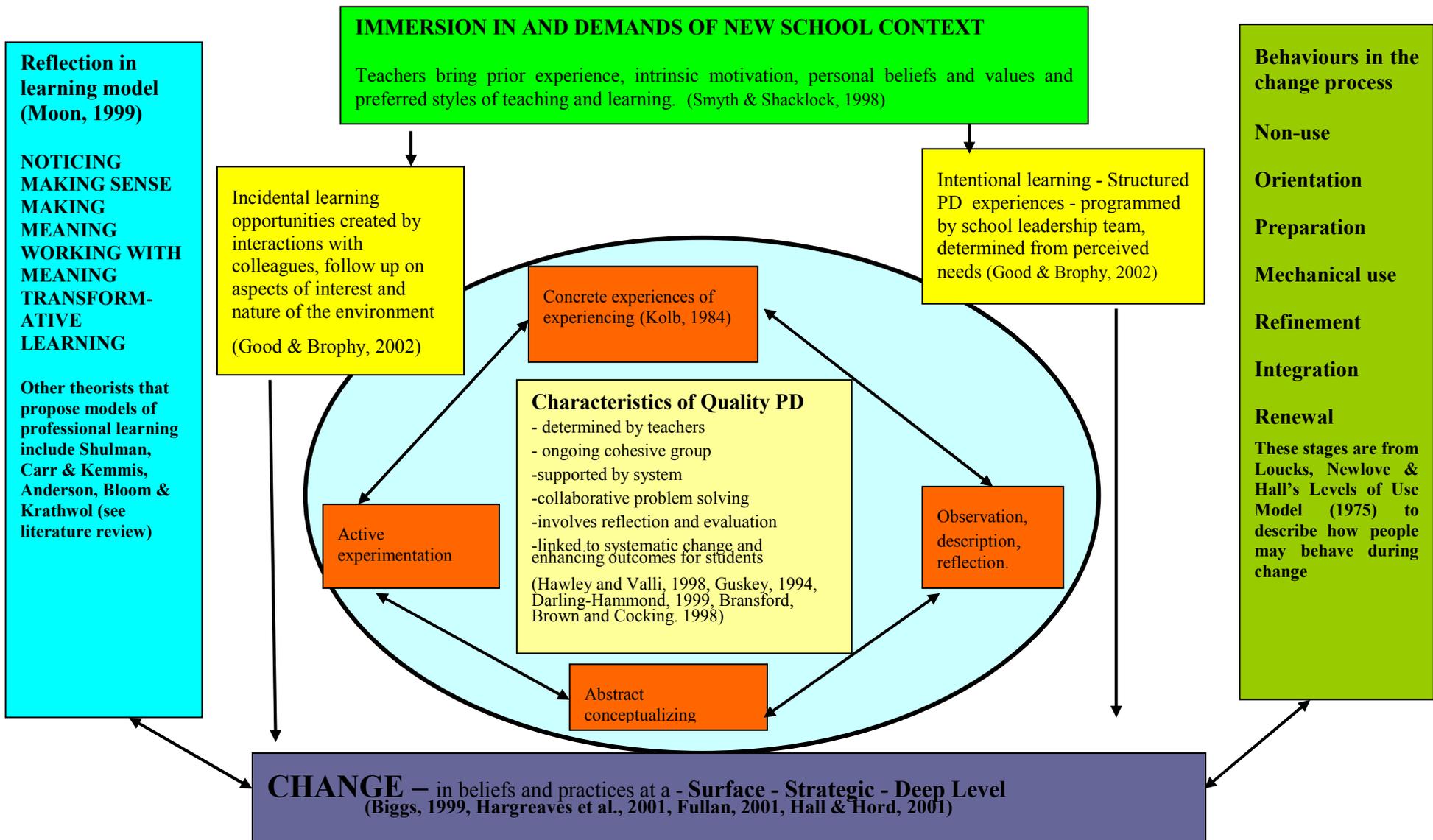


Figure 2.3 Sensitising ideas framework that guided the research process

Expert learners

Would the outcomes of teachers' learning at Fulton be a group of expert learners that in transforming their understandings of the new sciences, and teaching and learning, be pivotal in sustaining the innovative culture of the school?

And what of teachers who did not present with the behaviours of an expert learner? How would they influence outcomes for students and the culture of the school?

Stages in learning

How did teachers' use of language and actions represent stages in learning as proposed by researchers such as Moon and Shulman and was this relevant in the explanatory model of PL at Fulton?

Pedagogical practices that promote effective learning

Did teachers exhibit the pedagogical practices identified in Hattie's (2003) research including those of challenge, deep representation, and monitoring and feedback or did such skills develop through the teachers' engagement in professional learning at Fulton?

Were teachers themselves open to challenges and feedback in their own learning and what processes presented them with opportunities to engage in developing deep representational knowledge of new and innovative content?

What processes or learning opportunities did the teachers describe as providing the most valuable challenges and feedback?

Did the school's professional learning strategy make explicit use of theories of learning and pedagogy, and if so what researchers were prioritised and why?

Preferred models of professional learning

What models of professional learning were prioritised in the opportunities provided for teachers at Fulton? And what approaches did the teachers prefer?

What were teachers' responses to engaging in professional learning opportunities including action research, reflective practice and learning communities?

Change processes and perspectives

Did the outcomes of teachers' learning promote change in the school?

What were teachers' descriptions of change in the school and within themselves?

Were changes associated with technical, cultural or political levels of change?

How did the outcomes of teachers' learning help achieve the school's vision of change and innovation in the teaching of science and mathematics in the senior secondary years of schooling?

All of these questions emerged as a combination of my immersion in the context of Fulton and of my engagement with the literature. As suggested by Mason (2003) to perceive something new one must "interrogate closely one's own experiences, and juxtapose that with what others have said" (p. 230). The process was a critical starting point in my research. However, as stated previously in this chapter, the grounded theory research process often generates several shifts in focus following much time in the field. These shifts become evident in forthcoming chapters and how this occurred is now presented in more detail. In the following chapter, the design of this study will be described, including the methods of data collection and analysis, and methodology.

3. Methodology and methods:

Ways of knowing about teachers' learning in context

"...professionals work in very different ways, rather than inhabiting the 'high ground' of professional certainty, they have to work in the 'swampy lowlands' of everyday life, facing situations that are complex and messy, defying easy technical solutions: 'the problems of real world practice do not present themselves to practitioners as well-formed structures. Indeed they tend not to present themselves as problems at all but as messy indeterminate situations'..." (Schon, 1987, p.4).

"...if you bring a certain kind of open, moment-to-moment, non-judgemental awareness to what you're attending to, you'll begin to develop a more penetrative awareness that sees beyond the surface of what's going on in your field of awareness. This is mindfulness. Mindfulness makes it possible to see connections that may not have been visible before" (Senge, Scharmer, Jaworski, & Flowers, 2004, p.50).

"...the idea is to create historically situated tales that include both highly focused portraits of what identifiable people in particular places at certain times are doing and a reasoned interpretation of why such conduct is common or not..." (VanMaanen, 1998, p x-xii).

3.1 Introduction

This thesis is the report of an ethnographic interpretive case study which investigated the processes and outcomes associated with teachers' professional learning in a setting that was designed to promote innovation and reform in the teaching and learning of science and mathematics. The thesis developed a theory and model of teachers' learning in an innovative environment; it did not attempt to generate propositional and transferable knowledge. As Stake (2000) said: "When explanation, propositional knowledge and law are the main aims of an inquiry, the case study will often be at a disadvantage. When the aims are understanding, extension of experience and increase in conviction on that which is known, the disadvantage disappears" (p.21). Sturman (1999) added further support for the use of case study methodology:

Where case studies are providing a detailed description and understanding of a case and where researchers are open to new ideas that may challenge existing propositions, they provide not only the means by which existing conjectures and theories can be tested, but also the capacity to develop new theoretical positions. (p.105).

The social purpose of the thesis was to illuminate and understand the lived experiences and perceptions of teachers as they contended with new approaches to teaching, curriculum and their own learning at Fulton. The very innovative nature of Fulton provided an opportunity to create an historical account of the experiences and transformation in teachers in the first few years of the school's operation. To achieve an authentic account of the teachers' lived experiences I positioned myself as an insider-researcher working intensely and thoughtfully with staff at Fulton over a period of six years. As an ethnographer I was attempting to understand and explain the processes and outcomes of teachers' learning in relation to previous knowledge of the professional learning field, my own experiences of providing professional learning for teachers and through looking in new ways at the relationships between the parts and whole of the Fulton professional learning model. Ultimately the final thesis is a representation of my interpretations of the teachers' lived experiences but through the use of grounded theory methodology, the emerging theories were scrutinised by a number of audiences including at national and international conferences and most importantly by the teachers themselves. Although the writing of the thesis was a solitary exercise the analyses of the data and generation of the theory and model was a highly interactive process with the teachers at Fulton acting as co-researchers throughout.

This chapter provides a rationale for the selection of methodology and methods drawing on the experiences of previous researchers and the demands and constraints of the context in which the research was situated. Each section of the chapter provides an opportunity to track my thinking and subsequent actions. This provides evidence on which the soundness and validity of the research process can be judged.

There are five sections in this chapter. The first section discusses my ontological and epistemological position noting influences on selection of methodology. Section 2 explores the choice of qualitative methodology and its characteristics. Section 3 focuses on decisions and actions taken in the research process including preliminary work and the more structured actions that followed. This section also provides details of data sources, data generation and key participants. Section 4 describes the data analysis and interpretation process. The final section considers the ethical issues involved in the research process.

3.2 What underlying principles guided this research?

3.2.1 Ontological and epistemological position

My history as a school and university based educator has helped shape my ontological values. I have a strong belief in the capacities of teachers to develop theories about teaching and learning based on their professional experience and to constantly refine these theories into

practices that result in enhanced outcomes for students. However, teachers' actions are often based on tacit knowledge that often remains tacit until they are provided with an opportunity to reflect either individually or with colleagues on the nature of their practice and educational decisions. When provided with such opportunities teachers can develop deep knowledge about the complexities of their roles and subsequently articulate why and how they do things. They can generate new ways of thinking about teaching and learning and develop new practices in line with new ways of theorising their work. I believe teachers who recognise the challenges associated with schools and schooling in the 21st century and actively engage in ongoing professional learning can make a difference for their students and schools as learning organisations.

I believe teachers' knowledge and their ability to reflect on, describe and analyse their lived experiences, in particular how these develop and change over time, is of significant value and interest to educational researchers. Seeking to understand what the "truths" are for the very people who are charged with the education of members of our society provides educational researchers with an opportunity to consider a number of critical issues. Of particular interest to my research are issues of teachers' recognition of their roles in reform and innovation and the influence their own learning has on the outcomes for schools as organisations, for themselves as professional educators and for their students.

I believe that developing such understandings about teachers' perceptions of their lived experiences is best supported by participating closely in their lives in preference to acting as a spectator. As an educator myself, I have lived the life of a teacher and developed my own theories and practices. My "truth" serves as a foundation that is rational and real for me but is open to transformation through sharing my descriptions and explanations with teachers at Fulton and listening to their descriptions and explanations. I believe such a mutual relationship of influence is reflective of the social world in which we live where all who have a common interest and spend time in dialogue with one another shape how we come to know what we do.

My beliefs and experiences as an educator and in working with other educators underpin my epistemological values. I believe knowledge is something we create, "in company with other people who are also creating their own knowledge" (Whitehead & McNiff, 2006, p.23). I believe we are constantly in a process of testing and retesting our knowledge against new information and lived experiences. This process of constant critique is designed to seek something better for ourselves, others and the wider society.

However, it is not enough to state, "I know" this to be the case but to clearly articulate influences on knowledge and recognition of how knowledge cannot be separated from the

complexities of people's and societies' values. As a researcher it is important for my methodology and methods to reflect the epistemological values of social inquiry based on openness, mutual relationships of influence, reflexivity and mindfulness (Senge et al., 2004).

3.3 What methodology was used in the research?

3.3.1 The philosophy of qualitative research

The choice of methodology for this research recognises that the processes associated with teachers' learning are inextricably linked to the complexities of their work. Furlong (2000, p.18) captures the essence of such complexities when citing Schon (1987) who said:

...professionals work in very different ways, rather than inhabiting the "high ground" of professional certainty, they have to work in the "swampy lowlands" of everyday life, facing situations that are complex and messy, defying easy technical solutions: "the problems of real world practice do not present themselves to practitioners as well-formed structures. Indeed they tend not to present themselves as problems at all but as messy indeterminate situations. (p.4)

Given that the teachers at Fulton are working in an innovative setting that demands new ways of working that do not always allow them to rely on existing knowledge and skills, Schon's concepts of "messy indeterminate situations" are highly relevant to this research. To develop a comprehensive and deep understanding of how teachers experience and perceive learning processes in an innovative environment leads to research questions that "are not framed by operationalising variables; rather they are [questions] formulated to investigate topics in all their complexity, in context" (Bogdan & Biklen, 2003, p.2). In seeking data to answer the research questions in this thesis a qualitative research paradigm was of most relevance.

Qualitative research can take many forms but the essence of such research is concerned with context and the researcher spending extended periods of time in that context collecting extensive and detailed descriptive data (Bogden & Biklen, 2003, Clare & Hamilton, 2003, Ely, 1996, Ezzy, 2002, Willis, Smith & Collins, 2000). As Bogden and Biklen (2003) said, "Qualitative researchers set up strategies and procedures to enable them to consider experiences from the informants' perspective" (p.7). This comment is certainly consistent with the aims of my research but attention is also drawn to other key characteristics of qualitative research noted by Bogden and Biklen. They suggested that beyond context and rich data description, qualitative researchers are concerned with process over outcomes or product. The processes that support or inhibit teachers' learning at Fulton are fundamental to this research and central to the development of a theoretical model of teachers' learning in an innovative environment.

The choice of a qualitative paradigm for this research also acknowledges that the researcher is not seeking to prove or disprove any previously held theoretical position but rather

to gather and analyse data that can explain a particular phenomenon: the processes and outcomes of professional learning in an innovative school.

Qualitative research is ultimately concerned with “making meaning” and in particular taking the meaning of others and interpreting this in such a way that the (re) told story is authentic to the informant and the reader. As Bogden and Biklen (2003) summarised: “...qualitative research can be characterized as a dialogue or interplay between the researchers and their subjects” (p.7). This research certainly drew on such a methodological paradigm and involved “interplay” between research and informant over an extended period of time. Such qualitative research has been described in various ways including symbolic interaction, phenomenology, case study, interpretive research and ethnomethodology (Bogden & Biklen, 2003, Ezzy, 2002). Bogden and Biklen suggested that the use of the various terms is dependent on individual preferences and user but that difference in the terms generally arises from historical perspectives and context. In essence preference for particular terms is often a reflection of epistemological beliefs being supported by what is taken to be true from experiences (ontological beliefs). However, most qualitative researchers no matter what terms they use to describe their methodological approach acknowledge that their work is underpinned by hermeneutics.

Ezzy (2003) describes hermeneutics in the following ways:

- “ ...a philosophical background from the practice of applied qualitative research (Polkinghorne, 1988, Lalli, 1989, Crotty, 1998)” (p.24),
- “...the art and science of interpretation.” (p.24),
- “..[engaging] with the image as a way of discovering the truth.” (p.24) and, finally;
- “...a dance in which the interpretations of the observer and the observed are repeatedly interwoven until a sophisticated understanding is developed.” (p.25).

The methodology of this research is situated within a hermeneutics philosophy and specific methodological terms and approaches are described in more detail in the sections to follow. At this point it is also important to note that the decision to locate this research within a hermeneutic philosophy demands the choice of specific methods for data collection and analysis. These choices are also explained in more detail in sections 3.3 and 3.4 of this chapter.

3.3.2 *An interpretive case study design*

An interpretive case study design was selected for this qualitative research as it “is an empirical inquiry that investigates a contemporary phenomenon within a real-life context; when boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used” (Yin, 1989, p.23).

Grounded theory was the principal method of inquiry in the case study and the following processes summarised by Charmaz (2006) reflected the essence of the research processes:

- The grounded research process is fluid, interactive, and open-ended.
- The research problem informs initial methodological choices for data collection.
- Researchers are part of what they study, not separate from it.
- Grounded research analysis shapes the conceptual content and direction of the study; the emerging analysis may lead to multiple methods of data collection and to pursuing several lines of inquiry.
- Successive levels of abstraction through comparative analysis constitute the core of grounded theory analysis.
- Analytic directions arise from how the researchers interact with and interpret their comparisons and emerging analyses rather than from external prescriptions. (p. 178)

3.4 *What methods were used in the research?*

The research was conducted within one school, Fulton Senior Secondary School, but specific teachers were selected to act as key informants. As Corbin and Strauss (1990) suggested, the use of multi-subjects within a site is preferred if the aim of the research is to develop theory, being an explanatory model of professional learning in an innovative school in this research. In developing an explanatory model of professional learning in this site, all teachers whether they acted as informants or not should be able to see themselves as fitting within the model that emerged. Details of individual teachers who were specifically selected to act as key informants are provided in section 3.4.4 of this chapter. From the selection of the teachers to the generation of the explanatory model of professional learning a constant comparative method was used (Glaser & Strauss, 1967, Strauss, 1987, Strauss and Corbin, 1990).

Glaser (1978, cited in Bogden & Biklen, 2003, p. 68) summarises the key steps in using a constant comparative method to develop theory. These include

1. Begin collecting data.
2. Look for key issues, recurrent events, or activities in the data that become categories of focus (in this research the initial categories of foci were learning and pedagogy and professional development processes that promote change in teachers' beliefs and practices).
3. Collect data that provide many incidents of the categories of focus, with an eye to seeing the diversity of the dimensions under the categories.

4. Write about the categories you are exploring, attempting to describe and account for all the incidents you have in your data while continually searching for new incidents.
5. Work with the data and emerging model to discover the basic social processes and relationships.
6. Engage in sampling, coding and writing as the analysis focuses on the core categories.

These steps are reflective of the processes employed in this research and are closely aligned with grounded theory, the principal method of this inquiry. As Glaser suggested the steps do not occur in a linear fashion but interact on a consistent basis. Ezzy (2002) also supported this process stating that “According to the methods of grounded theory, concepts, categories and themes are identified and developed while the research is being conducted....Grounded theorists begin by identifying some important issues that guide the collection of data” (p.12).

While Glaser (1978) believed that researchers employing grounded theory “should enter the research setting with as few predetermined ideas as possible” (p 3), Ezzy (2002) suggested this would be naïve and recommended that the first step for the researcher is to deal with one’s preconceptions by formally stating rather than denying them. Glaser’s and Ezzy’s views are both relevant to this research. I commenced with limited ideas and directions about what would be investigated but as I spent more time observing and interacting with the staff what I noticed, due to my own preconceptions, guided the direction of the ongoing observations and the choice of the literature to review. For example, the observation of staff as they engaged in developing an interdisciplinary curriculum generated a sense of the quality of teachers’ learning that occurred when engaged in “real” problem solving as opposed to the interest but lack of learning that was evident when teachers were involved in listening to experts talk about content that was not specific to their immediate needs. Working with and observing the teachers at Fulton while at the same time engaging with the relevant literature was critical to the development of themes that shaped the explanatory model of professional learning at Fulton. As Anslem Strauss (1987) stated “No [qualitative] proposal should be written without preliminary data collection and analysis” (p.286). Preliminary immersion in the field and data collection helped shaped the initial focus areas of the research. As the research was conducted over a six-year period it provided an opportunity to describe change over time and changes within the initial focus areas. For example, curriculum writing was not initially analysed for its contribution to teachers’ professional learning but following ongoing observation of interactions between staff as they engaged in this process and their description of learning outcomes that had occurred, the process emerged as central to the explanatory model of professional learning.

Throughout the research process I viewed teachers as both participants and informants. In the initial stages of the inquiry the teachers acted as informants, providing information about their experiences, practices and beliefs. The role of informant continued throughout the project. However, as collaborative partnerships with the teachers developed through engagement in joint-learning opportunities and professional presentations, they contributed to the research process. The collaborative and interactive participant role emerged from teachers requesting opportunities to engage in structured professional learning opportunities that would receive tertiary recognition and were tailor-made to meet their specific needs. As the provider of some of these learning opportunities I was able to seek feedback from the teachers that allowed me to modify and document change in my own practices and gather data that contributed to building an explanatory model of PL at Fulton. For example, in seeking feedback from my initial involvement in the structured professional development program I was interested in the following comments about the quality and outcomes of the activities provided:

“I think I needed more scaffolding and support, like some of my tutor group I need help even though I may not ask for it.” (Teacher C)

“I often felt in a blurry bundle. I don’t think I have done service to this learning because I never really finish things off, other things here get in the way.” (Teacher D)

“Seemed too open and lacking in the beginning but this has to do more with my lack of experience.” (Teacher E)

These comments served to assist me in shaping support in ways that these teachers requested, and, at the same time, contributed to building a model of professional learning at Fulton. The comments also provided insight into these teachers’ perspectives on themselves as learners, perspectives that served as starting points for further discussion about teachers’ beliefs and practices and helped generate the themes to be investigated. In essence the process reflected the overall approach taken in the research where my role became that of interpretive ethnographer. Ezzy (2002,) suggested the strength of such an approach is that it “allows the analysis to be shaped by the participants in a more fundamental way than if analysis if left until after the data collection has been finished” (p.61).

The interrelated process of data collection and analysis is also central to the grounded theory method. Ezzy (2002, p. 63) described well the approach used in this research. He notes that:

Examining data right from the beginning of data collection for “cues” is what makes grounded theory “grounded”. It is also the foundations of inductive theory building. Data collection is guided by either preconceived theories and ideas about what is important, or data collection is guided by cues that present themselves during the data collection process.

In this research both processes occurred; data collection was initially structured around questionnaires and semi-structured interviews but through immediate analysis of the data and engagement of the participants in the analysis, “cues” emerged that became themes to be investigated. As an interpretive ethnographer it was critical to be alert to the outcomes that initial analysis of data generated and the new questions that emerged. The process is captured well in the words of Risser (1997), “Questioning is...a probing of possibilities...the point is not so much that the questions get answered...but that in the questioning I am able to gain access to the otherness of the other” (p. 137). These four perspectives assisted in describing the evolution of the teachers’ learning at Fulton. The processes undertaken to ensure the voices of the “others” featured strongly in this research are discussed in more detail in sections that follow.

3.5 What actions were taken in the research?

The aim of the research was to investigate teachers’ opportunities for, and experiences of, engaging in professional learning and the subsequent outcomes of the learning as they worked in a school designed to promote innovation and reform in the teaching and learning of science and mathematics. From this investigation an explanatory model of professional learning emerged. The following actions all played a valuable role in the processes that led to the development of the model.

The research was conducted over a six year period commencing in the weeks before the school officially opened. During this time a number of different actions were undertaken to gather data to answer the research questions. Although there were several intentional data gathering processes a major approach to the collection of data was through immersion in the field. In the first two years of the school in operation I was an active participant in the daily life of the school and engaged in many of the activities available to staff. As noted above this provided opportunities to engage in ongoing data collection and analysis and this shaped the actions that are described below. The actions are described in longitudinal terms. The first section is a recount of some of the preliminary work I engaged in prior to developing the research questions and specific actions that were taken in seeking answers to these questions. This section provides a background to the research reflecting the processes and thinking that shaped my initial interpretations and questions. It also represents an example of the researcher entering the field without a pre determined agenda.

3.5.1 Preliminary work

“She has no formal hypothesis, and kept her hunches at the back of her mind while she listened and tried to comprehend the everyday reality of her informants.”

(Minichello et al., 1990, p.102 cited in Ezzy, 2002, p. 10).

Glaser (1978) suggested a qualitative researcher should enter the field open to as many possibilities as possible and I certainly embarked on my preliminary work with a sense of living the life of the teachers as they commenced on their new journey of teaching and learning in a very different environment and in very different ways. I, too, found researching in such a way as very different. In previous research I had worked in more traditional ways with well-constructed questionnaires and interview protocols seeking to support hypotheses I had proposed.

Having the opportunity to participate in these teachers' lives as they prepared for and commenced teaching at Fulton allowed me to reflect on the multitude of issues these teachers faced and note their different values and styles of interaction and management. For example, one teacher who had been engaged by the school as a curriculum writer prior to the appointment of the foundation staff struggled with the criticism of some of the learning objectives and planned activities that she had created. This teacher viewed the work to be very innovative, solidly based across disciplines and also rich in effective teaching and learning principles. Her sense of ownership and pride in the work was tested by the reflections of many of the new teachers. Her reaction was justified from her own perception and drew empathy from others who had spent long hours in the curriculum design process too. However, the views of those critical of aspects about the design were aired and noted as relevant also. One teacher commented, "I believe in being appointed to any school and asked to teach a specific topic [in this case a specific section of an interdisciplinary study], I would be afforded the professional responsibility of being able to modify and teach in ways that I viewed as being more relevant" (Teacher A). This "event" is reflective of the importance Hargreaves et al. (2002) and van den Berg (2002) placed on viewing the emotional responses of teachers in seeking to understand the patterns of functioning and development of individuals and how these affect others in the organisation and the organisation itself.

In observing this "event" as it unfolded over several days I recognised that these teachers brought specific values and ways of working that differed from one another and that changing these beliefs would require much more than a demand to do so. However, I also recognised the potential learning opportunity that such an issue could provide and that the learning opportunity was far different from the formal professional development that many of these teachers had previously engaged in. I also began thinking about how interactions and responses between teachers who were unfamiliar with each other's histories and personal values and beliefs could have a powerful effect on shaping the learning culture of the school in its infancy. Could these teachers move beyond personal difference to understanding how such differences could create powerful learning opportunities?

My preliminary engagement with the staff also provided a sense of the incredible workload required in the initial two week period. Staff were engaged in curriculum design, professional development sessions on learning and teaching, development of policies, timetable arrangements and in responding to anxious parents and students who had taken the risk to enrol in such a school during a critical phase of their education, particularly in terms of entry to university. I recall wondering how I could possibly ask the teachers to consider involving themselves in research projects as well. My response to this was to ensure that the research I was doing could be of value to this school in its ongoing development.

Key aspects that emerged from my preliminary work were many but I kept returning to the issue that although these teachers were working in an innovative environment with many opportunities to do things differently, I continued to see teachers talking about student learning and outcome requirements in very traditional ways. I also observed that many continued to work in traditional ways, in some situations taking a more traditional approach than they had previously. One teacher following the initial weeks of teaching within the new curriculum model stated, “I feel far more restricted about how I am teaching now than I ever have” (Teacher B). I found this comment of interest in that the teaching he was delivering was carefully planned with quite specific outcomes – a desirable model according to Wiggins & Mc Tighe (1998). Did the experience of “feeling restricted” represent a negative perception about working in this new way?” At the time this feeling was never challenged by his colleagues; in fact, there was a general agreement about the “problems” associated with delivering this type of curriculum. I pondered on why the comment was never analysed from the perspective of whether such a way of working was actually effective teaching for positive student learning outcomes. I also wondered why the school had vision statements about effective teaching and learning and mandated professional learning sessions delivered by “experts” in the field of learning yet the teachers did not relate their own learning experiences to their teaching experiences. Was it that teachers were familiar with attending professional development sessions that they viewed as being about students’ learning and not their own? These were questions that emerged for me as I spent the first few weeks of this research immersed in the work and learning environment of the teachers at Fulton. The experience provided an opportunity to work closely with the teachers, to observe and engage in discussions with them, and to listen to their stories. The rich data that was being collected as field notes kept leading to me the questions: “What does or will make a difference to these teachers’ beliefs and practices?” From the very early stages of the research, I considered myself as working in partnership with the teachers at the school and my openness to their issues influenced how the research was designed and ultimately developed over time.

The description of thinking processes in my preliminary work provides evidence of the ongoing movement between pre-existing theoretical perspectives and my own emerging questions. The process was supported by “memoing”, a grounded theory method that reflects the blending of description, interpretation and ultimately analytic statements with supporting evidence.

3.5.2 *The more structured actions*

The major actions in the research process were designed to answer the research questions and involved gathering data from a range of sources over time. Actions included inviting teachers to complete an inventory (Mason, 2000) and/or open-ended questionnaires, observation of teaching and teacher meetings, in depth interviews with specific teachers and members of the leadership team, participation in school committees, document analysis and gathering formal and informal feedback on teachers’ experiences of professional learning opportunities.

The first structured action taken in the research process was an information session for all staff. The session was conducted within the two week orientation program prior to the official opening of school. Staff were informed of the research project and processes. They were informed that the research was qualitative in nature and revolved around teachers’ professional development and would involve me as an “in-residence” researcher particularly in the early stages of the inquiry. I shared with them that my daily participation in their world for the next few weeks would be important in helping me shape the initial structure and framework for the research and any suggestions from them would be highly valued.

Many staff members were not familiar with formal research projects or working with university personnel and therefore it was important to inform them that there was no expectation or requirement for them to be participants in the research. Although I would be a regular participant in whole staff meetings and activities and observe interactions I would not include the comments or actions of any staff member who made a specific request not to be included in the research in any way. Staff were informed that ethics approval for the research from both the university and their own employing body had been granted and that there was a range of options for participating in the research from no participation through to acting as a specific case study. Staff were given time to think about being participants and were provided with a written summary of the project plan and participant consent forms. Staff were invited to speak with me personally if they required further information about the research and different participation options. Several staff sought me out for an extended conversation with most being willing participants and contributing additional ideas for me to consider as well. As new staff joined the school the same information sharing process occurred, generally at the beginning of each

year. Over 80% of the teachers were voluntary participants in the research and contributed in a range of ways including responding to surveys, engaging in informal discussions, voluntarily providing information they believed was of interest to the research and acting as individual case study respondents.

3.5.3 Questionnaires and inventory

One of the initial activities staff were invited to complete was a Self Inventory designed by John Mason, (2002, pp. 255-259, see Appendix C). The inventory asked teachers to respond to questions about their beliefs, roles and responsibilities and what they liked most and least about their work and ongoing training. The final three open-ended statements in the inventory invited participants to focus on the role of training and development and included

1. What I liked most about being trained (becoming professional) in what I do was.....
2. What I liked least about being trained (becoming professional) in what I do was.....
3. What I look for in professional development opportunities now is.... (p.259).

The participants who responded to the inventory in the first weeks of their teaching at Fulton were invited to complete the inventory again midway through their second year at the school. The responses provided valuable data to track changes in teachers' perceptions of their roles and preferences for ongoing professional development. Following the review of data I was also able to interview individual participants to investigate in more detail the reason behind changes in their responses. Such processes contributed to answering the research question: What factors, activities or situations associated with working in the school contributed to changes in teachers' beliefs and practices?

An additional survey focusing on teachers' beliefs about effective learning and teaching and activities that contributed to their own professional learning was developed and completed as part of a professional learning session (see Appendix D). The survey was conducted in the late stages of the second year of the school's operation. All staff were invited to participate on a voluntary basis and could include their name or remain anonymous. Over 80% of the staff participated in the survey with 60% including their name. The inclusion of names allowed for follow-up if required and also for adding to the data collected from the self-inventory. The survey was conducted via a web-based data collection process and allowed for responses to individual questions from all staff to be collated. This provided an overview of teachers' perceptions to such questions as:

1. What have been major changes in your beliefs about teaching and learning since commencing at Fulton?
2. What have been major changes in your teaching practices since commencing at Fulton?
3. What have been the major contributors to these changes in your beliefs and practices?

One of the final data collection activities conducted in the fifth year of the research process invited all members of the staff to respond to a further open-ended questionnaire. The second web-based questionnaire (see Appendix D) invited teachers to reflect on their time at the school and identify the key events, opportunities and actions they believed were significant in their own learning and why they believed this was the case. The responses to the self-inventory and the two web-based surveys provided a major data base on which to develop an explanatory model of PL at Fulton.

3.5.4 Case study teachers

In addition to the inventory and questionnaires several staff participated in interviews. In the initial stages of the project, staff were interviewed to capture their beliefs about teaching and learning and their sense of professional identity that had developed from their prior teaching experiences. Some teachers appointed to the school had extensive experience, many over 10 years and some up to 20 years of teaching in a range of secondary schools. However, two teachers were first-year graduates. Following initial interviews and ongoing observations and interactions with staff, five teachers were selected purposely to provide diversity, and challenge the evolving model of professional learning. Ezzy (2002) said, “a sample that aims for maximum variation [is] most useful if the aim of the research [is] to document the variations in patterns in a particular phenomenon” (p.74). The selection of cases sought variation in experience, gender, discipline expertise and role in the school. The data collected from the different subjects was analysed for variations and similarities in responses and for fit within the evolving model of professional learning.

A brief description of each teacher selected is provided below but a more extensive understanding of their sense of professional identity and beliefs and practices along with changes in these through their work at Fulton is provided in Chapters 4 and 5. A pseudonym has been provided for each teacher and these names are used throughout the research.

Lisa was a biology teacher with over 20 years of teaching experience. She had acted in a number of roles including head of faculty, state assessment officer and curriculum writer. She took an active interest in ongoing professional learning. In her first year of working at Fulton she applied for and won a \$25,000 state-funded scholarship to extend her professional learning

and used this stipend to travel to the United States of America to further her understanding in the field of Nanotechnology. Lisa was appointed to Fulton as a Coordinator 3 which included leadership of a team of teachers involved in the curriculum design and delivery of one of the school's Central Studies.

Scott was a graduate teacher having completed a one-year, post-graduate teaching qualification following the completion of a Bachelor of Science (Honours) degree. Scott was offered a scholarship to complete a doctorate in the field of chemistry. Scott had almost completed the doctorate prior to enrolling in the teaching qualification course. He subsequently completed the doctorate in his first year of teaching at Fulton. Scott specifically chose teaching as a career because he found the work of a laboratory-based scientist "boring".

Jackie was a mathematics teacher with over 10 years teaching experience, most recently in a rural school. Jackie completed a pure mathematics degree at university prior to completing a one-year, post-graduate teaching qualification. Jackie was actively involved in the state-level professional association for teachers of mathematics. She applied to teach at the school as another colleague, whom Jackie regarded as a mentor, had also applied to teach at Fulton. She was appointed to the school as Coordinator 2. This level involved her in curriculum writing but as a member of a team rather than as a leader.

Barry was a highly experienced teacher with a pure mathematics degree. Barry had taught in many schools in the state and also in international schools. He had been actively engaged in curriculum writing and sought out by professional organisations and education departments to deliver professional development and provide advice on curriculum writing. Barry was an active contributor to this research project but chose not to participate in many of the structured professional learning options available to staff at Fulton.

Johann was the only subject who did not commence teaching at the school in the initial year of operation. Johann had been a principal at an alternative school before resigning to work as a relief teacher. Johann commenced work at Fulton as a relief teacher towards the end of the first year of the school's operation. He fulfilled a number of roles throughout this time but his expertise and qualifications were in the area of mathematics. Johann was appointed to the school in its second year of operation as a Coordinator 2 and member of the Mathematics and Abstract Thinking Central Studies team. He was an active participant in many of the professional learning opportunities provided for the staff.

All teachers participated in semi-structured interviews and were observed in many roles including teaching, participating in professional learning activities and in social interactions with other staff and students. This was an ongoing process, particularly in the first three years of

the research. Interviews were audio-taped, videos were used to record some of the teachers as they were teaching and field notes were collected throughout the research.

3.5.5 Additional interviews

Leadership began to emerge as a significant theme in the research and therefore a decision was made to interview the Assistant Principal (Professional Learning), Frances, and the Principal of Fulton, James, late in the third year of the research. These interviews were semi-structured and focused on Frances's and James's interpretations of the role that policies and leadership played in the processes and outcomes of teachers' learning in the school. They were also provided with the opportunity to highlight other factors that they perceived as significant in teachers' learning outcomes that emerged during their time at the school. Frances commenced work at Fulton six months prior to the school's official opening and was responsible for the initial professional learning policy. James commenced as Principal as the school entered its second year of operation. I worked closely with James and Frances as we co-wrote papers and collaboratively presented as invited speakers at conferences and other educational institutions. Although we had an ongoing discussion about the professional learning of teachers at the school, the formal interview process allowed Frances's and James's beliefs, values and observations to be formally documented and used to test the emerging explanatory model of professional learning.

Frances's contribution to the research went well beyond the one major interview. I worked closely with her prior to the opening of the school and we spent much time considering the professional learning plans she had developed for the school. We worked collaboratively on many outreach professional learning projects as well. We developed papers to present at conferences and supported other staff in doing the same. As our relationship and professional interests developed Frances became an important informant and contributor to my research. She played a key "reference point" role as we discussed the data I had collected and my initial interpretations and analyses. Through this interactive process Frances influenced my focus and the questions that continued to be posed as the data collection and analysis continued. Ezzy (2002) noted, "The finite nature of human perception means that researchers always choose to focus on one or another aspect of a phenomenon. The voice of the participant, rather than the voice of the researcher, will be heard best when participants not only provide the data to be analysed, but when they also contribute to the questions that frame the research and contribute to the way the data are analysed" (p. 640). While Frances was a key reference point I worked in a similar way with many teachers as I engaged in the actions described in this section.

3.5.6 *Committee participant*

There were several other actions that became important processes in the collection and analysis of data. These actions were deliberate and designed to consolidate my role as an insider-researcher or interpretive ethnographer at the school. I was an active participant in two of the school's committees including the Teaching and Learning Leadership (TaLL) group. The TaLL group consisted of the school's leadership team and all Coordinator 3 staff members. The second committee was the "Core" group which involved staff from the school and university who were responsible for supporting and coordinating interactions between school staff and academics. I participated in both committees in a dual role, as a contributing member but also as a researcher making field notes as issues of interest to the research arose.

3.5.7 *Delivery of professional learning*

In addition to participating in the two committees I was also involved as a participant in the initial orientation program for all staff and the ongoing weekly professional learning program. Each week staff were engaged in a two to three hour professional learning program. The program was initially designed by the Assistant Principal, Frances, and provided a wide range of professional learning options from input from guest speakers to working as teams on issues of concern and interest to staff. During the professional learning sessions I acted as an observer and participant depending on the nature of the activity. Field notes were collected during these sessions. These field notes and those from my participation in committee meetings provided a significant amount of data used in this research.

The interaction between school and university academics was an explicit feature of the innovative practices of the school and academics were actively involved in sharing their knowledge with teachers, and in my case, learning from the teachers at the same time. Academics from the Faculty of Science and Informatics contributed content to both the Central Studies curriculum and the University Modules. My own expertise in the area of learning and pedagogy was used in the development of a tertiary topic that was specifically designed to meet the professional learning needs of staff at Fulton. The topic was designed in collaboration with another academic from the School of Education and Frances, the Assistant Principal of Fulton. The topic was offered as a professional learning opportunity that staff could access on a voluntary basis. The topic was initially offered in the second half of the first year of the school's operation.

The topic was called Issues in Professional Learning and was initially designed to provide an opportunity for staff to gain a post-graduate tertiary qualification for the work they were doing in curriculum design and pedagogical reform. Further details of the topic content are

discussed in Chapters 4 and 5. Fourteen of the initial staff of twenty-two participated in the topic. The topic was offered on site and situated in times that were of convenience to the teachers' timetables. These design features were specifically linked to the characteristics of high quality professional learning identified by Hawley and Valli (1999) including

- teachers' identifying their own learning needs,
 - school-based and integrated with school operations,
 - based on continuous and ongoing involvement of a cohesive group
 - opportunities to develop theoretical understandings of new knowledge and skills.
- (p.138)

I was interested in whether teachers would report that such a professional learning opportunity and experience affected and/or changed their beliefs and practices. Outcomes of teachers' participation in the topic are discussed in Chapters 5 and 6.

Several staff did not participate in the module in the first year for a variety of reasons but joined the topic in the second year with other staff members who were new to the school and one teacher from outside of the school who had connected with Fulton through her involvement in an outreach professional learning opportunity. This "outsider" had a particular interest in professional learning and applied for entry to the university as a post-graduate student. The participation of this teacher resulted in some changes to the delivery of the topic given she was engaged in teaching full time in another location. The topic was delivered after school hours on a weekly basis much the same as other university topics but it was still delivered on-site at Fulton. The topic itself also changed in content as a result of feedback from the previous group and the development of a second topic, "Leading Professional Learning" also emerged. Both topics became available to Fulton staff members and all post-graduate students at the university. The ongoing enrolment and changing nature of the students in this topic is of value to the research in itself but not within its scope to elaborate on at this point. However, it is worth noting that it was the school's leadership team's vision and initial group of teachers enrolled in the topic that contributed to generating an ongoing professional learning topic that is now accessed by professionals from a range of local and international educational settings. Such an outcome is of interest to this research and will be reported on in more detail in Chapter 6.

3.5.8 *Document analysis*

The professional learning topics described in the previous section were designed after careful consideration of the characteristics of high quality professional learning (see Hawley & Valli, 1999) but so were many other features of Fulton's professional development policy and therefore the review of the school's policy documents played an important role in the data

collection and analysis. The policy documents were centred on teachers developing individual professional learning plans and the creation of learning teams within the school.

Another major database emerged from the professional learning journal that many staff maintained as part of their work in the professional learning topics and for development of conference presentations. The curriculum materials developed by teachers also provided evidence of the outcomes of teachers' learning and are referred in Chapters 5 and 6.

My actions throughout the entire research are reflected in the advice provided by Ezzy (2002) noted earlier in this chapter:

The finite nature of human perception means that researchers always choose to focus on one or another aspect of a phenomenon. The voice of the participant, rather than the voice of the researcher, will be heard best when participants not only provide the data to be analysed, but when they also contribute to the questions that frame the research and contribute to the way the data are analysed. (p.640)

The actions in this research were designed not only to collect data but to develop relationships with the staff so they could move beyond informants to being participants in the research process.

In summary the key actions in this research involved the use of questionnaires and an inventory (Mason , 2000), semi-structured interviews, observations, participation in the daily life of the school including membership on committees, the design and delivery of topics in professional learning, and the development of relationships with staff so that they could act as co-researchers. The research was conducted over a six year period which provided opportunities to study change over time and generated a significant amount of varied data to answer the research questions.

3.6 What processes were used in analyzing the data?

The processes of data analyses in this research reflected those used in methodologies such as ethnography, action research, and grounded theory. The major technique used in this research was the constant comparative method (Bogden & Biklen, 2003, Corbin and Strauss, 1990, Ezzy, 2002, Gubrium & Holstein, 1997, Miles & Huberman, 1994). Glaser (1978) described the steps associated with the constant comparative method (see pg. 60 in this chapter) highlighting that the process does not always occur in steps but often in overlapping ways. He suggested that initial data analysis generates the need to collect more data as a result of theorising about why and how data may tell similar or different stories. This description is reflective of the processes of data analyses and theorising in my research. As I was engaging in the process I was also

aware that the actual movement back and forth between data collection and analysis reflected the processes described in the Map of Learning developed by Jennifer Moon (1999).

Moon's Map of Learning featured in my review of literature on professional learning and I also began to use it in my work with teachers in the school. As noted in the literature review the language used in Moon's model is very accessible to teachers and can be used to assist teachers in reflecting on their own learning and practices. For example, questions such as "What do I notice most as I engage in teaching?", "How do I make sense of what I am noticing?", "Does this fit with my current understanding of teaching?" and "How does any new meaning affect the way I work?" provided a scaffold for teachers in the process of tracking changes in their thinking and practice. As I continued to use the model and engage in the process of data analysis I found myself using the same language. What do I notice here? How am I making sense of what I am noticing? As I moved to the level of making meaning from what I noticed in the data I was able to generate codes to be tested in the ongoing analytic process. The coding became an example of working with meaning, the testing of my own interpretations, and in this research, the interpretations of my co-researchers, the teachers. The constant interactions and checking with staff about my thoughts and interpretations using a shared language based on Moon's Map of Learning assisted greatly in not only describing the transformative learning for the teachers but also to support the theorising that helped to shape the explanatory model. This research was about the learning processes and outcomes for the teachers yet at the same time it provided an ideal opportunity for me to think about my own learning processes as an interpretive ethnographer. Figure 3.1 provides an overview of stages in the research process as I moved from the initial stages of noticing to generating an explanatory model of professional learning at Fulton. Specific links with Moon's Map of Learning are identified through the use of bold type. The following section elaborates on processes and actions in each stage presented in Figure 3.1. The detailed examples provided an audit trail of my thinking processes as I commenced the data analyses and theorising processes using a constant comparative method.

3.6.1 An example of the initial data analysis and theorising process

One of the first things I noticed in my observations and interactions with staff during the two week orientation period was the anxiety and tension around curriculum and assessment and different teachers reflected in different ways to challenges and demands. I noticed an excitement at the possibilities the new curriculum provided but discontent from some discipline specialists as to a reduction in what they considered to be core content. There was also the additional element of academics from the university pushing the notion that the curriculum needed to be "innovative" and include the latest research and new sciences. Some teachers expressed concern about omitting content from the state-mandated curriculum in favour of the "new sciences" that

were not included in the Year 12 examination. One teacher commented, “I don’t really understand what is going on here, particularly in relation to the [state] assessment requirements. I have a tacit understanding of it...are we saying we are trying to cover eight learning outcomes from the [state] requirements...because as an assessor I would say we are only covering two or three and this will end up being a problem when the kids need to do Year 12 subjects.” I filled several pages in my field notes with similar comments (many of which continued well into the 2nd year of the school’s operation). In trying to make sense of these comments a number of themes emerged including that teachers’ pre-existing experiences, characteristics and sense of professional identity appeared to influence their thinking and reactions.

The teachers appointed to the school, with the exception of the two graduate teachers, were all previously involved in teaching at the Year 12 level. In many cases the success of their students in Year 12 reflected on their professional sense of self. Johann, a case study teacher, captured this notion in his reflections as he engaged in the professional learning topic, “My students’ results are a reflection of my professional abilities. That is, if they do poorly, by school or my standards, then I feel I have failed.” Such beliefs may be at the heart of teachers maintaining a keen focus on how the new curriculum was setting students up for success in Year 12. Although the teachers wanted to be innovative they were reluctant to do so at the expense of students’ success in Year 12.

In additional conversations about curriculum and assessment it appeared that some teachers had difficulty in trusting the new model to work over time as there was constant reference to the high stakes Year 12 examinations. The following teacher comment reflected a concern that the new interdisciplinary curriculum model at Year 10 and 11 would not be effective in preparing students for Year 12. The teacher said “We must be really careful that there is a firm foundation for success in Stage 2 topics. We could organise a committee to monitor what the students are doing and know as a result of this model, and if it’s not working, consider changes to it.” Another teacher comment also reflected a traditional roles and expectation from both teachers and students stating “If we don’t look at students’ work they will soon learn that they don’t really need to put effort in as no-one is looking”. Such comments led me to believe that pre-existing beliefs and sense of personal identity were influential in teachers’ responses to changed conditions of their work would also be influential in their responses to learning.

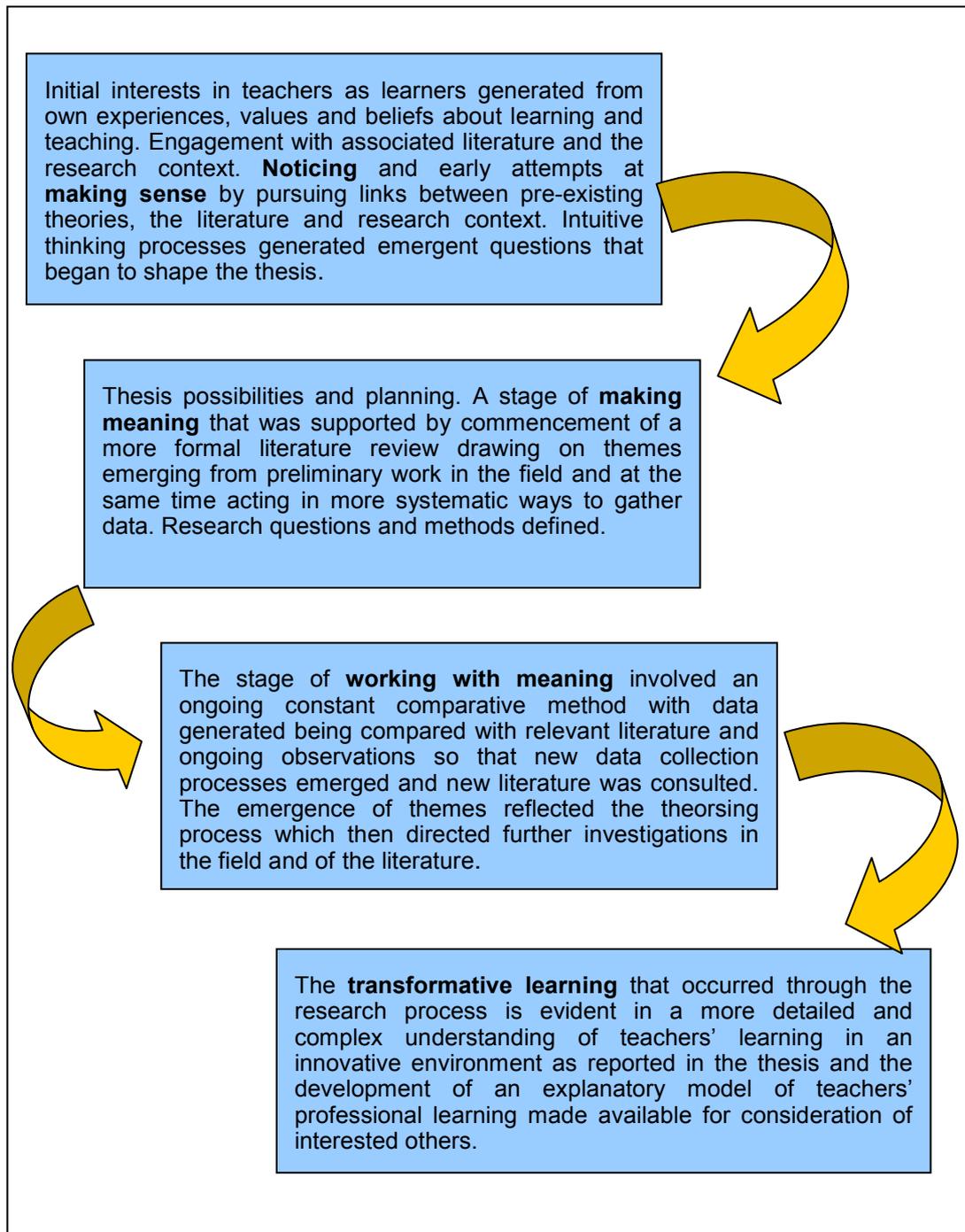


Figure 3.1: Overview of stages in the research linked with Moon's Map of Learning (1999)

I continued to listen for evidence of teachers responding to their work at the school from the perspective of previous experiences of education, and how it may affect their engagement with the innovations and learning opportunities at Fulton. This shifted the initial noticing and making sense to a level of making meaning of the data being collected. I could continue to make sense of my observations and field notes from my own perspective but to make meaning that was supported by evidence beyond my own interpretation, I needed to engage in continuous

review of previous research in the field and constantly check with teachers as to whether my interpretations of their comments and actions were valid. In this way I could start to work with the meaning by generating codes and themes that would be used as an initial framework to guide ongoing data collection and analysis.

In making meaning of the many comments on curriculum and assessment made by teachers in the early days of the school I turned to the work of Hargreaves. I noticed the following in reviewing Hargreaves (2003) research:

Under intensive and insensitively imposed change, teachers also find their emotional worlds turned upside down. Instead of using their emotional intelligence to be more effective with their pupils, or having the time to invest in the relationships that build emotional understanding with those around them, teachers have to engage in what Hochschild calls “emotional labour”...it’s hard to remain authentically optimistic and enthusiastic when you are overloaded. (p.60)

Although the leadership team at Fulton provided a very supportive environment and time for the teachers to meet and plan for their new ways of working, the amount of changes required and lack of time to explore how existing beliefs and value impacted on readiness for change may have been overlooked. My inductive thinking was influenced by my observations and engagement with the literature but it required direct testing with the teachers. I discussed with teachers on an individual basis their perceptions about the influence of their previous experiences on the reactions and responses to the new ways of working at Fulton and what they were feeling about their role and work in the school. Comments from teachers were varied but a sense of the “emotional labour” described by Hargreaves emerged in the following teacher responses.

- To tell you the truth at this point in time I’m exhausted, I have never worked quite so hard yet felt so frustrated, there is just not enough time to get this together in a way that I can teach. I agree with all the philosophies of this place but at the moment the intensity and expectations are grinding me down.
- I am conscious of thinking as if I was working in my old school, the emphasis is always on how to prepare kids so that they will be successful in Year 12...it’s hard to shift away from that pattern but I’m trying to keep an open mind and positive outlook.
- One thing I said to my Year 10s in my last school if that effort and attitudes go down this changes responses to things, I think this is happening to me too, I feel like I have hit the wall in trying to work out how it’s all going to work, I’m worried about this, I just can’t describe it, I need more detail.

The teachers’ comments provided some evidence of the links between emotion and their work. The use of the words and phrases like “exhausted”, “frustrated”, “hard to shift”, “hit the

wall”, “worried” and, from a counter position, “open mind” and “positive” reflected emotional responses to the challenges faced by working in a setting demanding change. The second response focused on the challenges of shifting from familiar patterns of thinking but, this teacher maintained a “positive outlook”. It was difficult to determine whether this outlook was due to the disposition of the teacher and his readiness for change, his interest in gaining a deep understanding of issues, his satisfaction with his current levels of understanding or, finally, whether he had invested the same amount of physical and mental energy as the other respondents. This thinking was another attempt at trying to make sense of new data and provided an example of the movement backwards and forwards between noticing, making sense and making meaning. As Glaser (1978) noted, the steps of a constant comparative method are rarely linear.

The process of moving between the first three levels of Moon’s Map of Learning continued throughout the research but it was also important to move towards the working with meaning stage if an explanatory model of teachers’ learning in an innovative setting was to be developed. Through my ongoing observations and listening to the teachers’ voices, interpretations of data and engagement with the literature themes of interest began to emerge. For example, from the observations and interpretations described previously the concept of teachers’ characteristics, capacities and sense of personal agency emerged as a domain to be considered in the framework used to guide the research. This in turn generated some of the research questions including, “What are teachers’ beliefs about effective learning?” and “How do teachers describe and explain changes in their beliefs and practices, and see their role and the role of the school in any changes?” Both questions were important as through the initial immersion in the field it became evident that teachers’ characteristics were of influence in their levels of understanding, readiness for change, and emotional responses to challenges posed from working in an innovative context. This tenet could now be challenged through the data-gathering process and ongoing engagement with the literature.

The work of David Perkins connected well with my thinking at this time. My initial observations of the teachers holding on to familiar patterns of working when challenged beyond comfort zones was supported by Perkins (2003) whose research found that, “In times of stress, when cognitive load is high, behaviour tends to regress towards simpler earlier-learned behaviours. And it’s hard to be progressive when the other guy is being regressive” (p.247). The second concept in this quote was of interest to my ongoing investigations, for example the question of how the school culture and philosophy influenced teachers’ characteristics and willingness to engage in learning and change could also be investigated through the research questions. New themes continued to emerge through the processes described above and

reflected Ezzy's (2002) belief that "the process of theory building involves an ongoing dialogue between data and pre-existing theory" (p.93).

Themes, or as Glaser (1978) described them, core categories that emerged in this research were a result of several sorting processes. Ezzy (2002) described the processes as commencing with open coding which involved coding for meaning, feelings, actions, making metaphors, contrasting and integration of codes and so forth. Open coding commenced early in the analysis process initially making use of a line-by-line strategy whereby written responses from teachers and my own field notes and memos were studied closely. The process of open coding was followed by axial coding where relationships between emerging codes were explored and compared with pre-existing theory before selective coding was undertaken. Selective coding identified the core codes, categories or themes that assisted in the development of the explanatory model.

The multiple forms of data gathered and described earlier in this chapter were initially sorted into open codes, for example, emotions, edu-speak (a form of teacher language), influence of colleagues, students, prior experience, interactions with academics, values, curriculum writing and so forth. From these codes several axial categories emerged until finally core themes were generated to describe the emerging theory of teachers' learning in an innovative environment. Several tools assisted in this process including the use of hand sorting and software such as "Inspiration" and N-Vivo. Each tool allowed for greater sophistication and flexibility in the coding and comparing process. However, the tools could only assist in organising the data and the process of making analytic interpretations required an ongoing process of writing and rewriting memos until the advanced memos became the draft explanatory model of professional learning at Fulton.

The development of a draft explanatory model of professional learning at Fulton did not complete data collection; rather it directed some further data gathering, for example, interviews with the principal and assistant principal. I continued to sort and examine any new data through a constant comparative process until theoretical saturation was achieved. Theoretical saturation is achieved when "no new properties" of the themes emerge during ongoing data collection (Charmaz, 2006, Ezzy, 2002). To assist my level of confidence in reaching theoretical saturation and therefore limit further data collection I continued to participate in the daily life of Fulton including attendance at committee meetings, observations, discussions with teachers and participation in many of their professional learning experiences. At this point I was actively evaluating whether any data generated could not be explained by the emerging explanatory model. I sought direct feedback from the teachers at the school and at presentations to the wider educational community as to the authenticity of aspects of the model. In essence I was

evaluating whether the emerging model adequately described and reflected the experiences of teachers in this school and how it answered the research questions and it related back to the reviewed and new literature I continued to engage with.

The detailed description in this section of the emergence of one of the key themes, teachers' characteristics, capacities and sense of personal agency could be contested by others' interpretations of the data and I, too, may view the data with new eyes after time and new knowledge influences my thinking. However, the description presents a "valid" account of my thinking at the time and is designed to assist the reader in understanding the processes that occurred in gathering and analyzing data to answer the research questions and build an explanatory model of professional learning at Fulton.

Figure 3.2 provides an overview of the data collection and analyses process. Four core themes that influenced teachers' opportunities and engagement in professional learning emerged from the grounded theory process. These were the 1) school context, 2) organisational elements, 3) relationships and 4) teachers' characteristics, capacities and sense of personal agency. Each theme ultimately shaped the explanatory model but through the grounded theory process additional and more specific themes of influence on the processes and outcomes of teachers' learning emerged and these are described in detail in Chapter 4.

3.7 *Establishing trustworthiness in this research*

Smith (2000) provides a detailed discussion about the concept and appropriateness of "validity" in qualitative research. He cites the works of Altheide & Johnson (1994), Barone (1990, 1992, 1997), Guba, (1981), Guba and Lincoln (1989), Maxwell (1992), and Mishler (1990) among others, in noting that the concept of "validity" as it sits within an empiricist orthodoxy is at odds with the notion of qualitative research. Smith also cites Jackson (1990) who succinctly suggests that "validity" is essentially a test maker's concept and is therefore best left to those who pursue that line of work..." (p.141). In reframing the concept of "validity" to fit within a qualitative paradigm Smith promotes a different perspective suggesting if we "no longer have confidence in epistemology to arbitrate the validity of knowledge claims, a case [emerges] where the process of validation can arbitrate on the basis of "value of goodness of a way of thinking" (p.140). In reconceptualizing the notion of "validity", Munro (1995) suggested the term "validity" is not useful in "research that seeks understanding and meaning" (p.149) as opposed to verification of an uncertain truth (if truth is viewed as individually constructed). Smith cited the work of Lincoln and Guba (1985) as reconceptualizing "validity" in qualitative research by the use of the term "trustworthiness".

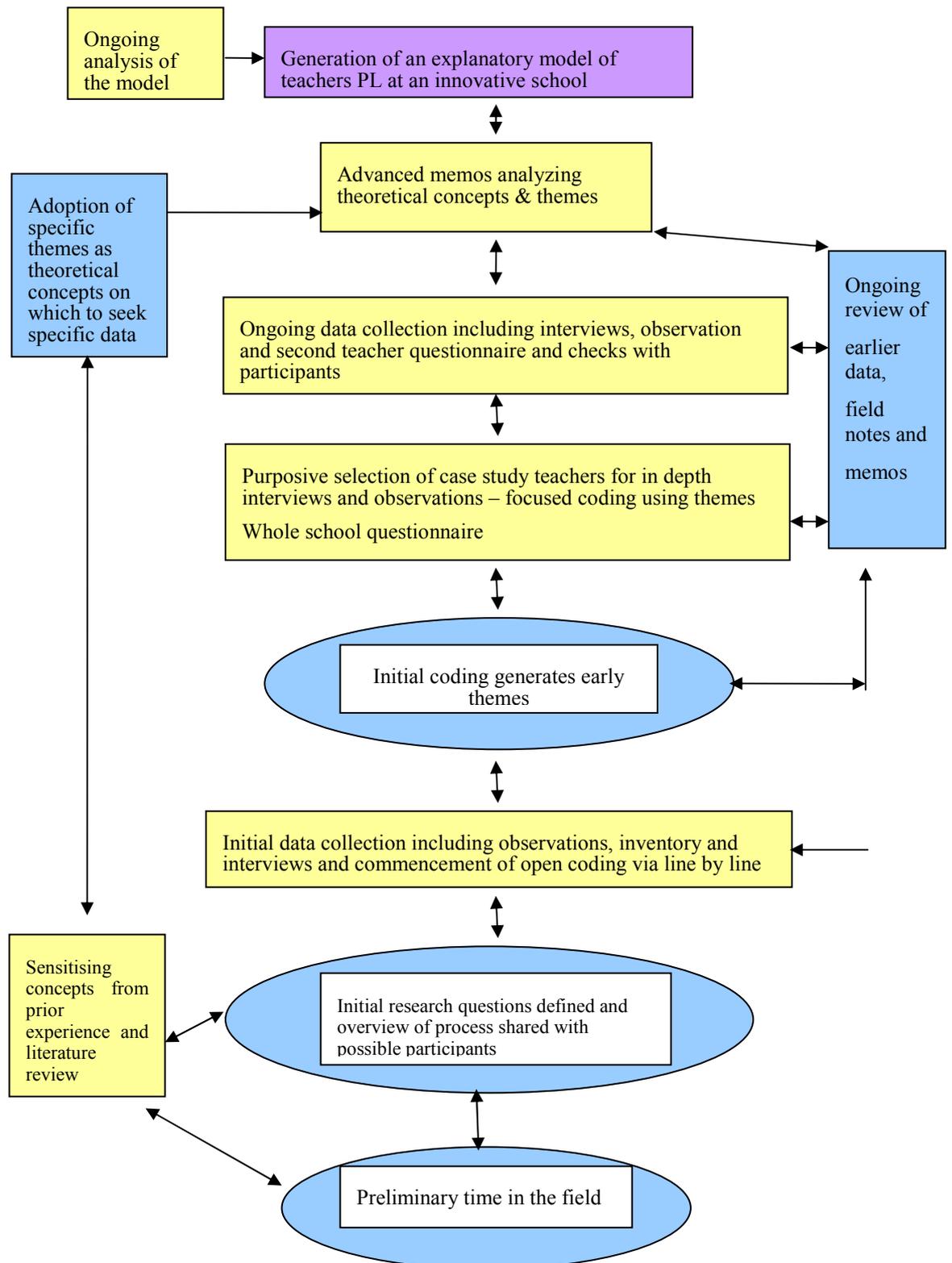


Figure 3.2 The grounded theory process employed in this research (modification from Charmaz, 2006)

It is not sufficient for a researcher to state that this is a “trustworthy” account of my research. “Trustworthiness” needs to be assessed as to the “adequacy of the conduct and reporting” process (Smith, 2000, p. 142). Initial criteria would relate to evidence of “reflexivity and transparency”. Smith cited Mishler (1990) who said, “Transparency carries implications for the structure of the account, the links between analytic coding categories and specific words and phrases” (p.144). Reflexivity should be evident through the research process and Altheide and Johnson (1994, p.489, cited in Smith, 2000) suggested the following five dimensions needed explicit attention:

1. ...the relationship between what is observed (behaviours, rituals, meanings) and the larger cultural, historical and organisational contexts within which the observations are made (the substance);
2. ..the relationships among the observer, the observed, and the setting (the observer);
3. ..the issue of perspective (or point of view), whether the observer’s or the members’, used to render an interpretation of the ethnographic data (the interpretation);
4. the role of the reader in the final product (the audience);
5. ..the issue of representational, rhetorical, or authorial style used by the author(s) to render the description and/or interpretation (the style). (p. 145)

All of these aspects need substantiating to ensure the “trustworthiness” of the research. To assist in this process Maxwell (1992) proposed five types of understanding that should be evident in the qualitative researcher’s account of their work. The five dimensions are descriptive, interpretative, theoretical, generalisable and evaluative. Smith (1992) has translated the dimensions proposed by Maxwell into a useful framework that can be used by the qualitative researcher to assess the “trustworthiness” of their work. His Framework for Reflexive Responding detailed in Table 3.1 has been used consistently in this research to ensure the “trustworthiness” of the final account.

Table 3.2 expands on Smith’s framework to identify a number of techniques to reduce the threat to trustworthiness of qualitative research. Several of these techniques were used in my research including

- prolonged engagement in the field,
- weighing evidence to assess the confidence in the explanatory powers of selected concepts (preliminary data gathering was contrasted with the literature in the area of learning, pedagogical practices, professional development and change in generating the initial guiding foci),

- purposive sampling
- detailed recordings and continuous member checks
- constructed accounts grounded in the teachers’ own language and concepts.

Adhering to a process of reflexivity provided an audit trail to explain the thinking and action processes within the inquiry. As DePoy and Gitlin (1994 p.278) said, this “allows others to agree or disagree with each analytic decision and to confirm, refute, or modify interpretations.” The research process also drew on the work of Piantianida and Garman (1999) who developed a list of criteria for assessing the quality of qualitative research. Their list of criteria connected well with Maxwells’ Framework and both were used to guide actions and as an evaluative tool in my research.

Table 3.1 Generating “trustworthiness” Maxwell’s Framework for Reflexive Responding – modified by Smith (2000).

	DESCRIPTIVE “VALIDITY”	INTERPRETIVE “VALIDITY”	THEORETICAL “VALIDITY”	GENERALISABILITY	EVALUATIVE “VALIDITY”
Types of understanding	Verified accuracy of the description of events, objects, behaviours (not meanings).	Verification of the meanings of the objects, events and behaviours as held by the participants; i.e. thematic perspectives	A more abstract account of events: An explanation as well as a description or interpretation of events, objects and behaviours	Establishing the broader application of the account. The inquiry is more commonly contained to internal generalization because the unique emphasis of qualitative research is on understanding more than generalization.	Judgment of the interest served by the idea, program, or event studied. Reconstructed account situating the researcher in the wider socio – cultural arena.
Threats to “validity	Challenges to the factual accuracy of the account in the form of: <i>-distortions</i> <i>-omissions</i> <i>-recognition</i> <i>-variations</i>	Misrepresentation s of descriptions of participants” perspective; participants not recognizing their accounts; and dismissing participants” perspectives on the basis that they are really unaware of their feelings or views, or may un/ consciously distort or conceal these.	Questioning the “legitimacy of the application of a given concept or theory [brought by the researcher] to established facts” (Maxwell, p.292); Challenges to the meaning of events; Questioning “an account’s validity as a <i>theory</i> of some phenomenon” (p.291)	Specificity of case; Specificity of population (i.e. questionable representation); Purposive sampling and progressive focusing - meaning non random and unrepresentative; Concentration on internal validity; Omissions – e.g. in brief interviews you only get part of the story, and researchers” extrapolations therefore can lead to flawed inferences.	Conceptual over determinism; Overgeneralisin g via clichéd concepts like class and “race”; asserting judgments without constructive humility; adopting role of critic over the role of the researcher; “going native” privileging comfortable ways of viewing phenomena.

Table 3.2 Validation techniques to reduce threat to trustworthiness – Maxwell’s Framework for Reflexive Responding – modified by Smith (2000).

	INTERPRETIVE “VALIDITY”	THEORETICAL “VALIDITY”	GENERALISABILITY	EVALUATIVE “VALIDITY”	DESCRIPTIVE “VALIDITY”
Fieldwork	Member checks for inter-subjective agreements to clarify disagreements and identify multiple perspectives; Detailed recording; Data saturation – collection of sufficient and appropriate evidence; Purpose sampling; recording quantities as well as qualities.	Prolonged time in the field (immersion); multiple data collection: repeated “measures”, triangulation, accessing all stakeholders; Member checks of research’s use of interpretive concepts; reviewing researcher affinity with particular people and interpretations.	Weighed evidence to assess confidence in the explanatory power of selected concepts; consciously checking or mapping the consistency of the interrelations between concepts that have been inductively constructed; seeking countering evidence as well as constructs; memoing or field notes continually maintained and refined.	Concentrate efforts to detail the context, especially in terms of commonalities with (or being representative of) other settings; review against the purpose of the research and the role of the purposive sampling; pursue data redundancy; consider alternative interpretations – i.e. attempts to falsify accounts.	Prolonged engagement in the field; triangulating both sources of data and alternative theoretical frames; seeking theoretical saturation; systematically accounting for the mediation of understandings via language, culture, context and history; member checks on reconstructive analyses.
Desk work	Thick description; utilizing informants’ language.	Constructed accounts grounded in participants’ own language and concepts; researcher makes overt connections between her construction of participants’ interpretations.	Researcher to be explicit about the meaning and efficacy of the theoretical constructs the researcher brings to the account; is the evidence and argument compelling?	Define boundaries explicitly (e.g. institutionally generalisable only); present your theorising in such a way that it demonstrably makes sense in relation to particular characteristics of settings which may be evident in other settings.	Reflexing on authorial power; consciously accounting for subjectivities; transparency in making links between judgments of power and value; care not to blame the victim.

Piantanida and Garman’s list of criteria for evaluating qualitative research are:

- Verite Does the work ring true? Is it consistent with accepted knowledge in the field? Or, if it departs, does it address why? Does it fit within the discourse in the appropriate literature? Is it intellectually honest and authentic?
- Integrity (as in architecture) Is the work structurally sound? Does it hang together? Is the research rationale, logical, appropriate, and identifiable within an inquiry tradition?
- Rigor Is there sufficient depth of intellect, rather than superficial or simplistic reasoning? Are the portrayals sound?

Utility	Is the work useful and professionally relevant? Does it make a contribution to the field? Does the piece have a clearly recognizable professional audience?
Vitality	Is it important, meaningful...non trivial? Does it have a sense of vibrancy, intensity, excitement of discovery? Is the proper personae (or voice) used for the author(s) and other participants? Do metaphors, images visuals communicate powerfully?
Aesthetics	Is it enriching, pleasing to anticipate and experience? Does it give me insight into some universal part of my educational self? Does it touch my spirit in some way?
Ethics	Is there evidence that privacy and dignity have been afforded all participants? Has the inquiry been conducted in a careful and honest way? Does the inquiry have an ethical sensibility?
Verisimilitude	Does the work represent human experiences with sufficient detail so that the portrayals can be recognisable as “truly conceivable experience”?

Criteria suggested by Piantianida and Garman, and Maxwell both have value in their own right. Piantianida and Garman’s list of criteria provides questions to evaluate the essence of the research with Maxwell’s framework and Smith’s interpretation of validation techniques allowing for evaluation of more pragmatic aspects associated with methods including specific approaches to field and desk work.

3.8 What are the ethical issues involved in this research?

As a qualitative investigation this research faced many of the traditional problems encountered in conducting research where the researcher’s role is closely integrated with the research participants. Lincoln (1990) highlighted concerns that were of particular relevance to my research including the, “emphasis on fact-to-face interactions, on faithfully representing multiple, constructed, and often conflicting realities, and on maintaining privacy and anonymity while using extensive word-for-word, natural language...”(p.83). The intimate nature of Fulton, including small staff numbers, open teaching environments, full staff participation in professional development and curriculum writing, and involvement in a range of research initiatives presented a number of issues in relation to confidentiality. My preliminary work played a major role in establishing my credibility as a trusted member of the learning community. In my early work in the school I interviewed several staff members, many of whom

shared openly their values and concerns. In my ongoing involvement several staff members have actively sought me out to discuss an issue that they needed “to air” but in a way that was one step removed from sharing with their colleagues. In such situations I needed to make a careful distinction between information that could be of value to my own research but would be unethical to use without the prior permission of the staff member. I always sought permission to use any information, either of an oral, written or performance nature, in my own work. However, this does not account for how the information shared by staff in private influenced my own perceptions of aspects associated with teachers’ work in this school, in particular issues that related to teachers’ beliefs, practices and identities.

In my preliminary work in the school I engaged with staff in informal “chats” over lunch through to the presentation of structured professional learning sessions. I interacted with some staff far more than others. I have found myself in lengthy debates with staff who held different values about teaching and learning. All of these experiences while promoting valuable relationships did not allow for me to act as an “outsider” in conducting this research. The work of Oakley (1981) provided support my position. She argued that:

...the mythology of “hygienic” research with its accompanying mystification of the research and researched as objective instruments in data collection [should] be replaced by the recognition that personal involvement is more than dangerous bias – it is the condition under which people come to know each other and to admit others into their lives. (p.58)

It is difficult to argue with Oakley’s perception that the personal relationships between the researcher and the participants in the research are to be valued in accessing information that may not be elicited if a more traditional research paradigm was rigidly maintained. However, it was still critical that I maintained the principles of ethical research defined by ethics committees of my university and the education authority responsible for managing Fulton. Such principles include assurances of confidentiality and voluntary participation (with the freedom to discontinue at any time during the research), clear explanations of the purposes and boundaries of the research, the time and type of participation required by participants, and most importantly, that the researcher will “do no harm”. This final point must be considered from a number of different perspectives in that “harm” can be closely associated with both emotional and professional harm. To assure that “no harm” came to the participants in this research the analyses and drafts of documents were shared with participants to ensure they believed my interpretations were based on a true account of their participation and also that they were happy to have such information (even with anonymity) made available in a public document.

3.9 Summary

The use of qualitative methods in the research and the opportunities to spend extensive time in the field as an insider-researcher resulted in a rich and detailed account of professional learning in an innovative context. The research process proved very time consuming yet illuminating as to the complexities and rigor associated with grounded theory. My learning was immense and satisfying, particularly as I commenced the research without any preconceived notion of outcomes. The explanatory model that emerged from the research process proved in my mind to be a powerful example of grounded theory in action. The model developed over time in response to answering the research question as to what supported and sustained teachers' learning and what processes teachers' identified as being significant to their learning. The model was the outcome of much theorising about the data and became more robust as data saturation occurred. However, the model is generative in nature and this fits well with the vision of Fulton to be constantly generative in approaches to teaching and learning as well. The following chapter is constructed to capture how and why the explanatory model emerged in response to the research questions and therefore provides a continuing focus on the influence of methodological choices on the outcomes of this thesis.

4. A learning environment that enabled and facilitated teachers' learning: contributions of contextual conditions, organisational elements, relationships and teachers' characteristics and capacities.

“Schools that are good learning institutions for children must be effective learning organisations for teachers and leaders too.” Hargreaves, (2003, p. 20)

“Most research, my own included, tends to identify existing instances of robust communities, but doesn't account very well how they got there. So professional learning communities are hot, they are increasingly organised, but they have been relatively weakly informed in terms of trajectory – how you would get started, what you would focus on. At the same time, there's good evidence that where you get strong workplace communities and relevant support for ambitious teaching, you see schools that are improving.” Judith Warren Little, (2008, cited in Crow, 2008, p.54)

4.1 Introduction

This chapter identifies and elaborates on the conditions that supported and created an environment for sustained teachers' learning at Fulton. As Judith Warren Little said, researchers need to consider in more detail the underlying elements that serve as the foundation of a learning community (Little, 2003). She called for closer attention to how learning communities get started and what aspects contributed to successful outcomes. As Wenger (1998) highlighted, *“Learning cannot be designed: it can only be designed for - that is facilitated or frustrated”* (p. 289). My research provided an excellent opportunity to observe and identify how Fulton designed for the learning of its teachers as I answered the primary research questions:

1. How is teachers' learning supported and sustained in this innovative school?
2. What are the processes of teachers' learning in this context?

The present chapter has a developmental focus as the research took place in the early stages of the school's formation and during its first few years of operation. This provided a unique window from which to consider the key elements and conditions that emerged as fundamental to generating learning opportunities and experiences that ultimately impacted not

only on teachers' values, beliefs and practices but on students' experience of school, the school as a learning organisation and the wider educational community.

The key elements and conditions that influenced teachers' learning at Fulton are interrelated and bound by the many different relationships that emerged from the school in operation. The interconnected conditions and elements that supported teachers' learning formed a system-based framework of affordances⁵ for learning at Fulton. System based theories shift thinking about studying isolated parts in mechanistic ways to recognition that parts of an organisation are rarely static and that they interact to generate a dynamic system (Fullan, 2001, Senge et al., 2000, Wenger, 1998). In this chapter the "parts" of Fulton that supported and sustained learning opportunities for teachers are initially identified and discussed from the perspective of how they emerged and what affordances they provided for teachers' learning.

Affordances for learning at Fulton were varied and in abundance. They were at the very heart of processes that allowed teachers to learn individually and collectively. However, as Wenger (1998) said, "one can produce affordances for the negotiation of meaning, but not meaning itself" (p.229). Wenger also claimed, "Learning is first and foremost the ability to negotiate new meanings: it involves our whole person in a dynamic interplay of participation and reification." (p.229). In essence Wenger identifies that "learning is a matter of alignment" (p.228) which depends on learners connecting their inner understandings and perspectives with learning opportunities presented to them preferably in ways that direct energies to the common purpose of the learner and the organisation. The present chapter explores what the enabling conditions designed to support teachers' learning were and how teachers aligned with these. The enabling conditions that supported teachers' learning were ultimately identified as affordances and Figure 4.1 is a visual representation of the alignment between affordances and teachers' characteristics required to support learning.

The importance of identifying affordances for teachers' learning at Fulton, as a response to answering the research questions, emerged as an outcome of my deductive, inductive and abductive analyses of the data gathered in the research process. A detailed discussion of how the data were analysed to answer the research questions can be found in Chapter 3. In this chapter, analyses of how teachers' learning was supported and sustained and the learning

⁵ Affordance: The term affordance is used as a noun to identify the relational aspects of the actor and their environment, in this research, the teachers and Fulton. James Gibson (1977, cited in Wenger, 1998), initially used the term to define the many possibilities of action when an actor interacts with an environment. Gibson provides the examples of a human coming together with a set of stairs as providing an affordance for climbing, similarly the claws of a squirrel and tree also provide an affordance for attaining a goal. An affordance is generated when the environmental conditions match well with the actor using the environment to achieve a goal. Affordance was selected for this research to describe the elements and conditions of Fulton that provided easily accessed learning possibilities for teachers.

processes they engaged in ultimately led to the identification of domains and affordances that are presented as an explanatory model of professional learning. The model identifies the enabling conditions or elements that interacted to support and facilitate teachers' learning at Fulton. Josephson (1996) said, abduction "is a form of inference that goes from data describing something to a hypothesis that best explains or accounts for the data" (p.1). Winter, (1989) also claimed "...theory" cannot simply be derived from the data, but is always the outcome of a process in which researchers must explore, organise and integrate their own and others' theoretical resources as an interpretive response to data" (p. 261). Therefore the chapter provides an account of how data "describing something" - in this thesis being what supported and sustained teachers' learning and how this occurred - formed the basis for developing an explanatory model that I believed best explained the conditions, elements and factors that interacted to support and sustain teachers' learning at Fulton. My "best explanation" is connected to relevant research from the field so that an acceptance of the explanatory model is based on a compelling account (Smith, 2000).

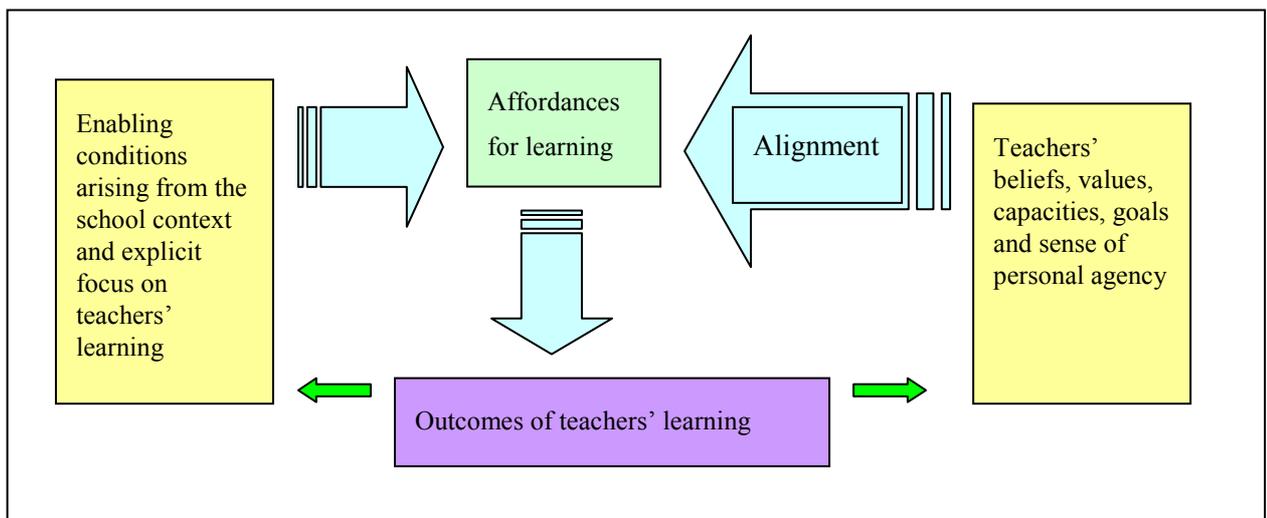


Figure 4.1 Factors that contribute to creating affordances for teachers' learning

Chapter 5 is designed to add to the compelling account by "testing" the explanatory model via five teachers' stories of learning at Fulton. The teachers' stories provide a more detailed focus on the processes of learning providing additional evidence from which to answer the second research question (stated in the opening paragraph of this chapter) and subsequently gain a deeper understanding of teachers' learning in an innovative school. Therefore, Chapters 4 and 5 connect to provide an understanding of how Fulton as an organisation supported and sustained teachers' learning and what processes of learning occurred that made a difference to teachers' beliefs and practices. These chapters also provide the foundation for considering the outcomes of teachers' learning which are reported as relevant in Chapters 4 and 5 but more explicitly in Chapter 6.

4.2 Overview of the explanatory model and sections of the chapter

The explanatory model proposed here serves two purposes. Firstly, it is my response to answering the research questions and therefore explicitly establishing the foundations for teachers' learning at Fulton. The model is a representation of how the contextual conditions, relationship factors and organisational elements that emerged as supporting and sustaining teachers' learning interacted to generate specific affordances for learning to occur. Identifying how teachers engaged with the affordances for learning was fundamental to building a deeper understanding of the processes of professional learning in the Fulton context. The explanatory model explores the nexus between the design for supporting learning and teachers' engagement with the design that resulted in learning (Wenger, 1998). In essence, the model is an answer to the research question on what supported and sustained teachers' learning at Fulton. The supports for learning are identified as affordances and how teachers engaged with the affordances to learn provided an answer to the research question on what were the processes of teachers' learning.

Secondly, the description of the development of the model addresses Little's calls for a more detailed look at how "robust [learning] communities" (Crow, 2008, p.54) emerge. York-Barr et al. (2005) also highlighted the importance of explicitly identifying the structural conditions and social and human resources that support school-based learning communities. They referred to the earlier work of Kruse, Louis, and Byrk (1995) who identified physical proximity, interdependent teaching roles, communication structures, access to expertise and supportive leadership as significant elements of successful learning communities. These elements and conditions linked well to those that emerged from the data generated in my research and lent support to the categories identified in the explanatory model introduced in this chapter.

The chapter is divided into three major sections which report the overarching domains that supported teachers' learning. Each section makes use of teachers' reflections, data gathered through surveys, interviews, and my own observations to illustrate how additional and connected affordances generated by the unique interaction of contextual, organisational and human elements emerged as foundational in the explanatory model of professional learning at Fulton.

The first major section of the chapter considers the domain of **contextual conditions** as they contributed to teachers' learning and how specific aspects of the school context led to affordances for teachers' learning. Significant affordances for teachers' learning generated from contextual conditions included

- School culture and philosophy (SCP) including the school's vision and its purposes
- The physical and technological environment (PTE)
- Supportive leadership (LDS)

Organisational elements was a second domain that supported teachers' learning and as such forms the second major section of the chapter. Specific affordances that emerged as significant to teachers' learning in the domain included

- Fulton's professional learning strategy (PLS)
- Designated Assistant Principal (Professional Learning) (AP-PL)
- Interdisciplinary curriculum (IDC)
- Tutor groups (TG)
- University modules (UM)

Relationship factors as they emerged from the discussion of overall contextual conditions and organisational elements are considered within each of those sections as relevant. However, they also formed a domain in their own right and therefore the third major section of the chapter explores specific relationship factors that acted as affordances for teachers' learning including

- Teacher colleagues (TC)
- Professional partnerships (PP)
- Students (STU)

Reeves (2008) highlighted the importance of teacher colleagues (TC) on teachers' learning, suggesting working with and alongside of colleagues were reported by teachers as their most influential source of professional learning. However, Fulton proved to be a unique environment and the affordances for teachers' learning went well beyond those found in schools that are more traditional. Contextual conditions, organisational elements and relationship factors all provided affordances of substance for teachers' learning and while each is reported on in different sections of the chapter it is important to acknowledge the interconnections between and across all areas (noted by the circular arrows in Figure 4.2, see page 94 of this chapter).

The explanatory model of PL that emerged in response to answering the research questions is initially presented in Figure 4.2. In this figure contextual conditions, organisational elements, relationships and teachers' characteristics, capacities and sense of personal agency are overarching and connected domains that give rise to underlying affordances for teachers' learning. Figure 4.3 provides a representation of the connection between the overarching domains and the more specific affordances. These affordances are represented by coloured

hexagons linked to the overarching domains. Sustained dialogue sits in the centre of the figure as it emerged as central to each of the overarching domains and connected several of the specific underlying affordances as well. Figure 4.4 represents the combination of the two layers of the explanatory model while Figure 4.5 highlights that all aspects of the model acted as resources for teachers' learning. This form of presentation is not designed to suggest that only one domain gave rise to specific affordances. The decision to represent the explanatory model in this way was based on trying to achieve clarity and identify that some affordances were more closely aligned with specific overarching domains. For example, teacher-located affordances included openness, motivation, purposeful listening, and the ability to be trusting of others. Through ongoing relationships with others, affordances of respect and mutual engagement emerged and the ability to contest each others views in productive ways. Contested views supported, and were supported by, contextual conditions and so forth. Table 4.1 provides an alternative presentation format of the overarching domains (which also acted as affordances) and the more specific underlying affordances that connected with the domains. However, it will emerge throughout this chapter that the underlying affordances in the explanatory model often influenced each other and in some instances affordances, for example, feedback and support could be located across all domains.

The affordances that emerged as supporting teachers' learning and are closely connected to conditions and processes that support effective professional learning found in the research on professional development, for example, trust, respect and access to expertise (Darling-Hammond & Richardson, 2009, Martin-Kniep, 2004, Hawley & Valli, 1999, Wiggins & Mc Tighe, 1999, Yorke-Barr et al., 2004). However, there were additional affordances identified that that appeared unique to Fulton including being innovative and physical proximity. Each aspect of the model is discussed in the sections that follow to provide an account of how they emerged as supportive and sustaining of teachers' learning at Fulton. Some discussions are more detailed as they draw on teachers' voices to substantiate how their learning processes were influenced by access to various affordances, and how this in turn supported my theorising about affordances that supported teachers' learning.

Throughout the three major sections of the chapter, affordances for teachers' learning that emerged from my interpretation of the data are compared and contrasted to existing literature, both new and that reported in Chapter 2. The following sections are designed to instantiate the explanatory model detailed in Figures 4.2, 4.3 and 4.4 and provide evidence of the trajectory that supported and sustained teachers' learning at Fulton that , Little, (2008, cited in Crow, 2008) reminds us is so often missing in explanations of the formation of professional learning communities.

Table 4.1 Overarching domains and underlying affordance of the explanatory model of PL at Fulton.

Overarching Domains	Contextual Conditions	Organisational Elements	Relationship Factors	Teachers' characteristics, capacities and sense of personal agency
	School culture, philosophy and vision Supportive leadership Learning environment	Assistant Principal (PL) Professional learning strategy Interdisciplinary curriculum Tutor groups University modules	Professional partnerships Students Teacher colleagues	
Underlying Affordances	Physical proximity to expertise Being innovative Use of a specific language for learning	Time for learning Distributed leadership Writing to learn Curriculum writing teams Reflective practice	Respect Mutual engagement Collaboration Contested views	Openness Purposeful listening Motivation Trust Feedback and support

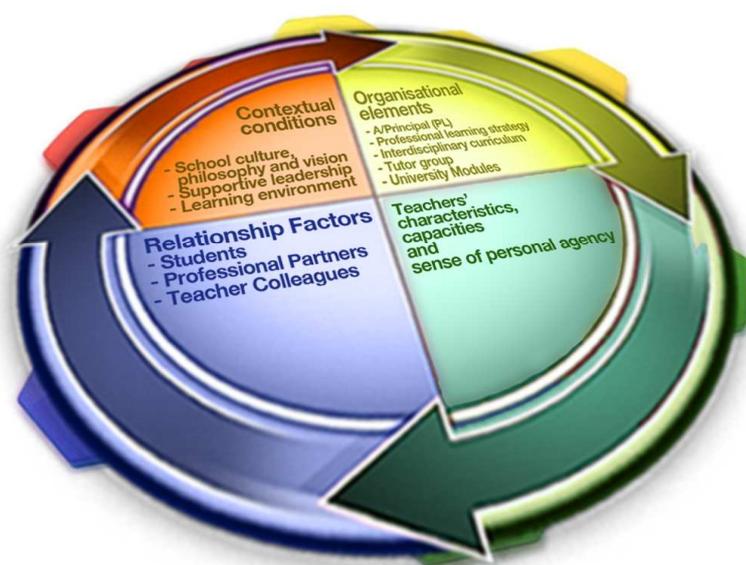


Figure 4.2 Overarching domains of the explanatory model of professional learning at Fulton



Figure 4.3 Underlying affordances generated by the interaction of the overarching domains of the explanatory model of professional learning at Fulton



Figure 4.4 An explanatory model of professional learning at Fulton



Figure 4.5 The explanatory model of professional learning at Fulton from a resources perspective

4.3 Overall school contextual conditions that facilitated teachers' learning

This section of the chapter introduces three contextual conditions that proved significant in providing support for teachers' learning; 1) School culture and philosophy which includes the subsections of, an innovative school, school purpose and vision, and a learning school, 2) Supportive and encouraging leadership, and 3) Learning space: Physical and technological environment.

4.3.1 School culture and philosophy

"The opening day of the year with the balloons and everything was such a surprise to me...I mean for the past 10 years I have been walking into schools and commiserating with the students about being back at school....it's a different feel altogether here, you want to be here" Fulton teacher reflecting on the first day in the school's second year of operation.

"There's no boundaries here - in the building, or to our learning" Student quoted in the Evaluation of the Higher Education Innovation Programme at [Fulton] Australian Council for Education Research, May 2005.

These reflections from a Fulton teacher and student indicate that the school provided a learning environment and culture that was highly regarded by different stakeholders. However,

of greater interest to my thesis was the question of what aspects of the school generated an outcome whereby students and teachers would make such comments and how such comments were connected with affordances for teachers' learning. The answer emerged in explicit recognition of the significance of the school culture and philosophy as an affordance for teachers' learning. A number of elements contributed to the overall school culture and philosophy including: 1) the unique and innovative nature of the school, 2) the newness of the school that subsequently demanded attention to vision statements prioritising the creation of a learning community, 3) the physical and technological aspects of the environment, and 4) the building of relationships among stakeholders. The following sections provide an insight into the contextual conditions that supported teachers' learning and my interpretation of how they were of influence. The section commences with consideration of how the "innovative" tag itself generated an affordance for teachers' learning.

4.3.1.1 An innovative school

The term "innovative" was heard in many forums during the formation of the school and Chapter 1 in this thesis provides details of the history of the development of Fulton and the focus on being innovative. My aim in this section is to explore how the concept of "innovative school" served to influence teachers' learning and in turn contributed to a school culture and philosophy that prioritised teachers' learning.

Smith (2006) developed a set of parameters to describe an "innovation" and as identified in Chapter 1 Fulton certainly met the criteria for being an innovative school. Smith's suggestion that an innovation should be site-specific, identified as a process that is both dynamic and social, and involves an alignment of ideas, practices and actors captures well the essence of Fulton. Davies, Heath and Bissaker (2006) said that, "The genesis and development of [Fulton] was an innovative opportunity and an opportunity to be innovative"(p.1). The term innovative was on everyone's lips as evidenced by the following response from a teacher at the school:

I think it [Fulton] is innovative in every direction you look, it's innovative in the curriculum design for senior secondary school and that's quite different to what you'll find almost anywhere. It's innovative in the building design which impacts on your teaching approach and the innovation is also unique in that other open spaces places I've worked at...you haven't changed your practice, you've still taught the same way...whereas here people are looking at different ways of working in this environment. It's also innovative in the way support is provided for teachers in their professional roles and the amount of resourcing that's behind that. And then it's innovative in the connections it has with other people, other places and how it takes us into not only other schools but other educational forums so that we are involved in discussions about educational futures, about curriculum design, about decision making structures, policy development in relation to secondary schooling and in some cases schooling across the board.

This reflection highlights several contextual conditions that supported teachers' learning in the school. These conditions included a vision for innovation, the consequent school culture and philosophy, the purpose designed physical and technological environment, the prioritising of teachers' professional learning, and the nature of professional partnerships. These contextual conditions are considered in more detail in the sections that follow but it is the very use of the word "innovation" that interested me. All stakeholders used the word constantly and consistently and I identified a subsequent connection to teachers' learning.

In my ongoing literature review I found that Pace Marshall (2006) and Kegan and Lahey (2001) called for close attention to the language used in learning organisations such as schools. Pace Marshall (2006) highlighted that, "Language serves as a context, structure, and process for thinking and perceiving" (p.16). She also suggested that, "when our language is prescriptive, our schools cannot be generative. When our language is controlling, our schools cannot be creative" (p.17). This proposition was well supported by one staff member who commented "When the leadership provides a mandate for innovation and supports your ideas you feel motivated to think beyond the box."

Kegan and Lahey (2001) proposed that the language used by people to promote change in organisations needed explicit attention and recognition for the influence it has on thinking and learning. They focused more on the form of language over the content suggesting:

The forms of speaking we have available to us regulates the forms of thinking, feeling and meaning making to which we have access, which in turn constrains how we see the world and act in it. Some language forms concentrate more individual and social energy than others do and, enhance capacity... In our experience, these novel language forms do not spring up on their own. They require intention and attention. A good gardener must plant them and help them to grow (p. 7).

At Fulton there was intention to talk of "innovation" and being "innovative" in all that the school engaged in. Following is a range of teachers' comments (all using the word innovation) that describe aspects of the school that were perceived by teachers as innovative and supportive of learning and teaching:

- The overall vision and innovative nature of the curriculum as an interconnected structure, and different views as to what this means for the design and delivery of curriculum has been powerful to my learning
- The variety of options available in the application of technology to classroom teaching provides an opportunity for us to be highly innovative
- The culture of innovation at [Fulton] has increasingly focused my leadership towards student-centred schooling. Exploration of ideas that place students and their learning at

the core of schooling practices now are key drivers for my reflection and understanding of what we currently do.

I considered that the constant use of the term innovation appeared to be linked to teachers' learning although teachers or leaders did not explicitly note this as an affordance for learning. The opportunity to be innovative and the constant use of the word innovation generated enthusiasm but required teachers to be open to new ways of doing things. It also required motivation to engage with the innovation and its subsequent learning. The connections between context and teacher characteristics provided an initial example of the alignment between contextual conditions and teachers' characteristics, capacities and sense of personal agency that resulted in the affordances *being innovative*, *use of specific language*, *openness* and *motivation* that supported and ultimately sustained teachers' learning. All of these affordances were included in the explanatory model of PL at Fulton.

Kegan and Lahey (2001) hypothesised that organisations are consistently influenced by three powerful forces of nature that support or act as a threat to innovation including

Entropy – a process that leads to the gradual decline of energy and order resulting in the breakdown of once dynamic systems

Negentropy – being the opposite of entropy whereby people and systems are energised by specific factors that lead to embracing greater complexity in the recognition that it leads to a greater capacity and enhanced outcomes for the system's members.

Dynamic equilibrium – a process that consistently seeks to maintain the “norm”, a powerful force that no matter what changes are initiated there is an ultimate return to the status quo. (see pages 3-5)

Kegan and Lahey warned that the force of dynamic equilibrium can be the greatest threat to sustaining an innovation and change effort. I will return to Kegan and Lahey's hypothesis in the summary of this chapter to consider its links with the explanatory model presented in Figures 4.2 to 4.4. However, at this point I wish to draw attention to their notion of negentropy and people being energised to learn and develop. In relation to Fulton, that energy appeared to be linked to the word innovation and a mandate for being innovative. There was “energy” in the teacher's reflection included earlier in this section as it referred to one innovation after another finishing with a sense of how the school may end up influencing schooling in general. Such a response is reflective of what Scharmer (2009) called the positive energy loop. This occurs when the learning “really matters” and it will “create a positive difference” (Scharmer, 2009, p. 189). The teachers at Fulton were highly committed to enhancing teaching and learning in science and mathematics in the secondary years and this motivation combined with the mandate for innovation generated many positive learning loops resulting in a negentropic organisation (Kegan & Lahey, 2001).

Positive energy loops are still evident at Fulton six years into its existence and they are still connected to being innovative. Recently a leadership team members described the visit of students from a range of international schools to Fulton by saying, “Getting together like this also gives us an indication of how far these other schools are stretching the boundaries of involving students in their leading edge work – we want to be connected with setting benchmarks around the world” (Flinders Journal, 2008). Of interest, Kegan and Lahey highlighted the fine line between being a negentropic and an entropic organisation suggesting that:

Many leaders work toward accomplishing significant change – that is, negentropic change that moves their group or organisation to a new level of capacity or complexity. Other leaders worry about their organisations losing their competitive edge and running down – that is to say, succumbing to the entropic processes of complacency, routinization, loss of focus, or dissipation of energy (p.5).

In reflecting on the leader’s comments there appeared to be a sense of anxiety about the school’s competitiveness in setting benchmarks, possibly as an outcome of becoming too complacent about the success and recognition achieved by the school in its six years of operation. However, the comment also reflected that the school was not resting on its previous success and that the drive for ongoing pursuit of the new was never far from the language and thinking of the school’s leadership and staff, and of course this demanded an ongoing focus on teachers’ learning.

The constant pursuit of being innovative resulted, at times, in the opposite of the positive energy with elements of an entropic organisation evident. Smith (2006) highlighted that being innovative may acquire “object like” status and actually lose its potential to act as a catalyst for learning and change. The constant drive to be innovative resulted in some teachers becoming frustrated by the focus on the “new” seeking a retreat to more familiar territory as noted in these teacher reflections:

I think I have hit the wall with the need for everything to be new and different, I have never worked so hard in a school before and it’s time to put some things in perspective, we still need to do the stuff that is required to pass the SACE⁶.

I am feeling overwhelmed by commitments at the moment and I don’t wish to attend another session on ways to be more innovative!

Such responses were minimal and possibly linked to reduced levels of energy based on the significant workloads but are important to note in relation to the sustainability of teachers’ learning in such an environment.

⁶ SACE stands for the South Australian Certificate of Education which is awarded on a student’s successful completion of secondary school.

Being an innovative school proved significant as an affordance for teachers' learning from two perspectives. Being innovative acted as an affordance for teachers' learning as it provided not only a basis for doing things differently it provided a specific language from which to think about and document learning. The use of specific language although commencing with a focus on the word innovation subsequently included specific language for describing processes of learning and ways of working with students. Additional reference to use of specific language is found in other sections of the chapter. However, the word "innovative" is associated with something new, and there were many examples of this at Fulton including new curriculum, new student grouping, different teaching and environments and so forth. Teachers needed to be open to innovations, to connect with them and to understand their influence on roles in the school. Openness was identified as a teacher-located affordance which also linked to the teacher-located affordance of motivation for learning. In most cases teachers were very open to innovations and presented with high levels of motivation for learning and for doing things in new ways. Such positive alignment between being innovative and openness generated levels of motivation that resulted in positive learning outcomes including new curriculum models and new uses of technology, and at the same time, contributed significantly to the learning culture of the school.

4.3.1.2 School purpose and vision

One teacher at Fulton captured well the initiative behind the development of the school when he stated, "This school is not new for the sake of being new but new because *it matters.*" The teacher's reflection was well supported by numerous reports on the state of science education in Australia (Goodrum et al., 2000, Goodrum & Rennie, 2007, Masters, 2006, Smith, 2003, Tytler, 2007) which highlighted the importance of responding to declining enrolments, state of curricula, students' perceived difficulty and lack of interest in mathematics and science curricula, and the reducing numbers of high-quality science teachers. There was much support for making significant changes to the way science and mathematics were taught and Fulton was specifically designed to achieve the vision of being "a quality school that provides leadership of innovation and reform of the teaching and learning of science and mathematics" (Vision Statement, 2004).

Achieving the school's vision involved the commitment of a range of stakeholders including the students and their parents, teachers, the governing body and system level authority, and university and industry partners. However, each stakeholder group had a different perspective on the purpose of the school based on its individual interests and needs. For many students, the purpose for attending the school was to achieve a high Tertiary Entrance Rank (TER), the score which provided entry to preferred courses at a university of choice. The

system-level authority wanted a school that would meet legislative requirements but provide leadership in the area of science and mathematics education and act as a professional development site for other schools. For some university partners, particularly those from the Faculty of Science and Engineering, the purpose for the school was associated with infusing the traditional secondary science curriculum with new and cutting-edge content including their own areas of research specialisations, for example, nanotechnology. A university professor who acted as a driving force in the development of the school challenged traditional high school science curriculum, stating: “Biomimetrics, intelligent polymers, DNA fingerprinting, laser tweezers, artificial photosynthesis...does our current teaching and learning in high school speak to our students of these areas?” University partners were also hoping that graduates from the school would seek places in the university’s science courses as enrolments in these areas had fallen steadily over the past decade.

Teachers’ beliefs about the purpose for the school varied based on individual perceptions and prior experience. Some believed the school was designed to achieve outstanding results for students in mathematics and the sciences while others believed the transformation of the senior secondary years of schooling was the priority. One teacher captured both these purposes when he commented that “This school epitomises what I have been looking for, an opportunity to work with scientists on a regular basis and kids that love science and mathematics... and to do so in ways that are different from traditional classrooms.”

The challenge for the leadership group at Fulton was to acknowledge that different stakeholder groups adhered to different purposes for the school and to consider how the variations in purposes could all be accommodated in the school’s vision. The goal was to develop a shared commitment to the vision for the school from all stakeholders no matter what their beliefs were as to the purpose of the school. It was important not to privilege one group’s purpose over another but encourage regular meetings of all stakeholders with a focus on building relationships, achieving clarity of vision and purposes, and a sense of shared commitment to actions that would achieve the vision. Many meetings were held to assist in policy development and ultimately the process of reaching a shared commitment to the vision resulted in support for teachers’ learning. This factors was not initially identified by the leadership team as a process that would support teachers’ learning but it emerged as extremely valuable.

Senge et al. (2000) suggested that to achieve commitment to a shared vision a three step process is required: 1) provide a voice for every member of the school community and acknowledge contested beliefs and purposes; 2) recognise that a shared vision must be generative and allow for the community to express their “deepest hopes and desires” (p.290);

and, 3) take action so that members of the school community “have the inherent satisfaction of re-creating the school together” (p.201). The process for achieving commitment to a shared vision at Fulton proved similar.

The vision of Fulton was initially generated by a steering committee in consultation with teachers, system-level personnel and university partners. The vision was reflective of the need to respond to the “crisis” in science and mathematics education. Although there was intensive discussion and dialogue in generating the vision, the opportunity to consult with the parents and students who would be a pivotal part of the school community was initially limited. Therefore, it was recognised that the initial vision for the school would require ongoing debate and consultation as new partners in the school community emerged and it would generate many contested viewpoints that all needed acknowledging. Senge et al. (2000) suggested that a school’s vision must be “...like a diamond with many facets, and each member of the audience sees his or her own aspirations reflected there” (p.290). They also said that a school’s vision should reflect a culmination of “intensive discussion and dialogue” (p.290) that takes place over extended periods of time.

The following teacher’s reflection provides an example of how different stakeholders’ purposes for the school generated *contested views* which ultimately acted as an affordance for teachers’ learning:

There is real evidence of our students having succeeded as learners but my definition of success of learners is much broader, as is our school’s articulated vision of success. We talk about a whole range of capabilities that we aim to develop in our students. They don’t always sit comfortably with a TER7 score...A certain group of students, and I find it extremely frustrating,...are absolutely dead set on getting the highest TER score they can because that is what is going to open up their future. Their parents want this too. So achieving the vision of change is frustrated by the system that has driven students and parents to wanting one thing...and there are teachers at this school that want that same thing too...so achieving our vision means being able to defend what we see as more important than a high TER score.

This teacher’s comment reflected the belief that the primary or substantive purpose of the school was to generate educational change and successful outcomes for students which were well beyond a TER score but she clearly recognised (and felt frustrated by) students and parents having a different primary purpose for the school. For teachers to articulate the primary purposes of the school and to assist their students and parents to look beyond achieving a high TER they must be provided with an opportunity to engage in debate and dialogue about

⁷ TER represents Tertiary Entrance Rank which is a score provided to students who successfully complete a university track South Australian Certificate of Education (SACE).

education and schooling so they develop deep knowledge as to the purposes of the school and an ability to defend their beliefs.

Working in a school where different stakeholders brought different beliefs to the vision for the school provided an affordance for teachers to engage in learning through contested views. Contested views may create tension in organisations and at times this was evident at Fulton. However, Warner (2006) and Senge et al. (2000) both proposed that contesting traditional views of schooling and providing all school members with a voice is paramount to achieving change.

Fulton is not the only school that is constrained by a focus on achieving high tertiary entrance scores and its subsequent influence on transforming teaching and learning. Warner (2006, p.71) claimed that:

In Australia, the unrelenting focus on tertiary entrance scores is constraining the influence on genuine school transformation. It influences the maintenance of traditional schooling subject curriculum...It influences how schools operate; it produces "preparing for exams" rather than self-directed learning; it causes strict management and control. It, above all, is a very strong deterrent to transformation.

Fulton teachers were well-supported by the school's vision for leading innovation and reform and by the call for educational transformation (Fullan, 1991, 2003, Hargreaves, 2003, 2007, Warner, 2006), but as Warner (2006) argued, "Schools can only provide innovative learning and foster creativity when their environment allows risk-taking and individual and group exploration of learning" (p.83). In recognition of such insight, Davies et al. (2006) recognised that to achieve Fulton's vision of innovation and transformation and to satisfy a range of stakeholders' purposes the school would need to:

- Respond to current and future interests and needs of its students through establishing critical and transparent models of excellence in science and mathematics education
- Provide a learning environment of leading edge and enterprise oriented science, mathematics and technology
- Provide a learning culture for its students that derives from the learning culture of its staff, which in turn derives from their interaction with university and industry scientists and educators
- Prepare young people to be creative, critical, informed and motivated contributors responding to professional, personal and social issues
- Increase participation and success of senior secondary students in science, mathematics and related technologies and transform students' attitudes to science and mathematics as career paths

- Be an agency for change and enhancement of science and mathematics education for the state of South Australia and then nationally and internationally. (p.2).

The achievement of such outcomes was heavily located in teachers' knowledge, dispositions and skills and as such they needed significant support in developing a deep understanding of the school's vision and what it meant for their own roles. For example, teachers needed to understand and enact "critical and transparent models of excellence in science and mathematics education". What did this mean and look like? Such questions engaged teachers in *sustained dialogue*, *purposeful listening* and *reflective practice*, all affordances for learning identified in the explanatory model. Through sustained dialogue many *contested views* emerged. Contested views appeared to be a constant element in teachers' lives, particularly in the early days of the school, as they continued to encounter new provocations based on understanding the school's vision and purposes and the requirement of working in a very different environment with university partners, people not often seen in schools. University partners often acted as a provocation in their own right but also engaged with teachers on a number of aspects associated with the school. Such engagement created additional affordances for learning.

The following extract from a university partner reflected his/her perception of the challenges generated by the innovative nature of the school and variation in stakeholders' perspectives and the contested views that emerged.

Generating sustained and productive interactions between [Fulton] and the university staff has proved more difficult than one may have imagined, and has been a major learning experience from the project. It would be fair to say that in the first instance the [Fulton] staff regarded the university staff as remote consultants and could not see how they would fit into their working lives. Similarly university staff had almost no appreciation of the variety of roles and responsibilities of school staff in relation to their teaching, and could not understand their preoccupations.

A striking manifestation of this problem was that meetings rarely discussed science and mathematics- what was to be learned or taught. They focused almost exclusively on organisational matters like the formation of tutor groups, on the use of new technologies, and particularly on the personal and social motivations and interests of students. The view among teaching staff was that science and mathematics content was not an issue, except for the amount of it, but that student motivation was. It is a major undertaking to create an environment in which science and mathematics content will be questioned and reconsidered, and related in a living way to current scientific practice and social issues.

The comment provided additional evidence of the variation in perceptions of stakeholders. There was some recognition that the roles of both groups were not clearly understood and that the work of the teachers was too focused on secondary priorities in the minds of the university partners (Australian Council of Educational Research, 2005). As an

insider-researcher I can attest to the challenges faced in generating common ground on the priorities for team meetings. However, I would also contest some of the comments, particularly those suggesting that the teachers were not interested in science and mathematics content. There were constant discussions in teacher meetings about how to include innovative mathematics and science curricula as proposed by the university partners while at the same time ensuring that students had every opportunity to achieve success in the mandated and more traditional discipline-based exams. This proved to be a serious provocation for teachers and the following interaction between teachers reflecting on students' outcomes in a summative assessment piece highlights the tension in trying to meet university partners' expectations. The following extract also provided another example of contested viewpoints as to the purposes of students' activities and learning.

Teacher 1: I think the Earth Summit⁸ provided the students with a great opportunity to share their knowledge in an authentic way.

Teacher 2: Yeah, they did a good job and I think several people were impressed but Bill⁹ was disappointed in the kids...he thought the kids were limited and sometimes incorrect in the information they shared. He raised questions about their knowledge-base and I felt he was expecting a great deal of the students and us.

Teacher 3: Really the Earth Summit was about the confidence to present an argument; the reality (of the science) is possibly not the most critical thing.

Teacher 2: Sure...but we do need to get our heads around what scientific knowledge is most important for the kids to know and that we have a good understanding of it as well – we have nanotech coming up and I have very little background for that.

Teacher 3: I know...they are so focused on new knowledge and we have to still cover SACE content and learning skills. I mean it's great to work with these guys and learn new stuff but the kids still need to pass exams.

The teachers appeared more grounded in their recognition of meeting the demands of the state-based examination requirements and the purposes of students and parents for enrolling at the school. At the same time the teachers also valued the opportunity to work with university partners in developing their own learning about new science and mathematics content.

The complexity of the teachers' work at Fulton was also discernible in the following teachers' reflections:

My concern at the moment is that if we are trying to be different in all ways to all people then we may not achieve any sustainable success. Hence I would like to have a sense of what our core differences are, and how they may ultimately connect to make this place workable.

⁸ The Earth Summit was a culmination activity where students presented the outcomes of their learning in the Sustainable Futures central study. The Earth Summit was attended by a range of community stakeholders including academics, industry partners and parents.

⁹ Bill – (not his real name) is an academic from the science faculty of the university. He was a driving force in the creation of the school and the need for reinvigorating the curriculum.

Another hindrance is the problem of constantly dealing with an uncertain future. This can add layers of complexity to significant decision making – the need to constantly explore values and positions – nothing can be taken for granted, nothing is quick and easy.

Both comments provided an insight into teachers' recognition of the challenges in coming to a shared understanding among stakeholders. However, the engagement in developing clarity of understanding about the school's vision resulted in teachers reflecting on their place in the school and the impact this had on their sense of professional identity. All of this contributed to teachers' learning, though often in tacit ways that were not always identified by teachers as supportive of learning. At times they found such processes frustrating and challenging to their perceived professional roles.

Norton (2000) defined identity as encompassing “how a person understands his or her relationship to the world, how that relationship is constructed across time and space, and how the person understands possibilities for the future” (p.5). The vision and purpose of Fulton challenged many teachers in how they understood their relationship with the school and what the future held for them. They needed to consider a greater range of stakeholders' perspectives, in particular the university partners and this resulted in many challenges to familiar ways of thinking and working. The initial angst and frustration as noted in previous teachers' reflections ultimately acted as a significant affordance. Being confronted with varying viewpoints engaged teachers in much reflection and sustained dialogue about the notion of education in the 21st century and their role in it. The outcomes of these challenges and subsequent and substantive shifts in identity and thinking are reported in more detail in Chapter 5 and 6 but, it is important to say that much of this may not have occurred without the intense focus on bringing all stakeholders, and in particular the teachers, to a deep understanding of the school's vision and purposes. The following comment reflects one outcome of the constant recognition that new and different purposes existed at Fulton:

As frustrating as it may seem to meet the needs of everyone here I find a growing passion for learning more...I mean I really want to spend more time talking with Bill and perhaps watching him teach the uni students as well...we have to make more time for this...we've got to get their picture of things.

Such a reflection indicated a growing respect for the roles played by different people in the school and the potential this model provided for supporting teachers' learning. In fact, the comment reflected the concept of energy for learning and the notion of the negetropic organisation proposed by Kegan and Lahey (2001). The unique professional relationships that developed resulted in contested views but rather than this generating a destructive culture it led to opportunities for all involved to see from new perspectives and this often created energy for learning. Contested views together with the teacher-located affordances of openness, motivation

and purposeful listening proved critical to teachers' learning about their identity, the purposes of education at Fulton and beyond, and the connection between complexity and capacity building. Teachers were engaged in developing deeper understanding about core philosophical issues associated with their work. Hord (2008) claimed too often schools spend time focusing on where and how teaching will occur without addressing the bigger issues of "why am I doing this?" and, "how do I hope to contribute?" Such questions were at the forefront of the sustained dialogue at Fulton and emerged as significant to teachers' opportunities for sustained learning.

The process of learning for understanding through debate and dialogue about the school's vision and purposes was not explicitly set up or even recognised as an intentional learning opportunity for the teachers but proved substantive to a range of outcomes. Through the affordances of being innovative, contested views, openness and so forth, teachers engaged in learning for understanding at different levels. Wiggins and McTighe (1998) described six different facets of understanding (see Chapter 2 pg. 26) and teachers' engagement with stakeholders in developing a shared vision reflected these different facets including:

Interpret - Tell meaningful stories; offer apt translations, provide a revealing historical or personal dimension to ideas and events; make it personal or accessible through images, anecdotes, analogies, and models.

Take a new perspective - See and hear points of view through critical eyes and ears; see the big picture

Empathise - Find value in what others might find odd, alien, or implausible; perceive sensitively on the basis of prior direct experience.

Develop self-knowledge - Perceive the personal style, prejudices, projections and habits of mind that both shape and impede our practices. (p. 44)

At the time of the debate and dialogue about the school's vision and purposes, it was the tensions and frustrations that were often noted over and above the very valuable learning that is described by Wiggins and McTighe's facets of understanding. Indeed such facets of understanding emerged from many learning situations at the school but it was not always clear whether teachers recognised this. I am also unsure whether the teachers would acknowledge the benefits of the early tension-filled days to the quality of understanding their own identity and the bigger issues of schooling in the 21st century. However, in my "making meaning" of the situation it was the priority placed on clarifying the school's vision and purpose that enabled teachers through a number of specific affordances to develop deeper understanding of the basis of their work and their role in school. At the same time, the constant engagement with other stakeholders served as the foundation of a generative learning community. As Senge (1990) said, effective learning organisations are places "...where new and expansive ways of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (p.3). Fulton represented an example of Senge's proposition, particularly

for those teachers employed by the school in the early days of intense debate around school vision and purposes. The time spent on this aspect of the school provided for many incidental but powerful learning opportunities and outcomes and set the scene for achieving the intended vision and purposes of the school.

The questions generated by the intense focus on vision in the early years were “What happened for teachers who joined the school after the debate on vision and purposes subsided?” and “Were they provided with the same time and affordances for learning?” Although I don’t believe it was possible to capture the intensity and richness of the debate about vision and purpose that was evident in the early days of Fulton, the continued and explicit focus on innovation and the use of processes that engaged teachers in sustained dialogue with each other and other community members has generated a learning community that continues to provide highly valued affordances for teachers new to the school and as such provided support for a sustainable learning community. The following section considers in more depth the varied opportunities and affordances generated for teachers through the school’s vision of being a rich and complex learning community.

4.3.1.3 A learning culture

A fundamental philosophy that was constantly emphasised to all staff and stakeholders was that everyone at Fulton was a learner. Students were not the only people attending the school to learn. All members of the school community were learners including all teaching and administrative staff, as well as university and industry partners. This was a shift in culture for many members of staff who had opted to teach at the school because they believed themselves to be experts in their specific discipline areas. Many university personnel who believed their role was not to be learners but mentors to the teachers echoed the sentiments. Playing the role of expert may have been possible for many teachers and university personnel if the school functioned in the same way as a traditional senior secondary school. But this was not the case and the need to work in multi-disciplinary teams across year levels in an open-space learning environment positioned everyone as learners. No matter how experienced or how much of an expert a teacher was they were working in an innovative way which required them to be learners and to understand the philosophy behind the school’s vision. Such requirements provided additional evidence of why teachers were constantly engaged in reflecting on their professional identity and role. However, such conditions proved highly supportive of teachers’ learning too.

Considerable time was provided for teachers to engage in continuous dialogue about critical questions associated with their identity and role, for example:

- What did the design of the school mean for their teaching?

- How could they engage study in deep learning?
- What did deep learning actually mean?
- How could university partnerships work most effectively?
- How will students' engagement with interdisciplinary curriculum support them to achieve successful outcomes in their final year of schooling?

These questions were prioritised by teachers but were best answered when a range of stakeholders were involved in the discussions and it became commonplace to have a university partner sitting in on most meetings run at the school.

Creating a collaborative professional learning community was a priority of the vision for Fulton and leaders at the school and university were well supported in their thinking. Much literature supports the value of effective learning communities on outcomes for students and organisations in general (Curry & Killion, 2009, Fullan, 2005, Garmston & Wellman, 2009, Hargreaves, 2003, Little, 2003, York-Barr et al. 2006). Martin-Kniep's (2004, p.1) acknowledgement of the role of learning communities reflected a key purpose of Fulton's leadership in adhering to such a model.

Learning communities are the means by which we can break [teacher] isolation and foster a collaborative and reflective culture. In fact, creating a collaborative environment has been described as "the single most important" factor for successful school improvement initiatives and the "first order business" for those seeking to enhance the effectiveness of their school (Eastwood & Lewis, 1992, p.215).

Martin-Kniep also claimed the following beliefs and characteristics are evident in highly successful professional learning communities:

- Caring deeply about learning
- Feeling free to take risks
- Challenging each other and raising the expectations for everyone
- Respecting and valuing perspectives other than their own by seeking and valuing each other's input
- Asking questions of themselves and each other, even if the answers are sometimes elusive. (p.3)

These characteristics are of particular interest as they reflected many of the affordances generated by the culture of learning that existed at Fulton. However, the following section provides evidence of the processes and actions that resulted in such outcomes.

The location of the school on university grounds and the commitment of the university partners to the success of the school provided an excellent opportunity to engage university

partners in all levels of leadership at the school. Academics from either the Faculty of Science and Engineering or the School of Education or both actively participated in the groups established to guide the school's development and functioning. Four key groups were established to assist in the governance and management of the school including the:

- Governing council being responsible for meeting state education department requirements and determining school policies and procedures including responsibility for financial management
- CORE group being responsible for developing new and innovative curriculum options and for building relationships between academics and teachers at Fulton
- Professional learning teams being responsible for the generation and management of the professional learning strategy for the school and state, national and international programs.
- Teaching and Learning Leadership group (TaLL) being responsible for advancing the quality of teaching and learning in the school.

Many teachers in the school were also participating members of these groups. The groups provided an opportunity for different stakeholders to work in collaboration to achieve the vision of the school. I was a member of three of these committees for the purposes of furthering my research but also for my ability to offer insights into the area of professional learning. It was through my participation in these groups that I was able to experience first hand the opportunities, and at the same time challenges, associated with building a dynamic learning culture based on collaboration between different stakeholders.

Dunst and Paget (1991, cited in Dinnebeil, Hale, & Rule, 1999, p.12) define collaboration as a style of partnership that reflects "cooperation among two or more people concerning a particular undertaking", and although members from the different groups came from different backgrounds they were all committed to the same undertaking. The groups also provided an opportunity for the different stakeholders to develop relationships and an understanding of each other's beliefs, practices and aspirations for the school. Some members of the group cared more about processes of learning while others focused on the content of the curriculum. The variation in interests provided an opportunity to develop behaviours identified by Martin-Kniep as contributing to highly successful learning communities including "the ability to challenge each other and the ability to respect and value perspectives other than one's own" (2004, p.3). This concept reinforced the notion of contested views as an affordance that supported teachers' learning. However, contested views are often at odds with the notion of collaboration given that contested views also lead to tension and frustration (Hargreaves, 2003). The following section highlights a number of examples of tensions and frustrations experienced by the requirement to

work in collaboration and how these experiences ultimately generated new affordances for teachers' learning.

Fulton required teachers to work in different ways, often using curriculum that had been designed by academics and other teachers. The first comment made by a newly appointed teacher highlighted frustration at the lack of control she had over aspects of the curriculum while the second teacher was frustrated by lack of independent decision making :

I believe in being appointed to any school and asked to teach a specific topic [in this case a specific section of an interdisciplinary unit], I would be afforded the professional responsibility of being able to modify and teach in ways that I viewed as being more relevant.

By working in the ways we are expected to I often feel restricted, for example, if I have a good idea I can't act on it until I meet with the other eight people in my group.

The constant focus on collaboration between teachers and university partners did not always result in agreed ways of working. On many occasions, people would leave a meeting in "self-validation" mode and as such, collaboration was ineffective in achieving desired goals. Participants spent more time justifying their own perceptions and beliefs and were often closed to the ideas of others. As noted previously there are some positive outcomes of contested views and Dewey stated, "Environments with a high level of agreement between the subjects are relatively comfortable, they are not always beneficial" (Dewey, 1926 cited in Glassman, 2001).

A shift in thinking is evident in the following reflection from an academic who initially felt frustrated by the lack of new science that teachers were incorporating into their programming. In a group meeting with teachers, she commented.

We need to sit in on any discussions and reviews about your topic to date as it is very difficult for us to determine how to assist in programming...Martin¹⁰ thinks you should be doing a whole range of other things and we are trying to let him know that you are just surviving from one week to the next.

The academic's comments reflected a greater awareness of the challenges faced by the teachers and she provided support for them in her comments to other colleagues. Such awareness was supported by spending extended periods with teachers. In my own observations I certainly developed a sense of the complexity of the teachers' work and lives and that the "support" of university partners was often a two-edged sword, at times it provided supportive learning opportunities and other times it created frustration.

¹⁰ Martin (not his real name) was a senior science faculty academic with a strong commitment to the inclusion of innovative cutting-edge science content in the school's curriculum.

Another example of varied perspectives between teachers and university academics occurred in a review meeting to discuss the quality of students' work following public presentations. One academic commented, "The perceptions of the students were limited and at times incorrect; I am feeling uncomfortable about the quality of their scientific knowledge-base." Such a comment acted as a provocation for the teachers and enabled them to reflect and consider if they contested the view. One teacher did and replied, "Really the purpose of the Earth Summit was for students to develop the confidence to present an argument, the reality of the science was not the most critical issues associated with this task, it was about critical analysis and creativity". The response left the university academic querying why both couldn't be achieved at the same time, and so the conversation went back and forth with both people justifying their perceptions of the situation.

The contested views held by different members of groups worked in two ways; one that demanded reflection on, and justification of, existing beliefs and two as an opportunity to use the discomfort and challenge to see from a new perspective. Scharmer (2009) proposed that powerful learning can occur if people are able to "bump into their blind spots." He also stated, "The blind spot concerns the part of our seeing that we don't usually see....The blind spot is present every day in all systems. But it is hidden" (p.22). Blind spots in our thinking and practices can often be uncovered by working with others on analysing why we act in specific ways (Scharmer, 2009). The following "teacher only" discussion on the need to teach unfamiliar content provided evidence of the teachers' thinking and their blind spots in relation to the school's vision:

Teacher 1: I can't believe they wanted us to teach something we had no background in...really only certain people should be teaching that stuff

Teacher 2: As teachers we can teach a number of things but this does not make it easy as we don't know what's come before or even if this stuff fits with the SACE and I know Jeff (not his real name) doesn't feel at all confident to do it.

Teacher 3: I felt like a TRT¹¹ - here teach this!

Teacher 2: Yeah, that happened to me too but I found I knew the stuff

Teacher 4: You might have but I didn't ...I spent all night working it out...this is happening more and more and I'm here as a Biology teacher not a Chem teacher.

Teachers' blind spots appeared to be associated with seeking to perpetuate their identities as successful teachers of specific science disciplines. This was at odds with the philosophy of innovative and interdisciplinary curriculum. Teachers had every right to challenge the expectations of others but, the blind spot based on familiar ways of working restricted the opportunity to "see their own seeing" (Scharmer, 2009). However, the discussion provided a

¹¹ TRT is a temporary relieving teacher who replaces a permanent teacher who may be on leave for a period of time from ½ day to 2 weeks.

window into elements that contributed to the building of a learning culture that ultimately supported and sustained teachers' learning too. The opportunity to share frustrations and build trust among colleagues is critical and it is the trust that allowed teachers to reach the magical breakthrough that Garmston (2009) highlighted, the moment when teachers connect with a new or another's perspective and have the chance to bump into their blind spots. The ongoing conversation among the teachers provided evidence of a shift from venting frustration to recognition that the issues at the centre of the discussion were fundamental to achieving the school's vision and although the answers were not immediately forthcoming there was preparedness to keep seeking them.

Teacher 5: This is an interesting conversation because we want the same things as these people¹² but we're finding it a massive challenge to the ways we are used to working...I don't really have the answers at the moment either...too tired to think...but we do need to keep thinking about how to get there in better ways...and I get the sense they are willing to take on board our ideas too"

Teacher 3: Sure...and that's why we are having these conversations...to feedback to them what's working and what's not.

The teachers in the conversations had developed trust between themselves and respect for the vision of the school and others' ideas. Trust and respect became paramount to teachers sharing their frustration and anxiety with one another but also to opening possibilities for considering challenges and contested views from new perspectives.

Senge et al. (2004) suggests that when group members explicitly recognise and value dissonance as important in their learning and are open to "suspending and seeing their seeing" (Senge et al., 2004, Scharmer, 2009) there is much potential for the work of such groups to generate powerful learning outcomes along with the building of a dynamic learning culture. However, I wondered whether the process for working effectively in collaborative groups would have been less tension-filled and more productive if attention had been paid to considering protocols for working effectively as a team.

Teachers and academics engaged in multiple discussions about deep learning and processes that supported learning but there little attention was paid to the practices of effective collaborative groups. Often these skills are assumed of people working at this level but when unfamiliar people come together, Garmston (2009) recommends developing the skills of "pausing, paraphrasing, inquiring, probing, putting ideas on the table, paying attention to self and others and presuming positive intention" (p.67). There were certainly plenty of ideas put on the table by members of the Fulton community and much inquiring and probing but initially less pausing and paying attention to self and others.

¹² "These people" is referring to the leadership team and university academics.

A shift in the relationships between teachers and the university partners occurred within the first year of the school in operation; it occurred for some teachers and academics that had developed close working relationships earlier than for those who had not. The affordance of collaboration developed to one of mutual engagement whereby teachers and academics viewed themselves as equal partners in learning. Garmston (2009) reflected:

...we have often witnessed moments when group members begin to inquire into others' ideas. Almost magically, the meeting tenor changes, participants show and feel more respect, and the quality of the work improves. When group members begin to paraphrase others as a way to clarify their understanding of ideas, the practice spreads, and relationships and work quality improves. (p.67)

The importance of developing respect for and attention to the ideas of others was essential for generating a dynamic learning community at Fulton that supported teachers' learning. Sustained interactions between teachers and academics ultimately created affordances of *respect* and *mutual engagement* that were possibly more significant to the school as a learning organisation than affordances like access to expertise and funding. Although it is important to acknowledge that without funding, time for teachers and academics to meet would have been restricted resulting in reduced opportunities to develop trust and respect. All affordances played a role in achieving such outcomes and this is identified in the explanatory model whereby everything is labeled as resources for learning.

Another affordance, initially introduced in the section on innovation, which provided significant support for teachers in the emerging learning culture, was the use of *specific language*. The specific language went beyond the word "innovation" to provide a language for describing learning processes and stages and for also developing the teacher-located affordance of openness. Moon's Map of Learning (introduced in Chapter 2 pg. 31) provided the very accessible language of "noticing", "making sense", "making meaning" and so forth for teachers to describe experiences and processes that had influenced their thinking. The other language for learning came from a model proposed by Senge et al. (2004) which was introduced at the school somewhat after Moon's model. The language came from the Theory U model initially developed by Scharmer and Senge and shifted teachers from articulating what they had "noticed" to "suspending" or "seeing their seeing" and where appropriate "letting go" of some existing practices and beliefs. The act of reflection was an initial element in the Theory U model and the language supported the process of some powerful reflective practice. It also added support to the strengthening of affordances such as trust and respect as it provided teachers with a process for acknowledging the worth of other people's contributions, suspending judgment and becoming more open to new ways of seeing. The use of specific language that reflected learning processes emerged as a powerful affordance for teachers' learning and the building of a learning community made up of people from diverse backgrounds. This teachers' reflection

captures how a language of learning supported building a learning community and new ways of thinking:

Well, I can't say I agree with Martin's perspective on this issue but I am willing to suspend on it for a bit...I'll talk to him again when I have had more time to see how he is seeing it.

Access to models (Moon, 1999, Senge et al. 2004) and their associated language acted as a protocol for working more effectively in teams and for developing a deeper understanding of the learning process. As noted earlier, such skills are often assumed of adults but the outcomes that emerged from the use of specific language left me wondering whether input on developing collaborative groups, and in particular purposeful listening, would have assisted in reducing some of the tension and frustration that emerged in the early days of the school as well.

Connections between all members of the learning community at Fulton strengthened over time but an underlying tenet that was evident from the inception of the school was a focus on teachers' learning that was connected to the university partners. The school philosophy document stated:

[Fulton] has a vision to provide a learning culture for its students that derives from a learning culture developed by its staff from their interaction with university and industry scientists and educators. (School policy statement, 2003).

There was a commitment to teachers and academics working and learning together.

Prioritising teachers' learning was well supported by research literature with Sykes (1999) saying "whereas professional development initially was regarded as one among a number of coequal policy instruments for promoting change, it is now reckoned as the centrepiece" (p.152). Robinson (2007) also identified that leaders who promoted and participated in teacher learning and development contributed to improved student learning outcomes. She highlighted that it was not enough for leaders to merely promote teacher learning, it was critical for them to participate as learners and go beyond this to act as the leading learner. The affordance of *supportive and encouraging leadership* is acknowledged in the explanatory model of PL at Fulton with the following section of this chapter devoted to this area. However, at this point it is important to acknowledge that leaders from the school and the university consistently engaged in learning with and from each other. Many sessions focused on issues of planning and policy but some leaders ensured they also engaged with the teachers and students to focus on enhancing content knowledge.

In the different spaces of the learning environment, I observed academics, teachers and students working and learning together. Sometimes it was an academic and teacher working with a larger group of students and other times it was a teacher, student and academic. I asked

one student about his experience of working with a professor and his teacher and he highlighted the following points of interest. Firstly, the student commented that the mathematics they were discussing was “way complex” and not connected to his “school work” but he found the professor “fascinating” because he knew so much. Secondly, he said he felt more relaxed knowing that his teacher did not clearly understand some of the mathematics being proposed by the professor but at the same time he was also grateful for the teacher’s lack of clarity as this allowed the teacher to ask questions that the student may not have thought of asking. Finally, the student commented that when the teacher explained to him a concept proposed by the professor in a way that made sense to him the professor responded, “I never thought of presenting it that way.” The student’s summary captured the essence of the emerging culture of the school when he stated, “In reality we all learnt something useful in that session, it felt good.”

In this scenario several affordances that supported teacher’s learning were evident including *access to expertise, openness, trust, respect, collaboration, mutual engagement* and *time for learning*. The academic, teacher and student all felt secure enough to work together in a way that allowed for the teacher’s lack of content-knowledge to be exposed to the student and for the academic to pay respect to the teacher’s pedagogical knowledge. The scenario also reflected the vision of the school for learning to occur in the time and space that best suited all learners and proved relevant and challenging beyond being related to state-mandated curriculum and exams.

The school’s explicit focus on building a school culture where all members of the community engaged as learners provided support for teachers’ learning that varied significantly from more traditional forms of professional learning, for example, workshops and conferences (Hawley & Valli, 1998). There was potential for learning to occur every minute of the day in the Fulton environment. Such an outcome was at the heart of Fulton’s philosophy but philosophy alone cannot create culture. The culture of Fulton emerged from the affordances for teachers’ learning that were generated by the interactions between contextual conditions and relationship factors and the quality of the alignment with individual teachers’ characteristics, capacities and sense of personal agency. The learning culture did not emerge overnight but through high expectations of teachers as learners and a sustained and intensive focus on bringing people together who could challenge one another and support each other to develop in depth knowledge and high quality pedagogical practices. This was an important finding in answering the research questions on support and processes for learning posed in this thesis.

The section that follows explores more specifically the role of leadership in supporting and sustaining teachers’ learning. However, the following reflection from one leadership team

member provided a sense of the commitment to building a learning culture in the school and the expectations on teachers to be involved.

It's critical that the school as a whole maintains a high profile and professional learning approach, a learning culture that is articulated frequently by its leaders and that these leaders show that they value learning in everything that they do and that occurs; and that not engaging in that is not acceptable as a professional. It's not about towing the line it's about a belief that when visitors come to our school and interact with us about our knowledge and professionalism, ask us questions that challenge us, we can all show that even if we don't have the answers it's evident we have thought very deeply about and understand what it means to be a teacher and a learner. This is not just about us looking good but about teachers really understanding themselves and their work. One teacher commented to me they did not feel a sense of expectation for commitment to professional learning but a sense of being allowed to really learn and engage in learning that was valued by the learner. Getting to this stage requires an ongoing belief and valuing of professional learning by the leadership team.

Research such as Robinson's (2007) and Marzano, Walters, and McNulty's (2005) acknowledged the role of leadership in promoting teacher learning and development. However, the commitment of teachers to the leadership's vision was also fundamental to achieving desired outcomes. To be "leaders of innovation and reform in science and mathematics education", daily attention to what supported quality learning was central to the work and learning of teachers. Daily attention involved constant discussions in stairwells and classrooms, over coffee and in car parks about the quality and purpose of the work of the teachers. There were many days when the only conversation in the teachers' lunch break was about teaching and learning. Many times, it was intense and passionate but always conducted with great respect for each other and a sense of all working towards the same goal. A learning culture was very visible; it felt different from many other schools I had worked in. The emergence of the culture also made more visible the learning processes teachers were engaging in, of which *sustained dialogue* was one.

An additional element that contributed to the school's learning culture, which is not often experienced in other schools, centred on the interest outsiders had in the school. Fulton, due to its innovative design and organisation, was a constant hub for visitors. Visitor's varied from local teachers and school children seeking to develop their understanding of the new sciences to international leaders including Baroness Susan Greenfield, Stephanie Pace Marshall, Andy Thomas, David Perkins and Etienne Wenger, to name a few. These people were leaders in their field and the opportunity for them to provide feedback on what they observed and how they interacted with the staff in both formal and informal ways generated not only a significant learning opportunity but a culture of seeking to learn and improve. The principal of the school also referred to the influence of visitors to the school in his comment:

You know all the visitors we have through the place...they are a constant reminder of how far out there we really are...and you lose sight of that when you are in the middle of it ...the reality is that we're three to four years in now so the opportunity to have those conversations with others has been immense. You converse as a educationalist, as school leader, a principal...almost as if this is common practice now...I still have great energy for it... and when you get other people reflecting on the school from a more conventional perspective...it's when you go...the light goes on and you go phew, hell...we are innovative! But the thing I appreciate the most is when these people open my eyes to something new...something I haven't seen because I'm so in it...I don't think you would get this opportunity in other schools...you just wouldn't get the type of visitor we get on a regular basis...we invite them because we want the feedback...we want to learn more... it's just part of our school now.

The leadership team deliberately invited experts to visit and provide open and honest feedback on the school and in doing so this provided teachers with opportunities to interact with and learn from experts in specific disciplines and in transforming schools. And because the school community had generated a culture of trust in each other and respect for the ideas of others they were willing to listen and take on board feedback provided by experts. The school never waited until "things were in place" to invite people in and this suggested recognition that learning can be more powerful when one is open to positive and negative feedback. Such characteristics are supported by Easton Brown (2004) who said that, "Creating context is an ongoing process. No school or district waits until exactly the right conditions (context) are in place to provide professional development." (p. 5). Fulton provided ongoing professional learning opportunities for its teachers and leaders through seeking experts' feedback on their context and culture recognising they did not have the answers to everything they were attempting to do. Such a culture of actively seeking learning opportunities and questioning current practices was reflective of Kegan and Lahey's (2001) notion of the negentropic organisation that is energised by embracing challenge, feedback and change. The philosophy of Fulton was pivotal to creating conditions that enabled teachers to access and engage in high quality learning opportunities with experts and this in turn created teachers who embraced the opportunities they had to learn from others and to facilitate learning for others too, including their students and colleagues. This pattern of interaction was fundamental to the school culture that emerged and continued to evolve over time and captures another process of teachers' learning.

It proved to be a rare day when the school did not host visitors of some sort. Visitors would range from prospective students and parents, other teachers, and as mentioned previously, experts in their field of science and/or education. Visitors engaged in either tours of the school in action, often stopping to ask teachers and students questions, or they were involved in shadowing teachers and students in action. More traditional seminars and workshops were also held with teachers from the school being presenters. These seminars were

often held in the same learning areas as students in class and the result was a very dynamic learning community with a futures perspective in action.

The school had a mandate for providing professional learning for other schools in the state, nationally and internationally as well, and this provided quite explicit opportunities for teachers to engage in learning. Teachers at the school were constantly articulating their beliefs about learning and teaching to others and this very act provided them with the opportunity to develop a deeper understanding about their practices. They engaged in many forms and levels of reflection and Arin-Krupp (cited in Garmston & Wellman, 1997, p.1) stated, “We don’t learn from experience, we learn from processing experience”, and the teachers at Fulton had multiple opportunities to process their experiences and clarify their beliefs and understandings. Such processes were included as the affordance of *reflective practice* in the explanatory model.

Teachers’ willingness to talk about their work and learning to colleagues and strangers reflected the outcome of a school culture that made it explicit that “it’s all about learning” (Stoll, et al. 2003) and importantly, about reflecting on learning too. The conversations and responses shared in this section of the chapter provide evidence of teachers, leaders and academics all developing as reflective practitioners and the notion of reflective practice featured strongly in the development of the learning culture at Fulton. Reflective practice as an affordance for learning is acknowledged in more detail in the section on Fulton’s professional learning strategy (see page 148 in this chapter) but it is important to highlight its influence on the overall learning culture of the school. Reflection is featured as a critical component in the learning process as illustrated in Moon’s (1999) Map of Learning and as such, it would seem fundamental to a school where the philosophy considered everyone a learner. The explicit recognition of reflective practice as an important affordance for learning supported Martin Kniep’s (2001) belief that learning communities based on collaboration and reflective practice provide the foundation to achieving reform, success of initiatives and effective outcomes for schools.

There was much evidence that Fulton’s philosophy of all school members being learners, and the support provided to achieve this outcome, enabled affordances for learning that included contested views, collaboration, openness, trust and respect, purposeful listening, access to expertise and funding, mutual engagement, use of specific language, feedback and support, and reflective practice. These affordances created reciprocal influences between teachers’ learning and school culture and the growth in one enhanced the growth in the other.

The three contributing aspects of the school culture and philosophy, 1) an innovative school, 2) school purpose and vision, and 3) a learning culture, provided unique opportunities

and much support for teachers as learners. Few teachers have the opportunity to be foundation members of a school designed to challenge existing paradigms of secondary science and mathematics education. The foundation leaders of the school made the wise decision to prioritise stakeholders' understanding of the school culture and philosophy and through the challenging and sustained process many learning affordances for teachers emerged. In essence, very few of these were intentionally planned but they proved powerful and contributed significantly to a dynamic and generative learning community. An important contribution was the ability to document closely how learning was supported and sustained and therefore identify many processes for learning that may have been overlooked as making a difference to teachers and outcomes for the school.

The other two contextual conditions that also generated affordances for teachers' learning to be explored in the sections that follow, supportive and encouraging leadership, and the physical and technological environment, provided more intentional and obvious processes for teachers' learning. However, they often resulted in similar affordances to those that emerged from the influence of school culture and philosophy.

4.3.2 Supportive and encouraging leadership

There is a myriad of literature on the role of leadership in supporting teachers' learning (Fullan, 2001, 2002, 2003, 2005, Perkins, 2003, Robinson, 2007, Sergiovani, 2000, Sparks, 2002). I did not consider this literature in any depth as I embarked on this research. However, from the continuous remarks that were made by teachers and the leadership team's "unrelenting" (their own words) focus on opportunities to engage teachers in learning, it became evident that this was indeed a critical support for teachers' learning and as such featured in the explanatory model of professional learning at Fulton.

Robinson (2007) in her research found that no one particular form of professional learning was required to improve student learning outcomes. Rather the ability to align achievement of the school's purposes with relevant but varied activities that provided learning challenges and an opportunity to "co-construct alternative theory of practice" (p.17) were of greater influence. Robinson's findings reflected well the actions of the leadership team in being explicit about the many purposes of the school, visibly acting as learners and prioritising the building of a culture of "co-construction" among students, teachers and academics, not just about theories of learning and practice but about all aspects of Fulton.

The leadership team at Fulton comprised the principal, the deputy principal, the assistant principal (professional learning) and the assistant principal (student services). These four people were responsible for the leadership of all aspects of the school from financial and resources

management to individual staff and student welfare. They had large administration loads but never let these get in the way of their own learning. They were ahead of their time in publishing an occasional paper for the school community and beyond on the importance of being the “lead learners” at Fulton. An extract from the paper substantiates their commitment to building a learning culture at Fulton.

Leadership of learning demands the creation of an ethos and culture about learning throughout the school and is not an activity to be vested in a few. It is generated by leaders who consistently demonstrate an overwhelming confidence in their own ability to learn and to lead the learning of others. It is the development and establishment of an attitude that is contagious. It's an activity that needs the attention of all in the school community and a pattern of leader behaviour that demonstrates confidence and trust in others to demonstrate their leadership.

The leadership team at Fulton provided an example of the proposition put forward by Sparks (2005) that “ Leaders’ thoughts and actions shape the culture of their organisations and set the direction and pace for the professional learning that is essential in improving organisational performance” (p. vi). The leadership team’s energy for creating a school that was truly innovative is also reflected in Fullan’s (2005) notion that “Agents of transformation are leaders who act in ways that produce others to act similarly” (p. 50). Teachers at Fulton constantly acknowledged the support and encouragement provided by the leadership team for their work at the school and their learning. One teacher reflected:

Change is more rapid and ongoing when there is support for these beliefs from leadership... I am also able to operate with a high degree of autonomy and be recognised as a professional, able to make good decisions in relation to my sphere of control.

The leadership team constantly inquired into new research and embraced feedback from staff and outsiders on the school, and their openness and availability to staff and students at the school generated many of the affordances introduced in the School Culture and Philosophy section including trust and respect, feedback and support, reflective practices and so forth. They behaved in ways Perkins (2003) described as “developmental leaders”. Developmental leaders are recognised for moving beyond having an explanation for how things should be and why things are like they are to taking action to create change. Perkins believed that developmental leaders are agents of transformation as they act in progressive ways and provide a model for others to follow. Perkins (2003) also acknowledged the willingness of such leaders to have their ideas critically scrutinised by others:

An ideal developmental leader tries to adopt progressive actions regardless of what others are doing. When given feedback the person offers communicative rather than negative or conciliatory feedback. When collaborating with others to start a project, the person brings to the table not fully developed ideas but trial balloons or sacrificial plans held loosely to avoid the danger of early retrenchment. (p.217)

The leadership team clearly recognised that teachers in the school were constantly faced with change and expectations to work in new ways or take on new challenges. They believed teachers would have a greater understanding of new directions if they were kept well informed and consulted often. However, beyond this, teachers were actively provided with opportunity to be the “lead learner” in a number of initiatives including identifying and trialling student management software, documenting curriculum development processes to present at workshops, acting as leaders in professional development projects for other schools, taking up opportunities and scholarships to work in industry and leading student teams on overseas trips. The leadership team adhered to a vision and policy of ***distributed leadership*** and every teacher at the school knew they could approach the leadership team about desired learning and leadership opportunities. Distributed leadership acted as a valuable affordance for teachers' learning at Fulton; learning that went beyond content and pedagogy to how teachers could be developmental leaders in their own right. A teacher's reflection captured the concept well when he stated, “it's a combination of the environment and the vision of the leaders which has been adopted and re-created by the teachers so that the [Fulton] emerges as a cultural environment...where everyone leads learning”.

The principal's vision and its links with the affordance of distributed leadership are well captured in the following reflection that commenced with acknowledgement of the complexity of Fulton:

You've always got to take this holistic ...sort of view...you are dealing with a system of interlocking parts and processes and so on...I mean you push the side of the balloon in one spot and it's got to expand in another...you get that ...sometimes it feels like you are trying to grab hold of a jelly...it squeezes through your fingers...or you know that other stuff...the paradigm of the plate spinner...you know trying to keep all the plate spinning at once...maybe that's not such a good paradigm because it talks about THE plate spinner...and for this school...I would hope that it's never going to be THE plate spinner, it's going to be multiple plate spinners...

The “multiple plate spinners” paradigm referred to the complexity faced by teachers at Fulton but also to distributed leadership. The words “distributed leadership” became a specific language for the leadership team. They actively considered how every staff member could engage in leadership positions. They considered leadership to be beyond a position of authority in the school to viewing leadership as any actions that contributed to and enhanced the vision and purposes of the school. The ***feedback and support*** they provided for staff in acknowledging the work they had done encouraged teachers to understand leadership in the same way (Harris, 2008). The affordance of feedback and support resulted in additional learning for teachers but also enhanced their sense of self worth and energy for commitment to the school. Ultimately the affordance of feedback and support was located between the organisational and teachers'

characteristics domains as the modelling of feedback and support provided by the leadership team was reflected in teachers' feedback to and support of one another. In many scenarios the feedback and support provided by teachers for colleagues was often all that was required for powerful learning to occur but such a scenario may not have emerged if not prioritised and modelled by the leadership team first.

Scharmer's (2009) asserted "an ever-increasing energy loop" (p. 189) is created when two conditions are met and these two conditions reflected the leadership team's perspective that: what someone does really matters and it makes a positive difference. Teachers' levels of motivation are enhanced if they experience these two conditions but when a leader explicitly acknowledges the value of the work the energy loop is enhanced. Many teachers commented on the support and encouragement they received from the leadership team as making a difference to their motivation. One teacher reflected:

I spoke with [Frances] and her enthusiasm for what I had in mind made me even more excited about the possibilities, she added ideas to consider and talked of resources she could help with...when you get that type of support and it happens all the time here you just want to do more.

The specific outcomes of teachers' learning that resulted from affordances generated by the leadership team are reported in Chapter 6 but it is timely to acknowledge that the support and encouragement of the leadership team created positive relationships, added to the learning culture of the school and engaged teachers in reflecting on their identity. Many teachers developed a profound sense of professionalism in their work and role and much of this was based on the leadership team's belief in, expectations of, and support and opportunities provided for teachers.

The following lengthy reflection from the principal of Fulton has been included for two purposes: firstly it focused on the work and professionalism of teachers and secondly it captured the type of leadership teachers at the school experienced. The reflection provided a compelling sense of the principal's understanding of quality learning and teaching processes, a belief in Fulton being able to contribute to the profession, the power of collaboration, and most, importantly the genuine and high regard in which teachers were held.

I believe...we're actually significantly changing THE profession of teaching...you know in a sense of... there's a culture of inquiry, of action learning, of professional development and all those sorts of things but here it's that overarching imperative that "I am responsible for generating this enriched learning stuff...I am not only responsible for it as a professional individual but I am responsible to my colleagues as well"...so there is this sort of ground swell of development that comes through everybody's work...so now the role of teacher has really stretched into...this is about kids' learning and so the focus is less on... here is the curriculum – I have to deliver...more on...how is this contributing to students' learning and how are we transferring the power to learn into kids' heads...

He expanded on the differences between the teachers at Fulton and other schools in which he had worked:

I mean the principal crap detector is out all the time...and you pick up all sorts of little indicators that almost seem superficial ...but...rarely do you see people sitting round the staff room here talking about pensions and superannuation...you hear them talking about kids and learning, and how they can do it better and how do they engage this student better and how do they motivate them and all of those sorts of things...so the teacher talk stuff is the first place you go to... The second thing is...I've never been in a place before where there is just this in-depth consideration and almost...you know... obsessive attention to detail about the construction of activities for learning...most commonly and I don't mean this in any sort of derogatory way...but in other places what happens is teachers get given the syllabus or curriculum statement and their interpretation of that is a very personal and professional decision...good teachers deal with that in a really professional way...they engage with it... they think about it...their next job is to go ...this is the bit of learning I want young people to engage in...how do I construct a learning activity that is going to generate that learning process...and that goes to the heart of quality teaching – generating that learning activity so that it engages and builds the knowledge and so on...you know in other places I hardly ever hear anyone talk about that sort of stuff...people go – well I'll get them to take some notes out of the book or I will engage them in this science experiment or you know and they repeat the practice...HERE there is a deep analysis of the practice...how are we going to do this...what are we going to do with it...how do we generate that...how will we group the students...how will we organise our time...what resources will we direct them to...who can we get them to talk to...how will we get them to demonstrate their learning about this...how will we help kids understand the quality of their learning...So there is a whole depth of reflection, analysis, construction...that is done in collaboration...and you know I've often said – you put five architects around a table or five interior designers...there's a sort of a creative stuff about team and stuff that causes a higher order outcome and it's exactly the same here...

The principal's reflection on the teachers at Fulton never once mentioned the leadership's role in such outcomes and yet the role was fundamental to teachers' learning and working in collaborative ways. The organisation of the school was the responsibility of the leadership team and they consistently reviewed how to make improvements, how to provide flexibility for teachers and students so that learning was rich and meaningful, and how to go beyond the school to make a difference for the lives of all students and teachers. There was a passion for “re-thinking” everything about schooling and this passion focused on teachers' learning as the key to transformations.

The leadership team's words, actions and priorities generated valuable affordances for teachers' learning, specifically distributed leadership, feedback and support, and also served to greatly enhance the teacher-located affordances of motivation, openness, purposeful listening and trust. Their vision and actions reflected the six behaviours that Sparks (2009) identified as supportive of achieving change in schools:

- Cultivating simplicity regarding ideas that are of substance to improvement efforts by continuously refining their ideas through writing and speaking to committed listeners who aid in the development of their clarity.
- Cultivating relationships that offer hope, provide encouragement and support in the acquisition of new practices and stimulate new ways of thinking about teaching and learning.
- Establishing new habits of mind and behaviour in themselves and throughout the school community that are intentional and sustained over time.
- Ensuring the school community and those beyond understand the implicit theories underlying the school's vision and subsequent actions.
- Creating new conceptual frames and mental models for themselves and others that enable continuous improvement in teaching, learning and relationships.
- Consistently employing "next action thinking" to ensure that their intentions to think and act in new ways are realized and that momentum is maintained. (p. 51 -54)

The leadership team's values and actions, along with teachers' acknowledgement of their influence on learning and levels of motivation, provided sound evidence for the inclusion of leadership as a fundamental contextual condition in the explanatory model of teachers' learning at Fulton and an obvious answer to what supported and sustained teachers' learning at Fulton. The final contextual condition that was included in the explanatory model of professional learning at Fulton was the physical and technological environment, as this too, provided valued support for teachers' learning.

4.3.3 Learning Space: Physical and technological environment

The affordances for teachers' learning generated by Fulton's purpose designed learning environment are considered in this section. The discussion commences with an overview of the contextual conditions created by the environment followed by a more specific discussion on how the conditions provided affordances that supported teachers' learning.

Fulton was a multi million dollar project that created a learning space very different from traditional high school. As stated in the architectural brief (Archive Document, 2003):

It is intended that [Fulton] will provide a very different learning environment and new direction in teaching pedagogy. This new approach has not yet been tested in Australian schools and facilities and internationally there is no one institution that embraces all aspects of the desired model. (p.11)

Davies, Heath and Bissaker (2006, p.2) also wrote:

The design of the building moves away from architectural-pedagogical paradigms that reinforce teacher-centred pedagogical practice and define the traditional power

relationship between teacher and student. The design of the building's learning spaces is an architectural response to the desired pedagogical approaches at the school. It is designed for highly collaborative and interactive, student-directed approaches that transfer the power of adolescent social interaction into the learning environment.

The 4000 square metre building was constructed over two levels. Figures 4.6 and 4.7 are basic floor plans of the building and these have been included to gain a sense of the difference in architecture from more traditional schools.

The building featured large open-space teaching areas called learning commons (LC). The 9 LC were approximately 160 square metres in size. Every LC provided workstations and storage lockers for approximately 50 students. The building was designed to accommodate a maximum of 450 students but in flexible ways. The LC provided a "home space" for groups of students. One teacher supervised the groups of students, between 10 and 15, and up to three groups would share one LC. The groups were known as tutor groups and would meet daily. Further details on tutor groups are provided in the section on school organisation on page 135 of this chapter). The openness of the LC allowed for staff and students from a number of tutor groups to interact and support each other. The LC also provided the key teaching areas and 3-4 different teaching and learning groups might be in action at any one time, or alternatively, 2-3 teachers within one LC may manage one large group of students.

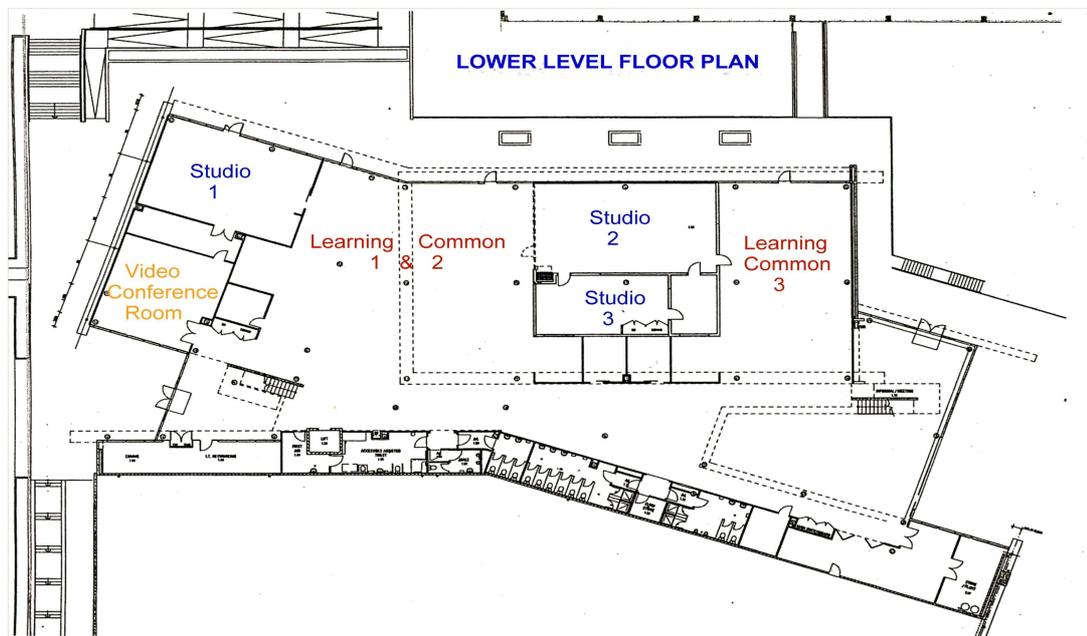


Figure 4.6 Lower level floor plan

The furniture provided in the LC allowed for lecture style seating, chair and table layout, larger tables for group work and combinations of all three. Whiteboards, data projectors, overheads and display screens were available in two strategic fixed locations with 30+ computers and

mobile teaching platforms (which provided access to DVD/Video players and large flat screens) also available in most LC.

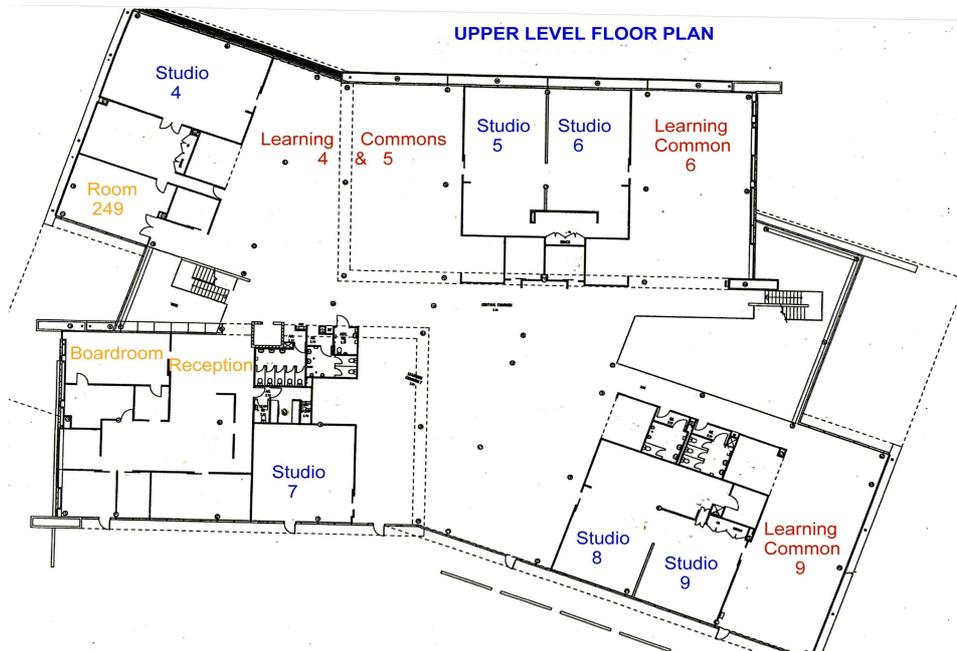


Figure 4.7 Upper level floor plan

The building also incorporated a series of learning studios as replacements for the more traditional school laboratories. The studios, all leading off the learning commons, were divided by transparent glass walls and sliding doors. The intended effect was to create a learning space where all student and teacher action could be readily observed and where there was a sense of connection between locations. The studios were designed to cross the boundaries between traditional disciplines and promote an interdisciplinary platform for learning. There were nine learning studios with varying names including Human Performance, Video Production, Physical Sciences, Applied Technology, Life Sciences, Environmental Science and Mathematics. No one teacher had responsibility for any particular learning studio as they were used when relevant to the learning needs of students.

Another key feature of the building was the Central Common. The architectural brief (Archives Document, 2003), said “the central internal space links all the functional spaces to promote a sense of community within the school....it provides a strong visual identity with an impressive two-storey space with raking ceilings and roof lights and larger areas of glass, ...and a flexible gathering space for 250” (p.14). The space has been used for a diverse range of functions including many conferences. These conferences attended by local, national and international educators and professionals are conducted in the same space as students attending

classes. The outcome of adults and students working together in time and space contributed further to the “learning culture” of the school. The building design was fundamental to promoting teachers’ and students’ learning and to the sense of a dynamic and generative learning culture.

To extend the notion of students and teachers working and learning together the building did not provide staff preparation or faculty offices. Teachers’ working spaces were distributed throughout the building and located off the learning commons. Two to three teachers shared these spaces. Teachers were constantly visible to students as they engaged in preparation, research, marking, discussion with colleagues and so forth. During teachers’ non-instructional time they were in a position to observe and hear the learning and teaching occurring in the learning commons adjacent to them which provided an obvious affordance to teachers’ incidental learning. The affordance specifically linked with the learning environment at Fulton was that of *physical proximity* and its influence on teachers’ learning is discussed in more detail shortly in this thesis.

The flexibility of the furnishing within the learning spaces provided numerous opportunities for teachers and students to create specific and varied learning environments. The building provided quiet and withdrawn learning spaces for 1 – 2 people through to larger open spaces that could cater for over 500 people attending a key-note lecture. Such flexibility allowed for many different teaching and learning configurations from one teacher working with individuals and small groups through to another lecturing to a group of 200+ students. It was common to walk through the building and not be aware of which teachers were responsible for which group of students. There were always teachers “on the floor” in the learning commons and teachers working in the teacher-area alcoves. Teachers often worked in more traditional ways as well, for example, leading a group of students as they introduced new concepts or assignments. Other teachers in the same vicinity not specifically engaged with students were always available if students needed clarification about anything.

Students also made interesting use of the environment. They could be found in larger classes in the LC, working in smaller groups in glass-walled rooms located off the learning commons, or studying individually on the long flat benches that were strategically located throughout the building. At times students appeared to be “resting” or opting out of more formal learning processes but it often came as a surprise to visitors and close observers that such students were actually engaged in learning and had merely chosen a more relaxed way for the body to do this (see p.135 of this chapter for an example of how such a situation acted as a valuable affordance for teachers’ learning as well).

The extensive use of glass and open walled spaces significantly reduced the wall space available for displaying student work or teaching resources. However, the material mounted on walls was strategically selected for its explicit focus on learning and to remind students what the school was all about. Posters featured learners such as Einstein commenting, "It's not that I am so smart it just that I stay with problems longer"

The differences between the learning space of Fulton and more traditional senior secondary schools were clearly evident. The open design was complimented by the significant availability of current technology including computers, smart boards, display monitors, mobile platforms incorporating DVD players, large digital televisions and sound systems. The school had a wireless network and many students brought their personal laptop as their primary learning resource. The students' work was kept in e-portfolios instead of lockers and could be accessed by parents through the school's portal system. Students' preferred technologies of mobile phones and ipods were incorporated, rather than excluded from the learning environment.

There is much evidence that Fulton reflected the high-quality learning environment that Malaguzzi (cited in Palsha, 2002) called for in Reggio preschools. Gandini (2002) described Reggio environments as "an amiable space", an environment that:

conveys the message that this is a place where adults have thought about the quality and the instructive power of the space. The layout of the physical space is welcoming and fosters encounters, communication and relationships. The arrangement of structures, objects, and activities encourages choices, problem solving and discoveries in the process of learning. (p.17)

Gandini's description of Reggio environments sat well with what was found at Fulton and there is no doubt that the learning space reflected Malaguzzi's ideas of an environment that amplifies learning opportunities and outcomes for both students and teachers.

Hargreaves (2003) and Warner (2006) both reflected on physical space in their commentaries on education in the knowledge era. Hargreaves, in his description of Blue Mountain School, (a description that mirrors Fulton in numerous ways), provided a brief overview of the physical layout of the school. He commented that the building was designed to encourage interaction among students, teachers and visitors but no ongoing connections were made as to how the learning space actually promoted learning. Warner (2006) spent more time on the issue of the learning environment and acknowledged that the learning spaces of 21st century schools need to be very different from traditional box-like classrooms. He suggested "using physical space to support learning rather than enclos[ing] it can have a significant effect on learning outcomes" (2006, p.94). The focus of Warner's and Malaguzzi's discussion is on how thoughtful consideration of the learning environment can provide enhanced opportunities

for student learning. Neither made comment on how such environments can also support teacher learning.

4.3.3.1 The environment as an affordance for teachers' learning

As the focus of my research was on teachers' learning rather than student learning, the influence of the learning environment became a focal point in considering how it supported and sustained teachers' learning. The design of the learning spaces at Fulton clearly promoted *physical proximity* and connectedness among the learning community. Physical proximity was identified as an affordance for learning in the previous section but the flexibility and interactive nature of the building design were also fundamental to both intentional and incidental learning for students, teachers and others who were visiting the school. Teachers in the school made the following observations of how the design of the building acted as an affordance for their teaching and learning:

I think this building has been one of the biggest contributors to my learning purely because you can't escape... it's the open nature, I can just sit at my desk and someone will walk past and I'll think what's he doing ...oh that is interesting...I never though about doing it like that...even if it's just a small idea or activity

I saw "James" teaching this unit I had designed the other day and was so surprised as I had never considered introducing it the way he did, I just sat back and watched and listened and it really opened my eyes to a new way of doing it

It's the environment...I haven't really invited other teachers into my classroom in the past...so even though I had good relationships with them we didn't look towards team teaching and really working together...it just seems the natural thing to do here

It's often the case that you attend a conference where someone will say that they have something really interesting in their class and they describe what they have done. At the time you think that this is a marvellous idea and that you will go and try it yourself. You return to your school and lock yourself away in a little box of a room and very little changes. Here, because of the open nature of the building and the collaboration that occurs it is very easy to see others have done those marvellous things and to be encouraged to try them for yourself.

It is interesting to note that the teachers' comments while focusing on the environment as an affording factor in their learning, all made links to learning from another person in the environment, not from the environment itself. The role of *teacher colleagues* and *students* was another critical affordance for teachers' learning and more explicit detail on the influence of both is included in the section on relationship factors to come.

A common complaint from teachers in more traditionally designed schools is the lack of opportunity to observe colleagues in action. The opportunity to spend time watching others teach is acknowledged by teachers and researchers alike (Easton-Brown, 2004, Darling-Hammond, 1999, Guskey, 2000, Hawley & Valli, 1999, OCED, 2009) as a powerful form of professional learning which in traditional schools is often hard to embed within daily life.

Space, time and costs often restrict teachers' opportunities to learn from colleagues in action. At Fulton, teachers were afforded the opportunity to observe their colleagues while they were working. Many commented on the small things they noticed others doing while they were teaching. For example, one teacher said, "I noticed [Larry] using this really interesting picture in a maths class so when I finished teaching...over lunch he told me all about it." There were numerous examples of this, all made possible by the design of the building – and teachers were motivated to 'notice'.

Teachers in their non-instructional periods were sitting adjacent to classes in action and therefore provided with ongoing opportunities to 'notice' what others were doing, both students and teachers. In general, the 'noticing' occurred when something was relevant or of interest to the teacher. Teachers responded in various ways, for example, by thinking, "that's interesting...I might talk with [Mike] more about that later." The noticing triggered more intentional plans from an incidental beginning. Alternatively, they responded, "that's interesting...I never knew that," with the new information stored (successfully or unsuccessfully), but with no further plan to follow up on that learning with the colleague. Such possibilities were well supported by the design of the environment but also demanded the teachers have a learning 'headset'. Teachers' personal characteristics and capacities influenced how they engaged with the environment and therefore learning was afforded by a combination of physical proximity and teacher-located factors such as openness, motivation, purposeful listening and so forth.

Teacher colleagues and students were critical elements in the environment that added to the quality of teachers' learning. However, there were also features of the environment that presented opportunities for learning in their own right. Fulton was a technology rich environment and this influenced teachers' learning. The following teacher reflection highlighted that the availability of technology influenced both content and pedagogical knowledge learning:

Its definitely the fact the we're using computers extensively that's causing this [new learning], it means that we both write the uses of computers into our materials and we also use computers for just about everything, our databases, our intranet and so on. There's a fair bit of learning going on there for teachers and students...

Learning about, and how to use, the available technology was often planned for. Teachers engaged in professional learning sessions run by colleagues or an outside facilitator but it was through the ready availability of the technology that teachers had the opportunity to 'practise' new skills and 'play around' with options before including such ideas in their teaching. The newness and reliability of the system encouraged teachers to make extensive use of technology as a tool for their own and student learning.

In addition to the ready availability of technology to support learning, Fulton was located within a university. This provided extensive access to the university laboratories (both indoors and outdoors) and a library full of texts and references on a range of disciplines and pedagogical research. There was also the opportunity to attend university events and more importantly meet with university partners over morning tea breaks without the need to drive long distances after work hours or taking extensive time away from the school. The school was designed for adult learning both within the school walls and in its location on a university campus. Many staff ultimately enrolled in university courses based on its physical proximity which added a structured and specific support for teachers' learning.

The learning space at Fulton, its physical and technological environment (PTE), was recognised as a contextual condition fundamental to the explanatory model of professional learning at Fulton. The PTE and the affordance of physical proximity that it generated influenced intentional and incidental learning opportunities for teachers. It proved to be a unique and powerful feature of learning processes and outcomes for teachers at Fulton.

The three contextual conditions that supported and sustained teachers' learning and are identified in the explanatory model of professional learning at Fulton involved two very visible aspects, the supportive leadership and the physical environment, and one more abstract element, school culture and philosophy. All three acted as a system, supporting and influencing each other. They were also key to supporting and sustaining teachers' learning. Using the analogy of stairs as an affordance for reaching a higher floor with greater ease, the affordances generated by the contextual conditions assisted teachers to achieve deeper learning in meaningful, supportive and cost-efficient ways. The following section on organisational elements and their influence on teachers' learning provides additional data to respond to the question on what supported and sustained teachers' learning at Fulton.

4.4 Organisational elements that facilitate teachers' learning

...you know there are some really simple things that are hugely innovative...like the year 10s and 11s going to class together in this school. Find me another secondary school in Australia where that is happening by design, it happens by default in an area school where they have two kids doing chemistry and one is in year 10 and other in year 11 but it's not by design. What's that really about and why did we go down that path? Well the answer is because we've always known that the age -grade structure is about teacher practice...and not about students' learning and so you know when you go into that very thing you get into areas like...you know it's about teacher practice...what happens in another place where you do have age-grade structures...and sometimes age-grade stream structures...not sometimes, more often than not...it's an absolute definition of the industrial age factory model of one class – one subject, one outcome...

The opening reflection from Fulton's principal acknowledged that the school was organised in unique and innovative ways and for reasons that are connected to understandings of quality pedagogy and learning. Such philosophical foundations were fundamental in the organisation of the school; organisation that varied significantly from schools that are more traditional and ultimately it provided significant support for teachers' learning.

In most traditional senior secondary schools in Australia students are grouped according to chronological age in year levels, each year level class generally consisting of 25-30 students with one or two home room teachers. The home room teachers meet with the students for approximately 15 minutes each day to manage such things as recording attendances, dispensing notices and additional administration requirements. The home room teachers may or may not teach the students in their classes but they are generally expected to develop positive relationships with the students and take on a student welfare role. Students come together in the home class and may have a few lessons together, for example, English, but more often than not are separated for much of the day as they undertake their individual timetables. Timetables generally consist of between six-eight different lessons each day made up of six-eight different subjects across the week. This model of schooling has changed very little from the commencement of the 20th century; indeed Nummela and Caine (cited in Dryden and Vos, 1999) said "One of the only places operating largely as it did more than 50 years ago would be the local school" (p.78). Fulton aimed to change the way a school operates.

The philosophy, purpose and environment of Fulton provided a unique opportunity to organise the school in ways that were very different from the traditional secondary schooling model. The most significant changes involved:

- a curriculum that was interdisciplinary rather than divided into discrete subjects,
- a timetable that provided extended length of time to engage with the interdisciplinary curriculum and involved varied class size groupings,
- opportunities to study modules designed by university academics and
- students organised in small groups across, rather than within year levels, with each group allocated the same tutor (teacher) for the duration of their time at the school.

Each of these organisational elements, although not initially considered as part of the school's professional learning options, were ultimately identified by teachers as affordances for their learning. Key elements explored in greater depth specifically identifying how each emerged as an affordance to teachers' learning include tutor group (TG), interdisciplinary curriculum (IDC) and university modules (UM).

A final organisational element that was explicitly planned as an affordance for teachers' learning was the school's Professional Learning Strategy (PLS). The PLS was pivotal to the

achievement of the school's vision and therefore it features strongly in the explanatory model of professional learning at Fulton. The PLS provided all staff at Fulton with a two-hour block every week for professional learning, an organisational element not generally seen in more traditional senior secondary schools. The value placed on teachers' learning was clearly evident but specifically how it acted as an affordance for teachers' learning will be addressed following discussion on Tutor Group (TG), Interdisciplinary curriculum teams (IDC) and University Modules (UM).

4.4.1 Tutor group

Students were assigned to a TG on commencement at Fulton. The tutor group consisted of 12-15 students and was generally managed by one teacher. Students across the year levels 10 – 12 were all represented in the TG. The teacher responsible for the group remained with the same group of students for the duration of their schooling at Fulton. Changes were made if believed to be in the best interests of a student's or teacher's welfare. To date this has been a rare occurrence. Organising students in this way provided transition support for students new to the school no matter what year level they were in and it also allowed for the development of close relationships with the TG teacher and peers in the group.

The TG played a significant role in the students' lives. The tutor group met daily, generally for 45 minutes after the morning recess break. A number of activities occurred during this time, including sharing of information important to all students' lives, development and recording of graduate capabilities' portfolios, more specific programs focused on issues such as cyber bullying and so forth. In particular it provided time for students to share with each other and the teacher their personal learning plans and to catch up on work, and for teachers to keep track of students' progress and provide strategies and support that assisted students in achieving successful outcomes in school and beyond. Tutor groups had a critical role given that the school expected its students to develop a sense of autonomy and independence in their study. Students new to the school often found the self-directed philosophy challenging and the issue of managing their time well was supported by more experienced students and the teacher during TG times.

Data analysis revealed that TG proved to be more than an innovative way to organise students at Fulton as teachers reported they generated many learning opportunities. Any time spent with students could be viewed as a learning opportunity for teachers. However, the use of TG as an organisational element of the school generated two clear affordances. The first related to intentional learning through action research projects, for example, how do teachers support

students' development of effective time-management through TG sessions¹³. Secondly, more incidental learning opportunities occurred through teacher observations, and these often acted as a catalyst for unplanned but more intentional learning. For example, in one of my observations I saw a teacher commencing her tutor group session by asking where a particular student was. Other students commented that he was lying on the bench (a soft lounge style bench). The teacher appeared annoyed by this and commented, "I'll deal with that shortly." She interacted with the other students for over ten minutes and once they were all settled she approached the student. I could not hear the discussion but the teacher only spent about one minute with the student and then walked back to the tutor group. The student joined the group about five minutes later carrying a novel. Following the session I asked the teacher what had happened and she responded:

Yes...that proved interesting for me as I was really annoyed that he was not at tutor group in time...I'd been stressing to all of them that it was important to turn up on time just the day before. I felt cross as I approached him but before I could say anything he looked up and I could see he was reading a book...he said "I'm coming...I just wanted to finish this chapter...it's great." I was torn thinking he could have come to the tutor group first and then finished reading but I said "Okay...don't be long"...which in reflection seems a strange thing to say now as he was already doing something I wanted him to do anyway! It makes me wonder whether we interrupt our students' learning too much with the way we expect them to drop everything for tutor group...it's much worse at other schools of course but I guess I fell back in to thinking all kids should be doing as I say in tutor group...it's another challenge to my thinking...that's the thing with this place [Fulton]...it's always making you think about how kids really learn.

The teacher's reflection suggested a 'disruption' in her thinking generated by the student's behaviour and her existing beliefs of how tutor group should function. It could also be viewed as a contested view between the teachers existing beliefs and those emerging through her learning at Fulton. However, I make specific use of the term 'disrupted' in describing the incident, being influenced by the work of Christensen, Horn and Johnson (2008). In essence, the teacher's perception of what a student should be doing or in this case not doing was disrupted when she realised the student was indeed engaged in learning. Christensen et al.'s (2008) text "Disrupting class" has the sub-title, "How disruptive innovation will change the way the world learns". The notion of disruptive innovation provides an interesting perspective on how the teacher was provided with a powerful opportunity for learning. The student was so engaged in his learning (the reading of a self selected novel that linked with his Central Study work) that he did not wish to be disrupted and recognising it was tutor time thought this was a valid way to use his time. The teacher's perception was that all students should come to tutor group first and to negotiate how they then wished to use their time. The paradox for teachers at Fulton arose

¹³ The process and outcome of one project is detailed in a teacher's story in Chapter 5.

from an expectation of students to follow protocol in attending school and being on time for sessions, yet fostering in them the desire and skills to be a self-directed learner. As Christensen et al. said:

Motivation is the catalyzing ingredient for every successful innovation...*Intrinsic motivation* is when the work itself stimulates and compels an individual to stay with a task because the task by itself is inherently fun and enjoyable. In this situation, where there are no outside pressures, an intrinsically motivated person might still very well decide to tackle this work. (p.7)

The student reading the novel portrayed the intrinsic motivation Christensen et al. described and Fulton aspires to promote in all students.

Christensen et al.'s comment that "motivation is the catalyzing ingredient for every successful innovation" is also highly relevant when considering TG as an affordance for teachers' learning. In effect the teachers' story could have been related to any school or any lesson. However, for teachers at Fulton the use of TG was an innovation determined by the leadership team but how they were best enacted rested with teachers; and teachers varied significantly in the way they viewed tutor group. The variations in views and styles of management of tutor groups created contested views, a familiar affordance for teachers' learning. Teachers were motivated to ensure TG time was used by students effectively and therefore teachers paid considerable attention to how TG were functioning, how students used their time and as such were in constant dialogue with each other about values and beliefs about learning. There was intrinsic motivation among teachers to 'get it right' and this behaviour reflected Christensen et al.'s notion of being compelled to stay with the task not because it was "inherently fun and enjoyable." Indeed it proved difficult and challenging most of the time, but teachers maintained sustained focus on such challenges because they were highly motivated to provide the best learning environment possible for students, and they had much support from the leadership team to do so. The sustained dialogue about how tutor group most effectively supported students' learning provided an affordance for teachers to deepen their understanding of learning and their role and identity as a teacher and reflected the process that was repeated often as new challenges emerged.

Tutor groups were not generated to support teachers' learning, they were generated to support students' learning based on a philosophy of developing sustained and positive relationships between a teacher and students. Relationships were identified as a key factor that provided affordances for teachers' learning. Tutor group provided the opportunity for teachers and students to develop relationships that allowed both to learn. The teachers' reflections that follow could have been generated from a range of activities at Fulton but were specifically related to the influence of tutor group on teachers' learning.

I think we have set up situations where the students know that we value their comments and advice and they are very articulate in evaluating our teaching and their learning...this really is supported by the tutor group time.

I've learnt to listen to the students...Collaboration was something I had given lip service to in the past but I really understand the power of it now...

I've tried several different approaches in tutor group...and realize I'll probably keep changing too as new kids come and go because they have a range of styles and characteristics and some things work better with some kids. I'm more relaxed about it now and we decide together what works the best.

All of these reflections indicated a genuine and positive regard for students, the building of trust in their abilities and openness to their feedback as well. Through the relationships that developed in TG the foundations of an effective learning community emerged where both students and teachers developed trust and respect and provided support and feedback for one another. The feedback from students during tutor group provided a learning affordance for teachers and provided support for teachers to further understand and shape their practice.

Tutor group was specifically identified in the explanatory model of teachers' learning as it generated much dialogue among teachers and a constant quest as to the most effective ways for it to be organised. The leadership team and teachers at the school also paid considerable attention to whether TG were the best way to support student learning. Through this process contested views were generated and this too, acts as another catalyst for teachers' learning. The dialogue in the sustained discussions went well beyond expectations associated with appropriate behaviour of students to deeper discussions about teaching and learning in the 21st century. As my research was being concluded the school requested that a university honours student conduct a research project on teachers' and students' perceptions of the value of TG, further supporting the inclusion of tutor group as an organisational element that provided an affordance for teachers' learning at Fulton.

4.4.2 Interdisciplinary curriculum

The development and implementation of an interdisciplinary curriculum at Fulton was a key innovation central to achieving the desired vision for the school. The decision to use such a model was made by those who conceptualised the school and sought to address three key weaknesses in traditional senior secondary science and mathematics curricula including 1) the lack of cutting-edge science included in curricula, 2) the lack of connections made between specific disciplines and, 3) the lack of opportunity for students to develop a sustained focus through inquiry-based learning. Such tenets were reflected again several years later by Tytler (2007) who said, "there is clear evidence that the curriculum and classroom practice is failing to excite the interest of many if not most young people at a time when science is the driving force behind so many developments and issues in contemporary society" (p.15). Fulton certainly led

the way in Australia in senior science and mathematics curriculum reform but I was more interested in the processes underpinning the reform and how they acted as an affordance for teachers' learning.

The founding staff together with their university partners recognised the need to develop a curriculum that would engage students and build knowledge through a focus on cutting edge science and contemporary world issues. Such a curriculum did not exist and therefore needed developing by teams of curriculum writers. Initially these teams consisted of teachers seconded from local schools and university academics whose task was to develop interdisciplinary curriculum underpinned by an inquiry-based learning model. These teams commenced prior to the school opening so that a curriculum framework would be ready and available for when the school commenced in early 2003. Several of the teachers invited to participate in the curriculum writing teams subsequently applied to teach at the school. When I queried what prompted some of these teachers to apply for positions at the school following their time as a curriculum writer they responded:

I felt so enthused by working with others in cross discipline ways and seeing how the connections between disciplines generated some fantastic learning opportunities for kids. This is the kind of science teaching I had wanted to be involved in for ages but it wasn't possible in the way schools are structured so I thought this looks like the school for me.

The curriculum writing was a great way to be opened up to new ideas from Trevor and Keely¹⁴ and we considered how we could use these in a curriculum that still met the criteria of SACE... but in interdisciplinary ways. I kept thinking this is going to be tricky as we can't throw SACE out to do our own curriculum but we kept getting this message from the leadership team – don't base it on SACE, do something different, forget SACE, we'll deal with this after. It was like a blank slate and it was liberating and I could feel my energy for teaching science and maths here [at Fulton] growing. I didn't want to spend all this time on curriculum writing not to get the opportunity to teach it!

The reflections from these teachers highlighted initial affordances for learning provided by curriculum writing including access to expertise and the opportunity of being innovative. Both affordances have featured in previous sections on contextual conditions but developing an interdisciplinary curriculum required a much greater focus on scientific and mathematical knowledge and therefore provided a much greater focus on teachers' learning in the area of content and pedagogical content knowledge (Shulman, 1987).

The interdisciplinary curriculum (IDC) was designed around themes of relevance and importance to students' lives beyond school and provided opportunities for them to learn in authentic ways. As Davies et al. (2006:4) said:

¹⁴ Trevor and Keely (not their real names) were university academics from the Science and Engineering Faculty.

These themes liberate science and mathematics from being seen as a set of narrow technicalities. The interdisciplinary studies facilitate deep engagement with essential scientific and mathematical knowledge, skills and attitudes across the key science disciplines and connect with projects of major significance that may involve university and workplace studies. Students and staff are weaving scientific and mathematical logic with cultural, social, historical, legal and ethical perspectives, generating meaningful and connected understandings about the world for students...The curriculum achieves a validity and depth endorsed by practising scientists and educators. The curriculum is ever evolving as new content and new pedagogical approaches to the teaching of this content emerge.

Science and mathematics were connected to other discipline areas found in traditional secondary schools including English, Studies of Society and Environment, History, Legal Studies, Philosophy and so forth. The school employed a range of teachers with expertise in fields beyond science and mathematics and these teachers all came together in teams to initially make sense of the curriculum that had been developed by the writing teams employed before the school commenced and then as curriculum writing teams in their own right. They were provided with time to work in curriculum writing teams and in essence curriculum writing was considered part of their work, much the same as programming and planning is undertaken by most teachers as part of their work. However, the demand to work in interdisciplinary ways to develop innovative curriculum served as a significant affordance for teachers' learning and further discussion on how this occurred will be addressed shortly.

Teachers were not only engaged in developing innovative curriculum they were also engaged in delivering it in ways that varied significantly from the traditional secondary school timetable. The development and implementation of IDC through Central Studies (CS) as a core organising feature for delivering curriculum transformed the traditional high school timetable. Table 4.2 provides an overview of the CS areas and how they were delivered each week. Nine different CS in total were delivered to all year 10 and 11 students over a two year period. The nine CS were titled:

- The Body in Question
- A Technological World
- Communication Systems
- Sustainable Futures
- Towards Nanotechnology
- Variety of Life
- The Earth and Cosmos
- Biotechnology
- Mathematics and Abstract Thinking.

Year 10 and 11 students were not separated into different year levels to complete the CS but grouped together (as noted in the section on tutor groups). Year 12 students followed a more traditional pattern of subjects and timetabling so as to meet state-based examination requirements. Outcomes of this variation will be highlighted in future sections and again in Chapters 6 and 7.

Table 4.2 Weekly timetable and scheduling of Central Studies across two years

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8.40am 100 minutes	Central Study 1 Year 1 S1 Body in question Year 1 S2 Sustainable Futures Year 2 S1 Towards Nanotechnology Year 2 S 2 Earth and Cosmos	Central Study 1	Central Study 2	University Modules	Central Study 3 Mathematics and abstract thinking (MAT)
10.20am	Recess				→
10.40am 40 minutes	Tutor group	Tutor group	Tutor group	Tutor group	Tutor group
11.20am 100 minutes	Central Study 3 Mathematics and abstract thinking (MAT)	Central Study 2	Central Study 1	Central Study 2	Central Study 2
1pm	Lunch				→
1.40pm 100 minutes Schools Ends 3.20pm	Central Study 2 Year 1 S1 Technological world Year 1 S2 Communication systems Year 2 S1 Variety of Life Year 2 S2 Biotechnology	Students' independent study time and teachers' professional learning time.	Central Study 3 Mathematics and abstract thinking (MAT)	Central Study 1	Central Study 1

The reduced number of “areas of study” allowed for the CS to be delivered in blocks of time which in turn provided students with the opportunity to engage in ways that promoted deeper learning, a sense of autonomy and control, and provided for greater levels of student and staff interactions. The timetable allowed for two CS to occur on a daily basis with a third, Mathematics and Abstract Thinking (MAT) offered three times per week. MAT was delivered across the entire year whereas other CS were only delivered for one semester. Although the

timetable indicates a daily schedule from 8.40am – 3.20pm the school was open to students from 8am – 6pm. Students were free to attend the school during opening time and make use of the facilities for individual study or work with colleagues on school or community projects.

As acknowledged earlier the initial CS were developed by seconded teachers and academics prior to the school opening. Once the school commenced the writing teams shifted to consist of a team leader and up to ten teachers who varied in their discipline specialisations. University academics were still encouraged to participate in these teams especially during review and development meetings. All teams would include teachers with expertise in the science disciplines, for example, biology, physics and chemistry as well as teachers with expertise in the humanities including media, design and technology, English, politics and studies of society and environment. This resulted in a range of content knowledge being available from which to build the CS.

In general CS were designed around a Fertile Question (see Harpaz & Lefstein, 2000) and included approximately eight modules which promoted a specific discipline and led to summative assessment pieces as well as answering of the fertile question. As one of the CS curriculum team leaders said, “The IDC retains the unique characteristics and distinction between the subjects [disciplines] but the connections between the subjects are emphasised. This is designed to enable students to repackage knowledge to create new understandings to meet the requirements of the 21st century.” Such a design also acted as an affordance for teachers’ learning by enabling teachers to learn new content outside of their area of expertise while at the same time teaching colleagues how to understand their own area of expertise. The following example provides a sense of the processes that occurred as teachers worked together and how that acted as an affordance for their learning.

The following observation occurred approximately 18 months into the school’s operation and involved interactions between six teachers as they planned a curriculum unit for a CS. The discussion commenced with the team leader, Lisa, sharing her work on the use of rubrics to build transparency in the assessment process and highlighting that the task of this session was to design an assessment rubric for the media studies section of the CS. The media studies specialist teacher led the discussion with a focus on the skills he wanted the students exposed to and the outcomes he believed should be achieved. Lisa listened and responded, “Well that sounds fine but how could I tell the difference between a fair piece of work and an exemplary piece, what exactly is the criteria I would be looking for?” The specialist teacher responded fluently about specific aspects of design, access and information that might vary to indicate the different quality of the work. Lisa was still experiencing difficulty in understanding the terminology and concepts behind the specialist teacher’s ideas. She responded, “I still don’t get this, perhaps it’s my lack of knowledge about the content area, I think you need to show me a visual example.”

The interaction progressed with other teachers with sound media studies knowledge contributing ideas to help Lisa grasp the difference between elements within the quality of work that could be presented. Lisa's colleagues in the team were taking on a sense of responsibility for her learning but this may not have eventuated if Lisa did not declare her lack of understanding and sense of responsibility for knowing this content. For IDC writing to influence professional learning all participants need to be actively engaged taking on both teaching and learning roles. The quality of the learning in such situations is determined by one or more teachers seeking knowledge and other teachers being in a position to contribute this knowledge without judgement. The work of Wenger (1998, p.76) is relevant in understanding the process of mutual engagement:

Mutual engagement involves not only [one's] competence, but also the competence of others. It draws on what we do and what we know, as well as our ability to connect meaningfully to what we don't do and what we don't know – that is, to the contributions and knowledge of others.

Mutual engagement amongst Lisa and her colleagues was successful as was new learning for Lisa and possibly other members of the team as well. The affordances of collaboration and trust and respect for each other were evident. Although Lisa was the leader of this team, in no way did this indicate she needed to be the one with all the answers or specialised knowledge. When asked about her role as leader of this team she commented:

Oh this team is really a fantastic team to work with...because the people are very very flexible and they are willing to try things and do things differently and they bring so many ideas...sometimes it takes time to understand where they are coming from especially if I don't have that discipline knowledge...it's so interesting using other people's stuff even if it takes a while to get my head around it. I said to [a TC] "I just didn't see the structure that you obviously had in your head when we were doing this designing but now I do...I see how everything fits together"...without our planning meetings this new understanding wouldn't happen and I'd avoid teaching those units.

This comment was of significant interest as it appeared to be in direct contrast to one that Lisa made when she was expected to teach a CS developed by a curriculum writing team prior to the school opening. An elaboration on this story can be found in a more detailed review of Lisa's learning journey in Chapter 5. However, the comment is included here as well to make note of the contrast:

I believe in being appointed to any school and asked to teach a specific topic [in this case a specific section of a CS], I would be afforded the professional responsibility of being able to modify and teach in ways that I viewed as being more relevant.

Perhaps this comment reflects that Lisa did not have enough time 'to get [her] head around' what had been expected of her or that over time she had developed a deeper understanding of what it meant to work in IDC teams and the benefits of learning from colleagues and working in new ways. It could also relate to varying stress levels associated with being newly appointed to a very different school. However, it is interesting to observe the shift in Lisa's response over time.

Lisa identified her engagement in the IDC meeting that focused on a discipline outside of her specialisation as an opportunity to develop new content and pedagogical understanding. The IDC provided a learning opportunity based on *mutual engagement*. In the example the mutual engagement is initiated by Lisa's active desire to understand more deeply issues that she viewed as being important to her ability to support her students' learning. She did this through questioning and seeking feedback as required and asking for visual support when an abstract concept was unclear. She engaged in this learning about 'content' through questioning her colleagues, challenging their explanations when she needed more explicit information and finally by trying to explain her understanding in her own words. For example, Lisa said, "So are you saying a good piece of work will have a design that is concise and minimalist as opposed to one that has too much information and colour and textures everywhere?" Sizer (1984) said, "Understanding...[is] the development of the power of discrimination and judgement...Understanding is more stimulated than learned. It grows from questioning oneself and being questioned by others" (p. 116-117). In this IDC meeting the learning process was driven by Lisa's questioning and discrimination and ceased when she felt comfortable enough about her ability to explain the required criteria to her students. It was evident that Lisa understood the power of questions when she reflected on her students' learning at a later date:

...and you know true learning is occurring when they're asking questions because they are picking up what they know and what they don't know.

Lisa's learning was a good example of the alignment between teachers' characteristics and personal agency and the affordances provided by working in IDC teams. Working in IDC teams was generated by the school's organisational elements but the quality of the relationships that had developed among teachers also proved a significant affordance for the learning outcome as colleagues were supportive of ensuring clarity of understanding and were also provided with learning opportunities. However, this was enhanced when teachers were open to new ideas and motivated to learn and make changes.

Lisa was a learner of new content in this IDC team scenario; however, her colleagues with a specialisation in the discipline were also engaged in refining their pedagogical knowledge too. Through Lisa's questioning they had the opportunity to consider how explicit

they were making the content at the centre of the desired learning outcomes and what language or strategies they would use to explain this to their students. If all teachers shared the same or similar understanding about content, the opportunity to spend time explaining the content in more detail to colleagues, and considering areas of confusion that might arise, may have been less likely to occur. And so an interdisciplinary approach to teachers' learning may prove to be even more effective than the popular model of Lesson Study (Darling-Hammond & Richardson, 2009). Lesson Study has emerged as a popular and effective approach to teachers' learning with teachers from the same discipline sharing their ideas about best practices. But the richness of thinking deeply about the nature of the content and approaches to achieving desired learning outcomes might be better served by having specialists from different disciplines assist each other as an effective approach for improving student learning outcomes. In effect it provides the specialist teachers with an opportunity to work with "novice" learners who are motivated to understand and will therefore pose a number of questions that a less knowledgeable or more passive learner may not. This notion is well supported by the story of the academic, teacher and student all learning together reported on earlier in this chapter (see page 116-117).

The example of Lisa's learning with and from the IDC team reflects the work on powerful learning by Brandt (1998) who identified elements of what, how and where one learns as being influential on the quality of the learning. He suggested that people will experience more powerful learning outcomes when:

- What they learn is personally meaningful.
- What they learn is challenging, and they accept the challenge.
- What they learn is appropriate to their developmental level.
- They use what they already know as they construct new knowledge.
- They can learn in their own way, have choices, and feel in control.
- They have opportunities for social interaction.
- They get helpful feedback.
- They acquire and use strategies.
- They experience a positive climate.
- The environment supports the intended learning. (p.34, cited in York-Barr et al., 2006)

Learning in the IDC teams as teachers at Fulton engaged in curriculum writing appeared to meet all of the criteria proposed by Brandt and certainly acted as an affordance for leaning not just Lisa but all teachers in the team. Although development of the IDC was not initially located within the professional learning framework of the school it emerged as a critical and powerful component of the explanatory model of teachers' learning at Fulton. McKernan (2008) said "A curriculum, to be truly educational, will lead the student to unanticipated, rather than

predicted outcomes” (p.3). At Fulton, the affordance of IDC also led teachers to many unanticipated outcomes as highlighted in the following comments from teachers when asked about processes that had supported their learning at Fulton:

The CS content has provided many opportunities to learn science and philosophy that's new for me, for example, in Nanotechnology (CS) and the Earth and Cosmos (CS) I've had the opportunity to read more widely and incorporate relatively new information into curriculum and teaching materials.

Collaborative programming and planning is exciting and at times the whole product can become greater than the sum of its parts, I've learnt so much in terms of content and teaching.

Working in curriculum teams to develop new and innovative CS has been a significant learning process for me...working with experts from the university and my colleagues adds a whole new dimension to the possibilities for the CS.

A major change for me in working at this school has been accommodating the interdisciplinary curriculum at Year 10/11...this has demanded a great deal of time on research and the development of suitable teaching materials and resources.

The IDC certainly demanded much time and consideration from teachers but proved central to achieving the vision of the school, in part being:

to provide a learning culture for its students that derives from a learning culture developed by its staff from their interaction with university and industry scientists and educators. (School policy statement, 2003).

The IDC therefore featured as an affordance for learning in the explanatory model of professional learning at Fulton. Further examples of the learning generated by engagement with the IDC will be reported through the teachers' stories in Chapter 5 and also in the outcomes of teachers' learning in Chapter 6. Closely aligned to the affordance of IDC is that of the University Modules (UM) undertaken by all students at the school every Thursday morning. The following section considers how the University Modules also served to support and sustain teachers' learning and involve teachers in learning processes that reflected the characteristics of effective PD identified by Hawley and Valli, (1999) including being school based and integrated with the developments and operations of the school.

4.4.3 University Modules

Fulton was developed to address the 'crisis' in the science and mathematics disciplines in secondary schools (DEST, 2003, Masters, 2006, Tytler, 2007) and in doing so key foundation members of the school believed that embedding the new sciences was critical but so to was assisting the teachers at the school to experience and understand the new sciences. One model for supporting the teachers to develop their content knowledge was through academics being part of the interdisciplinary curriculum (IDC) development teams (as illustrated in the previous section). However, a more specific model focused on academics developing university modules

(UM) based on their own research. The modules aimed to introduce additional new science into the school's curriculum through a process of teachers attending the weekly sessions alongside students and considering how such content could be included in future iterations of the IDC.

The inclusion of UM as part of the school's curriculum offerings provided an explicit affordance for teachers' learning, and the affordance initially appeared to be more in line with traditional models of professional development whereby teachers attended workshops offered by experts in their field. Many teachers certainly reported on the knowledge they developed through attending these sessions. However, the teachers were far from passive learners and they were expected to collaborate with the academics in reviewing the modules and providing feedback on areas they believed could be enhanced through modification or particular pedagogical approaches. This shifted teachers from the role of learner back to that of teacher or facilitator of more effective pedagogy. Both roles proved to be an affordance to teachers' learning as they generated opportunities to *collaborate*, provide and gain *feedback and support*, *access to expertise* and *time for learning* new content in authentic ways.

The UM were timetabled for 100 minutes each week and were often conducted in university laboratories or locations other than the school. Students were free to elect a UM based on their personal interest, although some options were negotiated based on enrolment numbers. The UM were offered more than once each year so students had up to four opportunities to complete a UM of choice. New modules were developed each year as students', teachers' and academics' interests and local and global issues emerged. Some of the titles of the UM provide an insight into the shift in focus from traditional secondary school science, for example, Robotics, Cryptography, Nano-chemistry and POT: Politics, Oil and Terror, and it is of interest to note that through the school's outreach program (see details in following section on the Professional Learning Strategy), several of these areas were ultimately included in local school curricula.

The release of university staff to develop and deliver the UM was initially supported by an Australian Government Higher Education Initiatives Program (HEIP) grant. The grant was designed to support the interaction between university and the school-based staff in the early years of the school's functioning and the grant was significant in promoting opportunities for interaction and development of innovative curriculum. As Davies et al. (2006) said:

The Modules allow students to delve deeper into a scientific aspect connected to one of the Central Studies. Students are able to follow an aspect of personal interest and relevance to a deeper level, bringing their new found insight back to their Central Studies work. Ultimately, these modules have found their way into the core of the Central Studies. And as this occurs the university staff work with the teachers at [Fulton] to consider the development of new Modules. So the cycle of generating new curriculum continues.

The incorporation of the UM into the weekly timetable was an innovative approach to the traditional senior secondary timetable but it relied heavily on well developed, funding and of course the location of the school on a university campus. However, it is of interest to note that the model continued even when the HIEP funding for releasing university staff was no longer available. New modules were developed and at times these became modules that teachers developed as well. But the connection between the academics and school was maintained and this suggested that professional partnerships that result in positive outcomes and learning for all can be self-sustaining. The affordance of professional partnerships for teachers' learning is discussed in more detail in a forthcoming section (see pg. 164).

One teacher reported on the influence of the university modules on his learning:

The university modules have been of interest to me. Initially I wondered whether they would seem like elective programs in other schools and that the kids would not take them that seriously and that I might even have time off too – they proved to be very different, the uni staff were keen to put on a good show and so there were lots of interesting things for the kids to engage in , some were more popular than others and at times I think this had more to do with the teaching styles rather than the content but it certainly highlighted to me the power of good teaching.

This reflection is of interest as it presents another direction for the teachers' learning and that is through the opportunity to reflect on teaching styles that are more or less effective in engaging students. It is of interest that pedagogy remained at the forefront of this teacher's thinking highlighting that the majority of teachers had an explicit and sustained focus on enhancing the quality of their teaching to provide the best learning outcomes for students. It is not surprising that this was prevalent in the teacher's reflection as a major aim of the professional learning strategy at Fulton was to develop a deep understanding in all teachers of how to support students to become independent and successful learners of anything. The following sections looks more closely at the professional learning strategy and the affordances it provided for teachers' learning.

4.4.4 Professional learning strategy

Hargreaves (2003) suggests that “as catalysts of successful knowledge societies, teachers must be able to build a special kind of professionalism” (p.15). Such a statement reflected the goals of Fulton's vision and the attention to teachers building a “special kind of professionalism” proved central to developing a research-based and well resourced professional learning strategy (PLS). Another underlying tenet of the PLS connected to the ancient words of Lao Tzu, “He who knows others is wise. He who knows himself is enlightened.” More recent insights that also added support to the focus of the PLS on teachers understanding themselves as learners came from Palmer (1993, cited in Pace Marshall 2006) who stated, “How we teach is

how we come to know” (p.124). These profound words lend weight to the importance of teachers understanding how they ‘come to know’ in explicit terms so they may consider new ways of teaching. Such knowledge also supported understanding of the “source’ from which teachers operated (Scharmer, 2009). The outcomes of such learning are discussed in more detail in Chapter 6. However, it was clear the PLS provided significant commitment to developing teachers as learners who had a deep understanding of their own learning styles and processes and also as teachers who developed expertise in the new sciences and enhanced their knowledge in their current discipline areas.

The PLS was critical to the school developing as a learning organisation and in achieving the vision of “*leadership of innovation and reform of the teaching and learning of science and mathematics*” (Vision statement, 2005). The PLS was complex and comprehensive and this section provides a snapshot of some of the key features of the strategy and highlights a few of the more specific activities including the university-school partnerships that promoted content learning, the weekly professional learning sessions that focused in general on the underlying principles of learning and finally some of the opportunities for teachers to achieve tertiary qualifications as part of their personal professional learning plan. Affordances for teachers’ learning that were specifically linked to the PLS and not introduced previously in this chapter include time for learning and access to resources and examples of these will also be acknowledged in the sections to follow.

In the initial proposal for Fulton, teachers’ learning was recognised as a fundamental issue and prioritised by the appointment of a professional development (PD) project manager 12 months before the school opened. The project manager’s primary role was to develop a deep understanding of effective models of professional development and consult with the wider community on possible PD models for the school. Through this process the school’s initial PD strategy and management options emerged.

The position of PD project manager was converted to an Assistant Principal position just prior to the school opening. The initial project manager, Frances, won the Assistant Principal position which provided for continuity in the implementation of the PLS and an ongoing and explicit focus on professional learning as critical to innovation in the school. The role ultimately emerged as highly significant and involved the ongoing development of professional learning opportunities to meet the needs of Fulton’s staff. In addition, the role required the organisation of the weekly PLS sessions, support and management of individual professional learning plans and leadership in the area of professional learning. Additional responsibilities beyond working directly with Fulton staff included working with state education personnel to develop state-wide professional learning programs in science and mathematics, planning for in-house study

programs for local, national and international visitors, and ongoing interactions with university academics to manage future directions of the school's PLS. The role created many connections for teachers and the school as a whole with "outsiders" who provided valuable support for learning and future directions. In essence the role acted as an organisational resource within the PLS which in turn was a significant affordance that supported and sustained teachers' learning

The PLS, with the explicit attention of Frances, was a well-planned and intentional approach for engaging teachers as professional learners. The PLS supported the notion that every staff member engaged in professional learning as part of their daily work drawing on both intentional and incidental learning opportunities. In addition, the design of the building allowed for many incidental opportunities for learning to occur. However, without an intentional plan for teachers' learning the incidental opportunities may be overlooked by staff. The intentional learning opportunities generated by the PLS were designed to support the development of a 'special kind of professionalism' Hargreaves (2003) called for. A professionalism whereby teachers integrate their learning and teaching and notice the incidental that then becomes the focus of their intentional learning (Teitel, 2003). However, for the teachers to notice the incidental and develop as more self-directed learners the PLS would provide specific time within the working day each week for teachers to come together to focus on learning individually, in teams and as an organisation. Providing *time for learning* acted as a major affordance for teachers' learning and linked well to the provision of other resources that were critical to successful outcomes.

There was a heavy commitment of resources to ensure the success of the PLS. Such commitment fits well with the Leading Complex Change Model developed by Lippitt (2003) and introduced in the literature review in Chapter 2 (see p.49). The model proposed that for complex change to be successful, and indeed Fulton could be viewed as a complex shift away from the traditional senior secondary model of schooling, explicit attention to clarity of vision, knowledge and skills, incentives, resources and a sound action plan was needed.

The PLS at Fulton was well connected to the vision of the school which explicitly acknowledged the role of teachers as learners in achieving innovation in secondary science and mathematics education. The strategy focused explicitly on building capabilities and providing incentives and recognised the importance of high levels of resources being available if the overall PLS was to make a difference. The subsequent action plan connected with a range of resources that came together to act as significant affordances for teachers' learning.

Access to funds from the State Government and through the Australian Government, in the form of the previously acknowledged HEIP grant, provided the resources and impetus for developing a number of affordances for teachers' learning, in particular collaboration in

curriculum development and the offering of university modules as discussed in previous sections. However, funding also provided release time for academics to develop the Core group, a key management group that consisted of academics from the Faculty of Science and Informatics, the School of Education and leadership staff from Fulton. The Core group met weekly to discuss and plan for the ongoing interactions among staff from both organisations and to contribute to the professional development strategy. Some members of the Core group were also members of the school's Teaching and Leadership Learning (TaLL) group. This approach to organisation allowed for Core group ideas to be represented at leadership group meetings and for university academics to have direct access to leadership group feedback and new initiatives. In essence key personnel from both the Faculty of Science and Informatics and the School of Education became significantly involved in the professional development planning and strategic actions.

Access to funds supported many initial actions in developing a strong learning community but no-one spoke of access to funds as being critical to their learning. The leadership team, in particular Frances, rarely acknowledged the need for money to achieve the vision of the school. Possibly this was because there were many resources in place, and indeed outsiders considered the school to be very privileged. Yet, when special funding ceased, the professional partnerships didn't. It emerged that financial resources, while greatly valued and supportive of building partnership, were not as valuable to teachers' learning as the cultural capital and physical and organisational aspects of the school. Hence access to funds, rather than standing as an affordance in its own right, was considered within the totality of the professional learning strategy. Such theorising reflected the teachers' and leaders' perspectives that focused far more on the importance and value of building professional partnerships, even if they were not always 'easy' partnerships. This commitment to building a professional and powerful learning community emerged as significant in how teachers' learning was not only well supported but sustained over the life of the school.

The interaction between academics and the teachers was central to the structured professional learning strategy, in particular to support innovative curriculum. Staff from the Faculty of Science and Informatics had a definite agenda of transforming the curriculum to ensure representation of the new sciences whereas staff from the School of Education were much more interested in issues of pedagogy and the role of the teacher in developing and supporting high quality learning outcomes. Coupled with this was the school's need to adhere to the state education authority's mandates and expectations in respect of curriculum coverage and professional roles. The interactions between the different parties and the promotion of different agendas generated affordances for learning acknowledged previously including *collaboration*, *contested views* and *being innovative* but also served to build a generative professional learning

strategy that addressed the complex needs of staff and the school as an organisation. Discussion of specific elements of the PLS follows commencing with a focus on how teachers were supported in new content learning.

4.4.4.1 Support for content learning

One feature of the PLS was on developing teachers' content knowledge, specifically in the new sciences. A belief held by a key proponent and pioneer of the school, Professor Rice (2004) stated, "*How does teaching and learning in schools speak to students about Satellite navigation, Biomimetics, Laser tweezers, Intelligent polymers, Quantum computers, or Artificial photosynthesis?*" As an administrator and leader in the tertiary science sector Rice recognised the gap between senior high school curriculum and the future direction of the sciences. He also recognised that for students to access learning opportunities in the new sciences their teachers needed to be familiar with the new sciences too. Rice believed a strategic focus on teachers' learning through collaboration with university academics was critical to developing new knowledge and skills and ultimately transforming the curriculum of the senior years of schooling.

The PLS provided many opportunities for teachers to work with academics. The model was based on providing time for academics and teachers to meet and focus on cutting-edge science. The model of university academics working with school teachers generates the notion of coaching or mentoring with the expert providing insight and opportunities for learning to the novice. And while the teachers appeared as novices in some of the content areas they were far more experienced in the challenges of teaching senior secondary school students. The teachers were also successful learners in their own right with much knowledge of value to the academics about working with school-aged students and of the state-mandated curriculum that would need to be addressed alongside the new sciences.

The model for such learning avoided a workshop approach and focused much more on teachers and academics building professional partnerships. For example, a group of teachers might meet with an academic with expertise in quantum physics, and following an initial presentation about the academic's work, the meeting would be opened up to questions and discussion either about clarifying specific issues and concepts or about how such ideas may work within the existing curriculum model or act as a potential university module to be offered to students. Following such meetings teachers with strong interest in the area would maintain connection with the academic and meet on a more regular basis. Such meetings would often result in teachers developing more in-depth content knowledge, in university modules being developed or in some cases papers being developed in collaboration for presentation at conferences. The initial collaboration developed into more significant professional partnerships. The model worked well for assisting teachers to build knowledge in the new sciences and this is

understandable as it reflected many of the characteristics of effective development identified by Hawley and Valli (1999), including teachers identifying their own learning needs, being school based and integrated with school operations and also based on the continuous and ongoing involvement of a cohesive group or in this case partnership.

Professional partnerships were certainly well supported by the school's PLS and although they feature in the explanatory model under the domain of relationships it was evident they supported and, were supported by, the professional learning strategy. Such interaction highlighted the connection between contextual, organisational and relationship factors in generating affordances for teachers' learning. Additional attention to professional partnerships is provided in section 4.5 of this chapter and through the teachers' stories in Chapter 5.

4.4.4.2 Support for learning about learning

Beyond engaging teachers in professional learning about the new sciences, an explicit focus on how learning occurs and is best supported was also prominent in the school's PLS. Once a week students would finish school at lunch time and teachers would engage in a 2.5 hour session devoted to a broad range of topics but all were directed to improving learning opportunities and outcomes for students. In general, topics focused on aspects of learning but often merged to connect with discipline and pedagogical knowledge and skills, and organisational management with a specific focus on teachers as learners. The PLS was developed with a view to supporting the complex role of teaching in an innovative school and moved well beyond the notion of university academics working with teachers to enhance their knowledge of the new sciences. The PLS was designed, in the words of the principal, to provide an 'unrelenting focus' on the underlying principles of the school.

An initial process in the very early days of the school designed to engage teachers in thinking about learning involved the use of a consultant. The choice of an outside consultant was made based on negotiations that all content material was designed to connect with the school's focus on developing a deep understanding of the learning process. A series of workshops was conducted by Julia Atkin¹⁵ who among other things invited teachers and a number of academics working closely with the school to complete the Hermann Brain Dominance questionnaire. The questionnaire when scored resulted in learning profiles mapped on red, blue, green and yellow quadrants. The outcomes of the questionnaire generated much discussion and at times amusement about variation among staff. It also engaged staff in reflecting on the range of activities they had included in the Central Studies (CS) to cater for the different styles of learners that attended the school. The shared activity and language proved to be a process used by Atkin to connect teachers to some of the bigger ideas associated with

¹⁵ Julie Atkin is an independent education consultant working with many Australian schools

learning and in particular the notion of supporting self directed learning through personal learning plans.

The workshops offered by Atkin appeared to serve the purpose of connecting teachers with the notion of self as learner and how to make use of this knowledge with students. The discussion of red, blue, yellow and green styles and activities did permeate teachers' conversation and CS planning as well but within weeks reference to the concepts was rarely heard. This outcome is not unusual and reflects the notion of a novelty that generates initial interest and value but unless it becomes connected to some deeper understanding and practice it is soon overlooked. In part such outcomes are reflective of 'one-hit wonder' workshops (Hawley & Valli, 1999, Sykes, 1999) and one might question the value of its inclusion in the mandatory weekly PL sessions. However, the underlying principles of the session were not about using the model for planning but about understanding diversity in learners. Through a first-hand experience of the differences between individual teachers a dialogue on how the school could diversify its options for students in both input and output emerged. This underlying principle was also on the agenda at Fulton and today is presented in the form of personalised learning plans for every student. I am sure that teachers who engaged in the initial activity would still remember it and possibly their own profile as well but planning from the red, green, yellow and blue quadrant faded for two reasons, one it was not comprehensive enough to serve the needs of the teachers and two, the learning gained from the experience was embedded in other, more meaningful ways, of working.

The outcomes of the use of a consultant, who initially generated much interest which then faded, is considered an ineffective form of professional development (Darling-Hammond & Richardson, 2009, Hawley & Valli, 1999, Stien, Smith & Silver, 1999). However, the use of the consultant and the activity fitted within the intensive and sustained focus on catering for diversity in learners. Although there was limited mention of the Hermann Brain Dominance model in teachers' dialogue and actions there was significant discussion about diversifying the curriculum, assessments and pedagogies to support more personalised learning plans for every students. In essence the workshops provided by Atkin met several criteria found by Darling-Hammond and Richardson (2009) to be features of effective PL. Criteria met by Atkin's input into the PLS included helping teachers to understand how students learn specific content, opportunities for hands-on learning, enabling teachers to acquire new knowledge, apply it in practice and reflect on the results with colleagues, and, most importantly it was part of the school's reform effort that linked curriculum, assessment and standards to professional learning. While it is fair to say that the series of workshops did not achieve lasting changes in practice they were strongly linked to the school's reform efforts, as were other mandated sessions included in the weekly PLS sessions.

While teachers were more than happy to attend professional learning sessions every week they were not always clear about the purpose of some sessions. Even with an explanation of why the session was important some teachers vocalised their concerns about whether the time would be more productive if spent on other activities. The PLS was developed by Frances in consultation with the Teaching and Learning Leadership (TaLL) team in advance each term with a focus on a mix of time for teachers to work in teams and whole school sessions. In the early days of the school in action much of the PLS was pre planned based on an explicit focus on areas that the leadership teams believed were pivotal to realising the vision of a successful learning organisation. Over time the PLS was driven by the democratic voice of the teachers, but there was often a sense that some sessions still needed to be mandated to ensure the focus on the big ideas of the school were not lost in teachers' daily work. Frances was well aware of some teachers' frustration with some of the whole school sessions; for example, when a session on meta-cognition was planned some teachers felt their time would be more valuably spent by working in curriculum writing teams. In discussing these tensions with Frances, she commented:

In reality we provide a lot of time for teams to work on Central Studies development but we also needed to keep our underpinning principles in the forefront of everyone's mind...meta-cognition, demonstration of learning in a variety of ways are important just to name a couple...I mean teachers can get all bound up in what lesson am I teaching tomorrow...we wanted to challenge people to think about the different, or key features of our school so we would perhaps run a session where we had some time to consider meta-cognition and what we meant by that and develop a shared understanding as much as we could as a whole group and then people would break off into their teams and they'd address "Well how are we looking at meta-cognition within our central study?" Obviously there's varying levels of connection with that in staff, we're talking about individuals here but that was the model we used and then as time progressed we moved to fewer of those sessions as the staff but we would increase the whole group session as we shifted to new issues...like now it's tutor group...asking questions like how our role as a tutor fits within the big picture and how critical it is as we move towards e-folios and personal learning plans...what do we mean by that...how do we manage that...that kind of stuff...so while I'm aware that these whole group sessions don't always please everyone it's only a few and we really need to ensure everyone is on the same page and the discussions whole group sessions generates helps to get us there...

This reflection provided a good example of the importance of two aspects of the explanatory model of professional learning at Fulton, the notion of alignment between individuals and the affordances for learning on offer, and the importance of never losing sight of the vision and purpose of the school. Lack of alignment between individuals and PL activities can occur for a variety of reasons including tiredness, feeling overwhelmed by workloads, perception of a lack of relevance of the content to personal needs, a 'been there, done that' attitude and so forth. Every teacher at the school probably attended PL sessions at one time and failed to effectively

align with the content or format of the presentation but the fact there were multiple opportunities to engage with the big ideas of the school and teachers had self-selected to teach at the school ensured that commitment to the PLS was exceptional high. Teachers on accepting a position at Fulton were made aware of the expectations that came with this including a sustained commitment to their own PL. The outcomes are reported on in more detail in Chapters 5 and 6. However, even with some tensions about the weekly structured program, teachers' aligned strongly with the many affordances this program offered.

Frances's continued reflection provided some additional evidence of the value of engaging all teachers in the weekly PLS sessions. She commented on a research project the school was involved in citing the following feedback:

Now, the researcher who was involved in running the various focus groups in our school said he had not seen such a strong, clear visions come from a staff in all the schools he'd been working with so in my mind those conversations that we've had have been critical to develop shared understanding. Now of course there'll be individuals that fit at various points along that line but basically I'm hearing that the PLS has been core to staff understanding what we're here for and what it is we're trying to achieve and how we're working towards that.

Once again Frances recognised the diversity among teachers in terms of their understanding and commitment to the school's vision but she believed the PLS was one way of ensuring clarity of vision was ultimately achieved for all staff. Lippitt (2003) and Senge et al. (2000) all comment on the importance of clarity of vision and it appears clear that the PLS certainly supported teachers' understanding of that vision. Part of the vision was focused on catering to student diversity but Frances was also very aware of the diversity among the needs and styles of the teachers at Fulton as well.

The tenet that all members of the Fulton community were learners and all had diverse needs was also acknowledged by the PLS. There was much importance placed on teachers taking control of their learning and, in addition to weekly sessions, part of the PLS strategy required all teachers to complete an individual professional learning plan each year (see Appendix B for an example of these plans). Teachers' individual plans involved working in action research teams, specific professional reading, developing new professional partnerships, completing post-graduate study and attending conferences were relevant to other aspects of their plan.

The personalised learning plan was a significant part of the PLS and met the criteria of conditions for powerful learning proposed by Brandt (1998, cited in York-Barr, 2006), including being personally meaningful, challenging but with the challenge being accepted, appropriate to developmental level and most importantly that learners learn in preferred way, have choices, and feel in control. Such conditions resulted in some significant outcomes for

teachers at Fulton and these are reported in future chapters. Positive outcomes may suggest that individualised learning plan should take precedence within the school's PLS. However, Frances and the leadership team were well-attuned to the need to build a community of learners as opposed to a school of individual learners.

The weekly PLS session engaged staff in meeting to reflect on such questions as "What is meant by interdisciplinary?", "How do we develop students as self-directed learners?", "What values do we believe are important to instil in our graduates?" and so forth. As individual members of the staff developed areas of expertise through their own learning they would often lead the weekly sessions. And as key themes across the school emerged in teachers' discussion, teams were formed to learn together through an action research process. Eventually all leaders, teachers and support staff at the school were involved in an action research team. Action research as a model reflected the learning processes described by Atkinson and Claxton, (2000) Moon (1999), and Shulman (2002) as reported in more detail in Chapter 2. However, the choice of action research as part of the PLS supported all staff to build community, engage as reflective practitioners, develop knowledge and capabilities and importantly be valued for their contributions to the policy and practices of the school. Through public presentations of the outcomes of their research teachers' often influenced other educators as well.

Frances with support from the leadership team designed a PLS that provided scope for individual's learning goals but certainly maintained a focus that connected all as inquirers into values held by the school. The focus on teachers learning through inquiry of their self-generated questions was reflected in the model that required students to respond to fertile questions in their own learning (Harpaz, 2005). This mirroring of teachers' and students' learning processes generated a sense of deep authenticity about the PLS and was fundamental to the school emerging as a learning organisation.

Fulton's dynamic and generative PLS supported not only teachers' learning but the school as a learning organisation through paying close attention to the five conditions proposed by Lippitt (2003) for managing complex change including clarity of vision, developing capabilities, providing incentives, sound levels of resources and sound action plan. A further element of the PLS that focused on these five areas but specifically on providing incentives was the opportunity for teachers to complete tertiary-level studies offered in collaboration with the university. Tertiary-level study or qualification programs are forms of professional development that teachers in the TALIS project (OECD, 2009) reported as being of high significance to quality professional learning. The following and final section of the PLS provides insight into how tertiary study acted as incentive for teachers, provided them with a valued learning opportunity and ultimately influenced whole school policies and practices.

4.4.4.3 Incentives for learning

The option for teachers to complete tertiary study, often within the school environment, was generated through a collaborative partnership between the school and the university and provided another form of support for teachers' learning. In essence the discussion between university partners and the leadership team of the school commenced with recognition of the quality and amount of work the teachers had engaged in through their development of innovative curriculum. In providing an option for postgraduate study it was critical that the processes and content of any course options linked specifically with supporting teachers in their work at the school. It was also important to consider the words of Hargreaves (2003, p.48) in planning options for teachers:

Professional development [must] amount to more than a slick, self-managed portfolio of certificates and achievements accumulated as individual credits. Collecting course credits does little more than put "bums on seats". It rarely reaches people's soul. Professional development, rather, is a personal path towards greater professional integrity and human growth.

Therefore the postgraduate study options were designed to integrate with the school's existing PLS and commenced with providing specific recognition for the work teachers had already completed in developing and delivering innovative curriculum. In addition, new tertiary level topics and qualifications were developed by the university specifically with the needs of the teachers at Fulton in mind. The option to participate in graduate study was voluntary as it attracted normal tertiary course fees. However, the leadership team at Fulton provided an additional incentive of a 50% rebate on all fees for those teachers wishing to take up the option. Eighty percent of teachers chose to engage in this additional form of professional learning and have it included as part of their personalised learning plan.

Teachers selected from a range of qualifications and topics based on their specific interests. Qualifications ranged from Graduate Certificate to Master of Education options with specialisations in Maths and Science, Information and Communication Technologies, Neuroscience, and Professional Learning (PL). The PL option was developed and delivered by me. I ensured sessions would be held at the school and where possible following the weekly PLS sessions to provide a follow-up to relevant issues emerging in the PLS.

The first topic in the course engaged teachers in reflecting on pedagogical practices through action research projects. I observed as part of my research that teachers felt confident in their innovative curriculum development but they faced challenges when thinking about innovative teaching practices and that the opportunity for teachers to inquire in a structured way into their pedagogy would compliment the work they had done in curriculum development. Peery (2004) argued that to revitalize one's creativity and sense of thinking about things in different ways one needs to be a 'true student' again. She goes on to suggest that we must

engage teachers in re-examining, “attitudes, personality type, learning styles, and communication preferences...[and then] apply new understanding to our own learning and to our work with students...we must engage in activities that require us to reawaken our learning selves” (p.36). The sustained focus on pedagogy with the added incentive of postgraduate qualifications resulted in some significant learning and contributions to the school’s development as a learning organisation as well.

Participants in the topic ranged from new graduate teachers to those with over 20 years of experience. Given that staff were facing many similar demands from the need to work in new ways it was initially expected that small teams would form to address specific problems. However, this did not eventuate as many teachers commented that they were already working in teams in other areas and wished to pursue something of individual interest. Although much of the research on effective professional development promotes working in teams (Darling-Hammond et al., 2009, Hargreaves, 2003, Timperly et al., 2007) teachers at Fulton were provided with both options. Such a choice by teachers highlights the importance of providing scope for individuals to engage in PL that is of specific relevance to them.

Areas of action research focus generated by the teachers ranged from students’ perceptions of the interdisciplinary curriculum, support of students in managing time more effectively, developing transparency for students and teachers in assessment practices, and changing pedagogical approaches in Year 12 Mathematical Studies. It is interesting to note that while these areas were all related to issues associated with the unique needs of the school only one explicitly focused on teachers’ pedagogical practices. I found this of significant interest, especially in how the outcomes of the different projects influenced the teachers and the school. The outcomes of two projects, Lisa’s and Johann’s, have been included here as they serve to highlight diversity in individual’s learning plans and how each acted as a process for teachers’ learning and influenced as aspects of the school as well.

Both projects on completion were assessed by peers and me as being of a very high quality showing evidence of the teachers engaging in a sustained and in depth investigation and resulting in deep understanding and changes in ways of working. While both research projects reported on changes in practices, Johann’s research provided evidence of greater transformation in the way both teachers and students were working.

A common element in both teachers’ learning was a sense of dissatisfaction with current practices, not unusual for action research projects (Mills, 2000, Stringer, 2004). However, it reinforces the notion that having a mandate to be innovative acted as a valuable affordance for teachers’ learning, and the school as an effective organisation as well. Lisa believed there was a need to focus more explicitly on the role of assessment in assisting students to achieve better

learning outcomes. She felt that the staff had been so focused on how to design effective interdisciplinary curriculum that the quality of and processes involved with assessment tasks had been neglected. Lisa believed that assessment tasks needed to be more transparent and reflect the intended learning outcomes of the curriculum. She believed that students should also be provided with rubrics that explicitly stated how students' representations of work would be assessed. Lisa's project engaged her and her peers in thinking more deeply about the role and processes associated with assessment and resulted in teachers clearly articulating the learning outcomes they viewed as meeting criteria that displayed evidence of students being at a beginning, proficient, advanced or exemplary level in the given task. Lisa recognised the power of considering assessment in such detail as assisting teachers to maintain a strong focus on core content in their teaching. The work was reflective of Wiggins and McTighe's backward design (1999) although Lisa has not been exposed to this model at the time. Lisa's learning had an important influence on the assessment practices in this school and on students' understanding of requirements for successful outcomes.

Johann focused on his own teaching practices being concerned that his understanding of how people learn was not always reflected in his teaching. He initially sought information from his students about the role of the teacher and other factors that assisted their learning. He talked to his students about his beliefs on quality learning opportunities and discussed his desire to change the way lessons were being delivered. There was some anxiety among students about Johann's proposed changes given they were in their final year of secondary schooling and were more focused on achieving a good grade in the exam over and above the quality of their learning. Johann had developed a very positive relationship with his students and encouraged them to consider a trial period ensuring they would receive as much support as they required to develop sound conceptual understanding of the mathematics content. In essence the lessons changed from Johann acting as the expert and taking responsibility for the majority of the teaching within each session to the student's being more responsible for teaching each other. A typical lesson would involve Johann in providing mathematical problems for the students, having the students work on the problems individually for about ten minutes and then join with one or two other students to further consider the problem and the different ideas that each student brought to the task. Following this the small groups of students would then be responsible for presenting their methods and justification for solving the problem to the whole class. Johann's role was one of designer of the tasks, supporter and challenger during the individual and small group sessions and consultant at the whole group presentation times. Following a tentative start to the trial with students expressing their concern that they would not be learning the 'right way', a new culture of learning began to emerge in the class. Johann's voice was heard in limited ways and the students took on more active roles in challenging each

other's problem solving approaches and answers. Students constantly commented that Johann's approach to teaching Mathematical Studies was different from every other subject they were involved in. One student commented, "*He hardly does any teaching while other teachers do it all and we just listen and try and absorb.*"

Although Johann's trial of using a more constructivist approach in a traditional examination and prescriptive curriculum-based course was a risk, he had enough conviction to maintain the approach for the remainder of the year and also to draw other colleagues into the trial. Johann's comment below indicates this may not have been the situation if he was not working at Fulton:

In the context of [Fulton] and change, where does this motivation come from. For me, there are the beliefs and values that are in tension with what happens at a system or whole school level as well as an individual relationship level. Change is more rapid and ongoing when there is support for these beliefs from leadership and colleagues. I felt that this has generally been the case at the [Fulton]. I am also able to operate with a high degree of autonomy and be recognised as a professional, able to make good decisions in relation to my sphere of control. I think the degree of collaboration within the maths department has been exceptionally supportive in relation to the approach and practices that have been developed in year 12 mathematics. In that sense [Phil's] leadership has been of note, thoughtful, clear principles and not controlling. My personal attitudes have also shifted. This is an interesting word. How often we talk about things shifting when we really mean small changes by little steps. In the past I have not really had a problem with Year 12 exams. I was happy to value the ability to perform in maths exams quite highly. Now I value the communication of mathematical problem-solving much more and see that it is possible to be doing good mathematics without being able to solve problems in a restricted time. I see learning associated with these problem-solving activities as more valid. Then I have seen how little exposition by the expert is required. If I were to return to my previous teaching situation, it would be far more problem-based and less expository. Note that these shifts did not originate as my conscious desire, rather my interaction with the environment.

Johann's reflection highlights a number of affordances that were influential in supporting shifts in his thinking and practice. Support from the leadership of the school, recognition as a professional, a high degree of autonomy within one's sphere of control, reflection on personal attitude and, more interestingly, interaction with the environment over and above conscious desire to shift practice, are all factors Johann associated with supporting changes in his pedagogical paradigms. In undertaking the action research project Johann noticed the many affordances supported his learning and although he stated his shift in pedagogy was not a "conscious" desire it does reflect a strong alignment of readiness to engage in such learning with the opportunity to do so. Although researching his own practice as an individual, Johann acknowledged the influence and power of working in an environment that allowed for professional interaction with other colleague both implicitly and explicitly.

In reflecting on the processes and outcomes of Lisa's and Johann's research there appeared to be qualitatively different outcomes for the teachers and students. Both research projects focused on improving learning for students, one through providing more clarity of assignment expectations and the other through engaging students in collaborative learning with extended responsibilities to be actively involved in the learning. Both could be viewed as not only making changes for the students but in expecting students to function in different ways. In Lisa's case the students were provided with an additional resource designed to assist their learning. The students in this sense were the passive recipients of a new idea that others viewed as being valuable to their learning outcomes. In Johann's project, students were required to be far more active in the learning process. In reflecting on the students being passive as opposed to active participants, a contrast in the essence of each case emerges.

Hargreaves (2003) discussed the difference between professional learning communities and performance training sects. Hargreaves claimed that effective professional learning communities will have at their centre the desire to transform knowledge, involving shared inquiry, evidence informed decisions, joint responsibility and local solutions to situations of complexity and uncertainty. In contrast performance training sects subscribe to transferring knowledge, imposed requirements, results focus, standardised scripts and deference to authority. In Lisa's research on transparency in assessment the outcomes had a focus on transferring knowledge from teachers to students, and imposing requirements and authority with a standardized script. This is not to de-value to quality of the work that Lisa engaged in; indeed it was highly valued by teachers and provided clarity of expectations for students and it was adopted as the preferred model for assessment tasks. However, when viewed through the lens provided by Hargreaves's characteristics it provided evidence of why Lisa's project outcomes resulted in changes in organisational aspects rather than pedagogical practices. In Johann's case changes in pedagogical paradigms were evident as his aim was to engage students in evidence-informed, inquiry-based learning where there was joint responsibility for learning and that the aim of the learning was clearly centred on the transformation of knowledge in students.

Should one outcome be preferred over the other? Both outcomes certainly contributed to building a culture of effective teaching and learning. Both teachers were intrinsically motivated to make changes to their ways of working and both focused on aspects that were relevant to them, and in turn the school. However, in keeping with the notion of innovation and reconceptualising teaching at Fulton Johann's project resulted in transformation of existing approaches to teaching and learning whereas Lisa's project focused on developing a new approach to improving an existing model of assessing students' learning. It may be tempting to value the work of teachers who transform the way they work with students in preference to the

work of teachers who focus on more technical aspects of their role. However, Hargreaves (2003, p.148) advised:

Professional learning communities and performance training sects each combine contracts of performance with cultures of commitment – but in different ways. There is a growing recognition in the field of school improvement that “one size does not fit all”. Different kinds of schools and systems need differing ways for tackling improvement. In this respect professional learning communities and performance training sects can offer complementary, not competing, improvement routes beyond standardization.

The initial idea of including postgraduate study options in the PLS as an incentive for teachers' learning resulted in a range of powerful outcomes not just for teachers but for the school, and more importantly the students. In addition, it also provided great insight into the need to see beyond one approach to professional learning. In considering the continuum of approaches from what Hargreaves termed the performance training sect through to the professional learning community it appeared that the whole range proved of value at Fulton and as such was acknowledged in the school's PLS.

The length and diversity of this section on the PLS indicates it was a major feature of the school's organisational elements and acted as an important affordance for teachers' learning. The PLS was complex and provided much diversity in what and how it offered affordances for teachers' learning. There are numerous other elements of the PLS that will be referred to in the teachers' stories in Chapter 5 and also again in Chapter 6. However, there was no doubt the role of Frances, the Assistant Principal (Professional Learning), was pivotal and as such it featured in the explanatory model of teachers' learning.

In reflecting on all of the organisational elements that acted as affordances for teachers' learning at Fulton it was apparent that the PLS was of greatest complexity and possibly overall importance. However, the affordances provided by the other elements including tutor groups, interdisciplinary curriculum and the university modules were often cited by teachers as a major influence on their learning. I theorised this may have resulted from these elements demanding teachers to work in innovative ways and as such they also demanded attention to learning to support understanding of how such elements worked and how the teachers fitted in. Innovations, novelty and newness all provide explicit starting points for learning but it can also be easy to adopt familiar ways of working to new environments and models. Without the PLS and sustained learning opportunities such as action research projects it may have been the case that some underlying practices and beliefs about teaching would not have changed and familiar patterns of working emerged even within a new organisational structure. The innovative ways of organising the school certainly acted as an affordance for teachers' learning but the

affordance of the Assistant Principal (PL) position and the PLS served as a critical organisational element to teachers' learning.

4.5 Relationship Factors

The influence of relationships among teachers, the leadership team members, university partners and students as an affordance for supporting teachers' learning has been acknowledged in previous sections of this chapter. However, this section of the chapter explores affordances for teachers' learning that have not been addressed previously. The section commences with an exploration of professional partnerships followed by the effect of relationships with students and teacher colleagues on teachers' learning. The quality of relationships among the various stakeholders of the school community was paramount to the quality and outcomes of teachers' learning. As Hargreaves (2003) explained, teaching to support successful outcomes for students in a knowledge economy "calls for teachers to work together in long-term collaborative groups, committing to and challenging each other, as a caring, professional community that is secure enough to withstand discomfort that disagreement creates" (p. 49). In the case of Fulton it was not just teachers working together but academics, the leadership team, students and other professionals.

4.5.1 Professional partnerships

A fundamental vision of Fulton was to situate the school on university grounds so that sustainable professional partnerships could develop. The partnerships were designed to support several outcomes, in particular affordances for teachers' learning. As Davies et al. (2006) wrote:

A key purpose of the professional partnership is to harness the expertise of academic scientists and educators, and of secondary teachers, to develop innovative curriculum and pedagogical practices in the new sciences and mathematics that will enhance students' learning and attitudes to science, mathematics and technology. (p.5)

The opportunity for interaction among staff in both organisations resulted in the development of many professional relationships. Staff from both organisations viewed themselves as professional partners and colleagues (PPC). Some partnerships have been sustained for the life of the school while others have been more transient depending on levels of interest, motivation and time. As professional partners, staff from the school and university engaged in developing innovative curriculum, co-presented at conferences, co-published in scholarly and professional journals and worked together on submissions and committees to influence policy and practices. All of these processes acted as a valuable affordance for teachers' learning and also for the academics' learning as well. Details of examples of the learning from these partnerships have been reported previously in this chapter. However, the

confidence developed in teachers from working collaboratively in sustained ways with academics provided impetus for expanding their professional partnerships to other people and organisations, and proved a valuable learning process for teachers.

The school is now strategically linked with large research projects and international organisations who seek to promote innovation in education, particularly in the areas of science, mathematics and technology. For example, teachers at the school have become regular contributors to the 'iinet' global network. Teachers are encouraged to write papers, often linked to their action research projects and graduate studies, to post on the 'iinet' site for other member schools to comment on. This process has served to develop professional relationships across countries and also resulted in many teachers from Fulton travelling to national and international conferences as presenters providing learning through the experience but also through distributed leadership as teachers would return to Fulton and lead discussions on their visits.

The school's mission to become a leader nationally and internationally in the innovation of mathematics and science education led to visitors to the school from all over the world. Many of these visitors have extended the relationship with Fulton by inviting teachers from the school to visit and work with them. Teachers have travelled to Thailand, England, Japan and Korea to work with schools on innovative curriculum, technology and pedagogy and self-directed student learning. Such opportunities engaged teachers in constantly thinking about their work and its applicability to a range of different environments and culture. The learning processes involved in these opportunities and the actual immersion in a new culture provided noteworthy affordances for learning.

Many schools developed professional partnerships but at Fulton professional partnerships and the specific development of PPC to support teachers' learning was explicitly planned for and influenced the organisation of the weekly timetable. As noted previously all staff were provided with a 2.5 hour meeting time specifically devoted to professional learning and students are released early one day per week to accommodate this. Initially many of these meetings were held on site with all staff members in attendance but, as professional partnerships developed, teachers used this time to learn in industry settings and provide professional development to other schools as well. In valuing and promoting professional partnerships as an affordance for teachers' learning greater flexibility in staffing options was required. For example, some teachers nominated themselves to act as facilitators of other teachers' learning in schools that developed partnerships with Fulton. The school was also approached to act as a partner with the university in offering onsite education for undergraduate teachers. Such options provided excellent support for teachers' learning but this was only made possible through the release of some teachers from their normal teaching duties. The leadership team at the school believed strongly in the affordances provided by such opportunities and spent time in managing staffing

to support teachers' learning from such options, while at the same time ensuring student learning was not compromised. Students' learning remained the priority for all at the school but students also contributed greatly to teachers' learning and the following section considers how.

4.5.2 Students

The nature of the organisation of the school and the vision for students to grow as self-directed learners was supported by an environment whereby teachers and students developed sustained relationships. This is not always easy to achieve in traditional high schools where teachers may see up to 100 different students a day and change home groups each year. The size of the school and features such as Tutor Group and teachers' workspaces being located in the learning commons enabled teachers to interact with and observe students at length. Many teachers commented on how students taught them a great deal about content and pedagogy, for example:

We have built a lot of ICT stuff into our maths program...some of the stuff I didn't know how to do before, I learnt it in many cases by consulting students, other times I had to consult experts.

The students here are much more open to tell you stuff that isn't working for them.

This kid said to me the other day... "well why can't I demonstrate my learning in a movie instead of writing"...I loved the way he used the same language we do..."demonstrate" and that they are open to challenging us.

The students are more than happy to tell me what works or doesn't, or ... "oh no, not another power point."

I think when they roll their eyes I subconsciously go...we might not use that again.

The teachers' reflections provided evidence of the many incidental learning opportunities that were afforded by the positive relationships between students and teachers. Students felt free to provide open and honest feedback from their perspective without the fear of being "punished" in some tacit way at a later date. The ability of students to connect with the school's culture of everyone being learners including the teachers was an important conceptual understanding that supported such feedback processes.

The quality of student-teacher relationships varied and appeared reflective of individual dispositions, beliefs and experiences and for many teachers and students new to the school the shift from the more traditional 'vertical' relationships often took time to comprehend and feel at ease with. However, the culture of the school constantly acknowledged the important role played by students in their own learning and also in the learning of others including the teachers. As students' learning outcomes were central to the success of the school and, of course, the students themselves, seeking feedback from them as to how to best support their learning was logical. Teachers constantly made use of tools such as Zoomergang to formally

survey students' perceptions of Central Studies or specific topics in Year 12. One teacher commented:

With the psychology class on our last day I got a big A3 sheet with each of the topics and investigations on it and asked to them to write stuff down...I said if you don't tell me that it doesn't work, it's terrible and boring, I'll assume that it wasn't and I'll do it again next year...you can tell me good stuff to keep as well.

This teacher focused on getting negative feedback prior to mentioning the positive feedback indicating a sense that critical reflection the priority. Students proved to be an ideal source for critical feedback and as such acted as another valuable affordance for teachers' learning at Fulton.

4.5.4 Teacher colleagues

Reeves (2008) in a review of research on professional development found that teachers reported that their teacher colleagues (TC) were their most influential form of professional learning. The following reflections from teachers also suggested that TC acted as a valuable affordance for teachers' learning at Fulton.

I found that asking questions in the team environment was the way to go...the staff here have been brilliant...so many different ideas and way beyond what I have experienced in other schools.

I was working in a new area and it was difficult but [Lesley] was reasonably familiar with the course and her husband was teaching it too so we sort of swapped bits and pieces. It's been very handy working alongside of people from different fields.

I watched [Merryn] teach my section for MAT the other day; I was surprised by how she did it and thought that's something I could try next time.

I've learnt a huge amount about ICT and I guess I've helped people understand chemistry a bit better...it's a matter of learning on the go...sort of as you need it for teaching...I'm not sure if this is a good idea but it works well...some I forget and need to ask again but there is always someone with the answer.

Each of these teacher reflections indicate that TC were highly supportive of planning for teaching from a content and pedagogical perspective. The learning in some cases was intentional but in many cases incidental. Some learning was more surface-level in nature and pointed to a sense of "strategic learning" (Biggs, 1999). 'Just in time' learning may be another analogy for strategic learning and a choice made by teachers at Fulton when they were faced with teaching beyond their discipline areas and with limited time to develop in depth knowledge of specific areas. Fortunately TC were always on hand to provide support and the strategic location of three to four teachers from different disciplines in each teacher workstation generated an affordance for learning that was highly valued by teachers.

Teachers at Fulton were highly committed to their role, the students and the school in general. They worked long hours and valued the support of their colleagues. Teachers' positive and productive relationships ultimately contributed to the generation of affordances for their own learning including being innovative, contesting views, providing feedback and support, trusting and respecting each other, and engaging in reflective dialogue. All of these behaviours contributed to the school culture being reflective of Kegan and Lahey's (2001) negentropic organisation whereby people and systems are energised by specific factors that lead to embracing greater complexity in the recognition that it will lead to greater capacity to enhance outcomes for the system's members. Teachers were committed to their students' learning but in the majority of cases just as committed to their own learning and that of their colleagues as well. Such an outcome was dependent on a number of factors identified in the explanatory model including the physical and technological environment and interdisciplinary curriculum. However, the quality of relationships among teachers certainly dictated how effectively teachers learnt from one another. Additional discussion of such outcomes are reported in Chapter 6 but there was more than enough data to support incorporating TC as an affordance for teachers' learning in the explanatory model of professional learning at Fulton.

The section on relationship factors of influence in teachers' learning has identified importance of professional partnerships, students and teacher colleagues in supporting and sustaining teachers' learning. Although the section is much briefer than previous ones this is a result of reporting on the influence of relationships as they connected with the other domains as well.

The completion of this section concludes the description of contextual conditions, organisational elements and relationship factors that provided evidence to answer the research question, how was teachers' learning supported and sustained in this innovative context. Theorising about the answers and the contribution of teachers' characteristics in the learning process led to the identification of many affordances for learning and the generation of the explanatory model of professional learning in an innovative school. The model is presented again in Figure 4.8 as a summary of the previous sections keeping in mind that all domains and affordances acted as resources for teachers' learning. The following section of the chapter addresses the final research question posed in this thesis: How do the processes and outcomes of teachers' learning in this innovative context reflect and contribute to the literature on teachers' learning? As such, the explanatory model that emerged from the research process is compared with recent research in the field of professional learning.



Figure 4.8 The explanatory model of professional learning at Fulton.

4.6 Contrasting the explanatory model of professional learning at Fulton to research on professional learning that supports exceptional outcomes.

My research provided an exceptional opportunity to develop a deep understanding of how a school was organised to provide an explicit focus on supporting and sustaining teachers' learning. One outcome of the research was the creation of a generative model that represented the diverse and complex ways in which teachers were supported and engaged in powerful learning. Many aspects of the model were explicitly planned for and others emerged through the interaction of a number of affordances. The previous sections of the chapter highlighted a very positive view of the affordances for teachers' learning at Fulton and in essence there is much to be commended. The explanatory model certainly contained many features that have been identified by other researchers as fundamental not only to teachers' learning but student learning as well. Several large scale evaluations of professional learning have occurred in recent years in Australia and internationally. Many of these have been referred to in the initial literature review and throughout Chapter 4. However, this section draws on the recent projects by Darling-Hammond et al. (2009), the OECD's Teaching and Learning International Survey (TALIS) (2009), research on schools achieving exceptional outcomes in Science in New South Wales

(Panizzon, Barnes & Pegg, 2007), and national studies conducted in Australia (Ingvarson et al., 2005) and New Zealand, (Timperley, et al., 2007).

Darling-Hammond et al. (2009) in the USA-based project, "Professional learning in the learning profession: A status report on teacher development in the United States and abroad," highlighted the importance of ensuring opportunities that:

- deepen teachers' knowledge of content and how to teach it
- help teachers understand how students learn specific content
- provide opportunities for active, hands-on learning
- enable teachers to acquire new knowledge, apply it in practice, and reflect on the results with colleagues
- are part of a school reform effort that links curriculum, assessment, and standards to professional learning
- are collaborative and collegial
- are intensive and sustained over time.

(Darling-Hammond & Richardson, 2009, p. 49)

Fulton's professional learning model provided for all of these outcomes. The previous sections of this chapter went beyond exploring theories of professional learning to provide evidence of what people, processes and interactions are required for such outcomes to be generated.

Timperley et al. (2007) in the New Zealand research project, "Teacher Professional Development and Learning: Best Evidence Synthesis Iteration," highlighted the following "effective contexts for promoting professional learning opportunities that impacted on a range of students' outcomes," (p.xxvii) noting that:

- extended time for opportunities to learn was necessary but not sufficient
- external expertise was typically necessary but not sufficient
- teachers' engagement in learning was necessary whether it was initially voluntary or compulsory
- prevailing discourses were often problematic and restrictive of new ways of thinking
- opportunities to participate in a professional learning community of practice were more important than where it occurred
- consistency with wider trends in policy and research were helpful
- active school leadership made a difference.

Once again, these factors are also reflected in the explanatory model of teachers' learning at Fulton. Timperley et al. also acknowledged that one specific condition is not enough for effective teachers' learning, and as reported in this thesis, it is the interaction of a range of affordances that promoted significant learning opportunities and outcomes.

Panizzon, Barnes and Pegg (2007) in their investigation of the characteristics of schools in NSW which had generated exceptional outcomes in science education highlighted a number of characteristics that related to the model introduced in this chapter. They found the following themes influenced the achievement of exceptional outcomes in Science for students:

- Science teachers committed to maximizing learning outcomes for all students
- Science teachers committed to the Faculty group and the school
- Interest in and enthusiasm for Science
- Experienced, thoughtful and reflective teachers
- High standards and expectations of self and students
- Quality pedagogy
- Distributed leadership. (p.65)

These themes are in many instances teacher-located and only the theme of distributed leadership provided any evidence of the role of contextual conditions that supported teachers' learning. While the themes identified by Pannizon et al. have strong links to the teacher-located affordances identified in this thesis they provided little evidence of how teachers and schools arrived at this point in the study, although this was not the primary focus of their research. They did elaborate on some features that were supportive of teachers' learning noting:

The importance placed on professional development was immediately evident in the Science staffroom in the range of teaching resources available to the staff. These resources were centrally located and considered valuable as indicated by the consistent reference made to them by staff. Supporting these resources were informal discussion about teaching and learning during recess and lunch times. Staff frequently mentioned the value of these discussions as a means of sharing ideas and communicating with others about experiences in the classroom. Equally important was the opportunity to engage with other staff (particularly those in specialist areas) about different ways of teaching particular concepts. This sharing was common and highly sought after in the schools. Furthermore, the informal professional development was observed and commented upon by support teachers who often shared recess and lunch with the Science teachers. (Panizzon et al., 2007, p.62)

This comment was of interest to my thesis as it highlighted a sense of qualitative difference in the experiences of teachers in Panizzon et al.'s study in contrast to the teachers' opportunities at Fulton. There is a sense that resources that had been developed by other people were central to the teachers' learning in Panizzon et al.' study and also valued by them. Although these teachers engaged in making sense of how such resources could be employed in their classroom, the same level of opportunity to actually design curriculum and resources for teaching that were available to teachers at Fulton was not evident. Generating interdisciplinary curriculum proved to be a major affordance for learning cited by the teachers at Fulton. Of course it is important to acknowledge that many schools would not be organised in ways that

provided the opportunities for curriculum development that were experienced by the teachers at Fulton.

Panizzon et al. alluded to professional 'development' as being informal and driven by recess and lunchtime conversation. Such dialogue was critical to teachers at Fulton as well and it was prioritised in weekly professional learning sessions rather than being left to chance. The OCED (2009) TALIS reported that informal dialogue with colleagues was the most common form of professional development experienced (93%) and 87% of participants in the survey rated it as having moderate to high impact. It is positive to think that the informal dialogue with colleagues results in such positive outcomes. However, many schools are not well designed or organised to support this form of professional learning on a consistent basis.

The form of professional development¹⁶ that teachers in the TALIS reported as having the greatest impact on their professional learning was the opportunity to engage in individual and collaborative research projects and qualification programs. However, teachers rated their opportunities to engage in these forms of learning as only 35% and 23% respectively. In contrast, every teacher at Fulton had the opportunity to engage in both forms of professional development and the majority did on a daily basis. Other forms of professional development that teachers in the TALIS reported as having high to moderate impact (percentage of participation followed by level of impact are included in brackets) were:

- reading professional literature (77% - 82%)
- courses and workshops (82% - 81%)
- professional development networks (40% - 80%)
- mentoring and peer observation (35% - 75%)
- observation visits to other schools (27% - 73%)
- education conferences and seminars (50% - 72%)

Teachers at Fulton were provided with all of these opportunities including the opportunity to visit other schools. However, this was never reported by teachers as influential to their learning. It was possible they gained sufficient stimulation for learning from observing their own colleagues and through interactions with the extensive amount of visitors to the school. The other form of learning identified in the TALIS as being of significance, but less so for teachers at Fulton, was attendance at courses and workshops. The teachers at Fulton often engaged in presenting such workshop and it may have been that they viewed the value in these was in designing them rather than attending them. Certainly many teacher attended workshops and conferences but they reported forms of professional learning such as curriculum writing teams,

¹⁶ Professional development was the term used in the TALIS report conducted by the OECD.

observations of peers and engagement in the professional learning strategy had the most impact on their learning. The findings of the TALIS reinforced that teachers at Fulton experienced similar forms of professional learning but more often and as such level of impact may have varied from teachers in the TALIS. Teachers at Fulton were also more fortunate in the scope of professional learning opportunities provided for them.

Another Australian research project focusing on teachers' professional learning also proved a useful body of knowledge from which to consider the explanatory model of teachers' learning at Fulton. Meiers and Ingvarson (2005) in their report on "Investigating the links between teacher professional development and student learning outcomes" cited the work of Loucks-Horsley et al. (1998) who proposed a number of professional development strategies that should be employed based on the desired goal of the professional learning. They identified fifteen strategies that were grouped into five processes based on links to specific goals. For example, *immersion* strategies were workshop or activity-based and used to introduce teachers to new content or pedagogical processes, while *examining practice* was best achieved through action research and case discussions. This approach to defining the best processes to support desired outcomes is acknowledged as an important consideration in the provision of effective professional development (Easton Brown, 2004) and also captured well the many different processes for learning that were afforded to teachers at Fulton. Meiers and Ingvarson (2005) found, "professional development programs characteristically combine different strategies" (p.19), and this is very much the case at Fulton. At Fulton there was recognition that teachers' diverse dispositions and characteristics combined with the numerous learning outcomes desired to achieve the school's vision required a comprehensive, flexible and generative model of professional learning.

Meiers and Ingvarson in their summary of issues that emerged from their research that required additional investigation included the design of professional development and school contextual factors. In their discussion on school contextual factors they said, "The case studies captured many of the daily realities of school life that hinder a continuing focus on teaching and improving learning. The difficulty in finding adequate time for planning, reflection and collaboration was an ongoing theme in interviews with teachers" (p.5). Such outcomes are not reflected at Fulton, and although teachers would always like more time for learning they recognised the model at Fulton is "better than any other school I have ever worked at," as summarised by one teacher. The physical environment of Fulton also provided an additional supportive contextual affordance for teachers' learning as teachers' physical proximity allowed for collaboration, planning and reflection that did not need to be restricted to recess and lunch periods.

Although the explanatory model of professional learning had much in common with the outcomes of the research projects just described it considered in more detail the minutiae of professional learning processes. This approach to researching teachers' learning at Fulton provided an opportunity to capture tacit dimensions that are often difficult to identify (Eraut, 2000). Eraut (2007) claimed the challenges of developing an understanding of how people learn in the workplace is based in part on the fact the "people are often unaware that they are learning through informal modes, and the word 'learning' weakens awareness of informal learning modes through its close association in respondents' minds with formal class-based teaching" (p. 404). Eraut's point was significant to my thesis as teachers at Fulton acknowledged a great deal of learning occurred through informal modes as their 'work'. This suggested they viewed their work as being influential to their learning rather than their learning being influential to their work. Of course there is a bi-directional influence between teachers' work and their learning but the perception that work influenced learning revealed a professional identity that was located around work rather than learning. Eraut suggested teachers viewed learning as something that occurred in more formal ways.

Fullan (2008) in his model the "Six Secrets of Change" identified one secret as, "Learning is the work." He argued that organisations must prioritise learning and view it as work as he believed this is a critical element for supporting improved cultures and outcomes. Such a concept is a considerable cultural shift and even at Fulton, a school that prioritised teachers' learning many teachers initially made a distinction between their learning and their work. For example, they viewed curriculum development as their work rather than their learning. However, the explicit focus on teachers as learners at Fulton challenged these perceptions and as noted in the teachers' stories in Chapter 5, teachers were capable of identifying themselves as learners and teachers. Having a language of learning helped many teachers to identify their work as learning.

The constant reinforcement of all members of the Fulton community being learners and the use of a language to describe learning processes was an important element in teachers' abilities to acknowledge what they were learning and how it was being learned, and ultimately that learning was their work. This was a significant finding in the research as many models of professional learning appeared to overlook the value of having a language to describe the actual learning processes that had occurred or were occurring for teachers. The teachers' stories in Chapter 5 provide powerful examples of the importance of the affordance of specific *language for learning*. Through access to such tools for learning and describing learning, the tacit dimensions of opportunities for learning noted by Eraut proved easier to identify.

Through his research, Eraut developed a representation of factors affecting learning at work called the two triangle model. The model (see Figure 4.9) had strong connections with the

explanatory model of professional learning at Fulton developed as an outcome of this research. Eraut included both learning and contextual factors in his model and located within these factors are elements that specifically linked to the Fulton model including feedback and support, challenge, and the value of the work and personal agency. Eraut's (2007) model included relationships and encounters with people at work under contextual factors and the unique physical environment of Fulton was also recognised as a specific contextual affordance for learning and one that promoted relationships. Eraut's contextual factor of 'individual participation and expectations of their performance and progress' potentially linked to the role of leadership and individual's dispositions and capabilities in the explanatory model developed in this thesis.

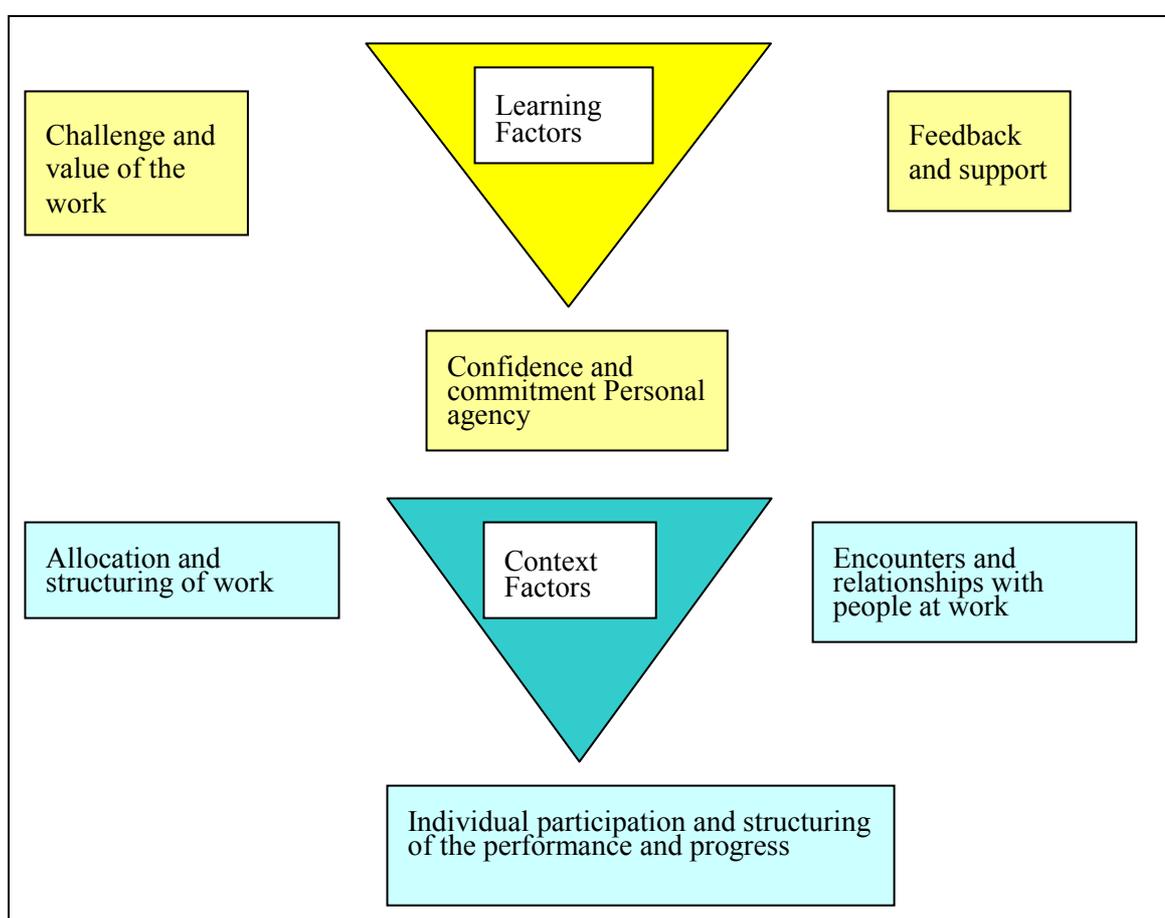


Figure 4.9 Eraut's two triangle model of factors affecting learning at work (2007, p. 418)

The contrast with Eraut's model provided some evidence as to the more comprehensive recognition of conditions, processes and relationships that influenced learning identified in this research. There was certainly potential to categorise features of the Fulton model into Eraut's model but factors that did not fit well included access to expertise, a language for learning, a vision of collective commitment, a specific PL strategy and distributed leadership. All of these with the exception of a language for learning would fit within contextual factors in Eraut's

model. A language for learning is more closely associated with learning factors as it provided teachers with the opportunity to explicitly identify processes in their learning.

A final model that appeared to more comprehensively link with the Fulton model was a framework developed by Kruse, Louis and Bryk (1995) to analyse school-based professional communities. The name of their model connected with the vision of Fulton to be a professional learning community, although the Fulton community ultimately stretched well beyond the school. An adapted version of Kruse et al.'s model (see Figure 4.10) included several characteristics, conditions and resources identified in the explanatory model of professional learning at Fulton albeit under different categories. However, the affordance of a *language for learning* was not included in the Kruse et al. model although "communication structures" had the potential to acknowledge as such a feature.

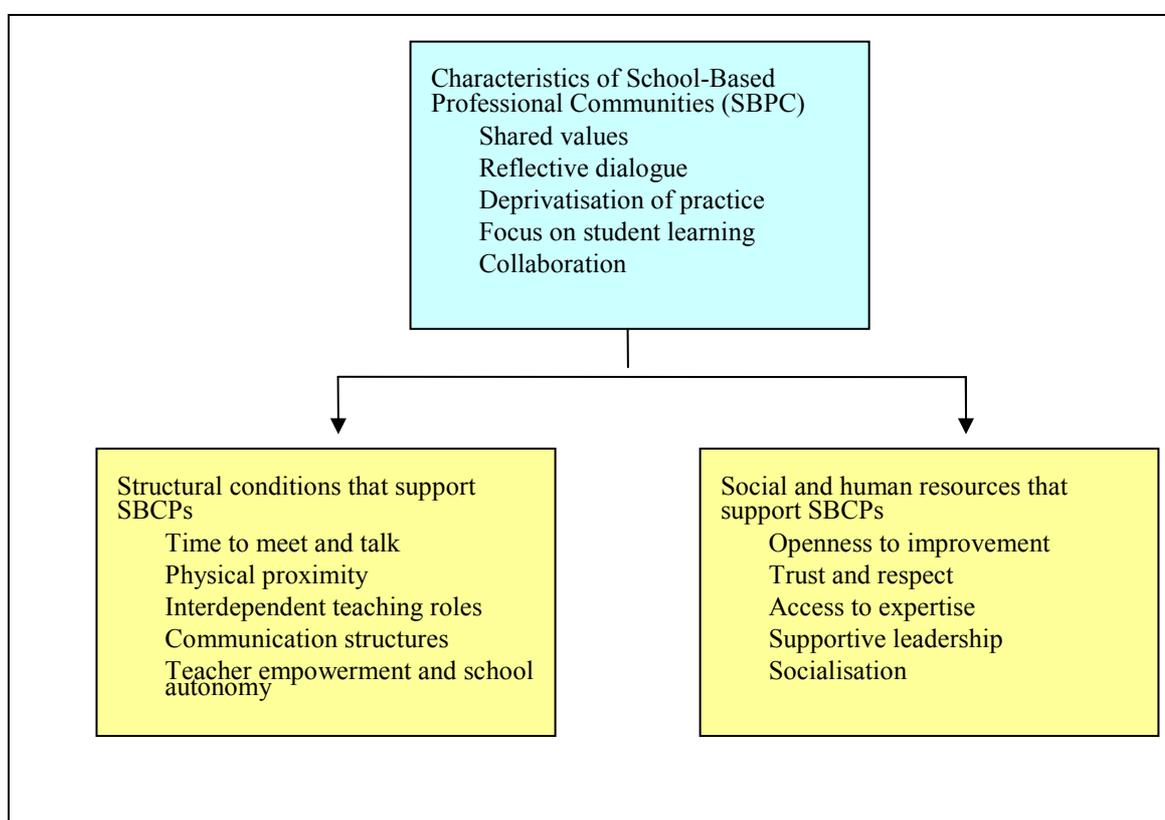


Figure 4.10 Emerging framework for analysing school-based professional communities developed by Kruse, Louis and Bryk (1995, p.25).

Other affordances of the explanatory model developed in this thesis not explicitly included in the Kruse et al. model were the notion of overall *resources* and *contested views*. Access to resources was a more obvious affordance that enabled teachers' learning at Fulton whereas contested views were more tacit in nature (Eraut, 2000). The longitudinal nature of the research process and the insider-researcher position provided an excellent opportunity to identify additional dimensions to existing research and models and the Kruse et al. model

certainly provided food for thought on other ways of presenting the explanatory model for teachers' learning at Fulton. However, the explanatory model developed as an outcome of my research explicitly acknowledged the obvious and tacit affordances and the interactions between them to more fully represent the complexity of teachers' learning at Fulton.

Kruse et al. believed the potential benefits of school-based professional communities were 'empowerment, personal dignity and collective responsibility for students' learning' (1995, p. 25). These outcomes certainly reflected the outcomes of teachers' learning at Fulton as well, and further discussion on the value of such outcomes will be considered in Chapter 6.

4.7 Summary

Contrasting the explanatory model of teachers' learning at Fulton to contemporary research and models provided recognition that the explanatory model generated through my research was indeed representative of current perspectives and factors that support and sustain teachers' learning in school-based environments. It also highlighted that Fulton provided an environment rich in opportunities for learning, and that the affordances identified for teachers' learning were generated by a range of factors and processes that represented a complex alignment of individual's disposition and capacities, contextual conditions, organisational elements and relationship factors. This chapter explored in detail the contextual conditions, organisational elements and relationship factors and the affordances they generated to substantiate the explanatory model's authenticity and soundness and as a response to answering the research questions posed in the thesis. Teachers' beliefs, values, capacities and sense of personal agency were acknowledged as a critical feature of the model and of significant influence to teacher-located affordances. However, the importance of their inclusion in the model is further supported by five case studies presented as teachers' stories of learning at Fulton. The inclusion of the teachers' stories in the following chapter is designed to illustrate the explanatory model in action and to further illuminate the complexity of the teachers' learning processes and their subsequent influence on outcomes for teachers, students and the school as a learning organisation.

5. Teachers' Stories of learning in an innovative school

'If we want to increase the quality of our action as a group or a team, we need to pay attention to the invisible dimension of its source; the place from where we operate.' Scharmer (2009, p.54)

"Since turbulent conditions appear everywhere and pervade our lives in both time and space, learning in permanent white water conditions is and will be a constant way of life for all of us – thus the phrase learning as a way of being." Valli (1996, p.26)

5.1 Introduction

This chapter explores in detail the processes of teachers' learning and how this was supported and sustained in the Fulton context. The chapter introduces five teachers and through a detailed account of their learning highlights the role that their characteristics, capacities and sense of personal agency played in their learning. The leadership team at Fulton recognised that different teachers brought different characteristics and capacities to the school and therefore designed a professional learning strategy (PLS) that provided diverse opportunities for learning, as detailed in Chapter 4. However, a primary focus of the PLS in the early days of Fulton was on self as learner. Scharmer's (2009) quote (see above) acknowledged the critical nature of the individual, and the personal characteristics and capacities they bring to learning and subsequently to the quality of outcomes for groups and in Fulton's case, the school as a learning organisation. The 'source', as Scharmer calls it, from which individuals operate, is not always clear to them or others and the leadership team at Fulton prioritised understanding oneself as a learner in the PLS. They believed increasing the quality of understanding of one's role and influence on others in the school would support greater understanding of, and improved planning for student learning. The teachers' stories in this chapter provide evidence of a deepening of understanding of self as learner, and how their values and actions influenced, and were influenced by, working in the Fulton context. Each story is unique and features different processes of learning. However, each story fits within the explanatory model of professional learning and contributes further evidence to answer the following research questions:

- How was teachers' professional learning supported and sustained in the context of this innovative school?
- What were the processes of teachers' learning in the context of the school?

- How do these processes and outcomes of teachers' learning in this innovative context reflect and contribute to the literature?

The teachers' stories highlight that interaction between the "source" from which teachers operated and the environment in which they were learning was a critical factor in understanding how teachers' learning occurred, and was supported and sustained at Fulton. The chapter provides evidence of why the domain of teachers' characteristics, capacities and sense of personal agency has been included with contextual conditions, organisational elements and relationship factors in the explanatory model (see Figure 4.2 in Chapter 4, p. 169).

The second opening quote in this chapter (Valli, 1996) provides an example of the conditions in which the teachers at Fulton were working and learning. The innovative nature of the school provided a dynamic but ever moving context. A new learning space, new curriculum, new ways of grouping students and new ways of organising time for learning and working together all led to shifting policies and practices. Often such "white water" conditions create chaos and are less than conducive to teachers' learning. However, the clarity of vision and commitment from leadership and teachers to achieving Fulton's vision resulted in acknowledging turbulence as important in the process of disrupting familiar patterns of thinking and working (Christensen et al. 2008). Throughout the course of the research there were times when the "white water" conditions appeared to subside a little but never for very long as the culture of the school was to constantly seek new and better ways to shape schooling in the senior secondary years. The outcome for teachers was that learning became "a way of being" and a feature of the 'source' from which teachers operated (Valli, 1996). The constant interaction between teachers and the environment served as the foundation for a complex and generative explanatory model of professional learning. The stories in the chapter are designed to illustrate the place of teachers in the explanatory model and their recognition of affordances that made a difference to their 'source' for operating.

The five case study teachers were purposely selected to represent diversity in teaching experience, gender, discipline expertise and position in the school. Ezzy (2002) suggested that, "a sample that aims for maximum variation [is] most useful if the aim of the research [is] to document variations in patterns of a particular phenomenon" (p. 74). The selection of these five teachers to act as informants occurred following a year in the field. This provided an opportunity for ongoing observations of teachers' engagement in professional learning and to look for differences in approaches, reflections on their work and interest areas. I worked more closely with some of these teachers than others across different periods of time. Each teacher was interviewed formally and informally on several occasions and they all participated in completing whole staff surveys. In addition, I was able to observe these teachers in a variety of

roles including teaching students, working with other staff, participating in meetings and at times interacting with visitors on and off site. Such engagement provided a rich data source from which to construct their stories.

The data gathered from the case study teachers acted as an important source in generating the affordances for learning that emerged from the coding and constant comparative process. The case study teachers' stories are introduced individually and used as examples of how specific affordances emerged and generated working hypotheses that determined ongoing data collection and additional theorising that in turn guided the coding and analytic induction process. As Strauss and Corbin (1998) noted the analytic induction process requires the researcher to take one case to illuminate how a working hypothesis has been generated (in this research the working hypotheses were the emerging affordances for learning that explained teachers' learning and when tested formed the basis of the explanatory model of professional learning). The working hypotheses, or in this research the affordances, are then 'tested' against another case to determine if both cases fit. The new case may or may not fit the theme, it may also generate new codes that are then tested against another new case and so the process continues. The data generated from each new case is constantly compared against existing cases until data saturation occurs. Bowen (2008) said that "data saturation entails bringing new participants continually into the study until the data set is complete as indicated by data replication or redundancy" (p.140). The outcome of the process in my research was the use of the 'tested' affordances that emerged from the data in an explanatory model that represented the phenomena of teachers' learning at Fulton and served to answer the research question of how teachers' learning was supported and sustained in this context.

The process of identifying affordances for learning through the analysis of one case followed by another also influenced the selection of case study teachers. Each teacher's story provided evidence of many of the affordances for learning identified as being significant to all teachers for example, teacher-located affordances of *motivation* and *openness* to learning as well as school-located affordances of *physical proximity*, *time for learning*, *students*, *collaboration*, and *sustained dialogue*. However, each case provided an example of how specific and varied affordances for learning were enacted in the learning stories. Table 5.1 provides an overview of the case study teachers and specific affordances for learning that were identified through their learning stories. The teachers' stories were unique but also representative of other teachers' learning journeys as well. Some stories illustrated how teachers' learning was intertwined with their colleagues through innovative practices at the school while other stories featured more individual processes of learning. All stories clearly acknowledged the interaction of teacher- and school- located affordances to support teachers' learning. The stories also acknowledged the outcomes of the teachers' learning and provided an

introduction to the complexities and extent of outcomes achieved that are reported on in more detail in Chapter 6.

The following interpretive accounts of the learning opportunities and experiences of the case study teachers sought to illuminate and understand their lived experiences as they contended with expectations of innovation and change. The chapter is a window through which the reader can view the lives of the teachers at Fulton and the 'trustworthiness' of my interpretations of those lives (Maxwell, 1992, Smith, 2000). As stated previously each teacher's story is used as an example of the emergence of particular affordances for learning. Most teachers had opportunity to read the account of his or her lived experiences detailed in this chapter and some were surprised by the accounts, not from my interpretations but from the extent of their learning and details of which they had forgotten. Johann, one of the case study teachers, responded on reading my account of his story:

My experience at [Fulton] was like a coming of age and this story captures it well. I am confident in the relevance and depth of my knowledge in mathematics, aware of my mathematical creativity, confirmed in my values re teaching and with the capacity to articulate these thoughts and beliefs to a wider audience. I never considered myself a writer but the experiences provided at [Fulton] have led me to understand the power in the process and its importance for extending knowledge beyond the school.

5.2 Lisa's story

Lisa was introduced in Chapter 4 where several examples of her learning illustrated particular affordances for teachers' learning at Fulton, in particular *interdisciplinary curriculum* writing and interactions with *professional partners*. Lisa proved an ideal model for a case study as she actively engaged in learning within and beyond the school, prior to, and throughout her tenure. She acted as a leader of learning for many others in the school. Lisa was a 'trailblazer' (Perry, 2004) as she constantly sought out intentional and new learning opportunities. Her story illustrated the many incidental, intentional and strategic learning opportunities Lisa and her colleagues engaged in at Fulton. Lisa's story involved many other teachers and as such provided a perspective on their learning as well. The story captured the processes and outcomes of teachers' learning that were generated by the interaction of a number of affordances. However, affordances that are specifically identified in Lisa's story included *contested views*, *teacher colleagues*, *collaboration*, *interdisciplinary curriculum*, *students* and *access to expertise*, along with Lisa's high levels of *motivation*, *purposeful listening*, *reflective practice* and *openness* to new opportunities. Lisa's story provided an example of development in learning that led to seeking different forms of professional learning, often beyond the school, particularly when linked to content knowledge of the new sciences. The outcomes of Lisa's learning resulted in her being invited to lead a national government project as a curriculum writer and leader of

professional development. Lisa's story also provided an excellent example of the emotional aspects involved in teachers' learning and how they were manifested in the Fulton learning community.

Table 5.1 Overview of case study teachers and alignment to affordances for learning

Teachers' pseudonym	Gender	Years of teaching experience	Field of expertise	Affordances for learning
Lisa	Female	29	Biology	Interdisciplinary curriculum Professional partnerships Action research as part of the PLS ¹⁷ Access to funding
Scott	Male	Nil	Chemistry	Distributed leadership Teacher colleagues Being innovative
Jackie	Female	19	Mathematics	Action research as part of the PLS Language for learning Writing to learn Reflective practice
Johann	Male	30	Mathematics	Being innovative Action research as part of the PLS Writing to learn Teacher colleagues
Barry	Male	30+	Mathematics	Contested views Being innovative Access to expertise Teachers colleagues

5.2.1 Lisa's learning characteristics

Lisa described herself as a senior secondary school biology teacher with over 29 years of teaching experience. She applied to teach at Fulton as she had a strong commitment to science education and more effective ways of engaging students in science. Lisa was appointed as a coordinator of a Central Study team leading up to 8 other teachers. Lisa was a self motivated learner and engaged in ongoing professional learning throughout her career to enhance her own knowledge and skills. Her most recent professional learning experience prior to commencing at Fulton was self-initiated tertiary study in the area of Information & Communication Technologies (ICTs) to investigate how such approaches to teaching could assist in enhancing

¹⁷ PLS refers to the school's Professional Learning Strategy of which action research was a core process designed to support teachers' learning.

learning outcomes for her students. Lisa actively sought leadership opportunities throughout her career and contributed to her discipline area by acting as a developer and moderator of state-based examinations and as a member of the professional association of science teachers. Lisa's previous teaching and professional experiences indicated she had a strong passion for her discipline area, a strong sense of accountability about her professional role and was highly motivated to learn.

5.2.2 Learning with and from teacher colleagues

The following extract was from a lunchtime conversation between 4 staff members including Lisa held just one week after students had commenced at Fulton in its first year of operation:

Lisa: It's time to revisit the units within our central study because from our reflections over the past week it's becoming obvious that we have over planned.

Colleague 1 (C1): Yeah, I heard one student say, 'I just start on one thing then another thing comes along'.

C2: We are very content intensive; we probably generated this from the need to meet outside criteria like SACE.

C3: But during students' unscheduled time only 6 wanted to discuss work – like others they're not interested.

Lisa: The kids that were the loudest were actually doing the most work, there were lots of arguments but in listening closely it was all about work...I thought this is what we are trying to promote.

Two affordances identified in the explanatory model are evident in the brief interaction. Lisa engaged in *purposeful listening* (to her colleagues and the students as they were working) and added to the discussion a *contested view* on the level and style of student engagement. These affordances were driven by Lisa's individual characteristics but were also clearly linked to the affordances presented by the school's contextual conditions and organisational elements. She connected with the school's vision and philosophy that promoted high levels of student engagement and the requirement to work in Central Study teams provided the opportunity for teacher collaboration and decision making. The alignment between teacher- and school –located affordances was often evident even in teachers' brief interactions.

The teachers' interactions highlighted the value of colleagues (TC) engaging in discussion about their work. Without the discussion, one teacher's perception of student engagement would have been left unchallenged. Lisa's contribution provided an opportunity for her TC to perceive students' behaviour in a new light. The example acted as incidental learning for Lisa's TC and also provided evidence of the role students played in Lisa's learning. She clearly observed the students closely and her 'discovery' that students were actually engaged in

some valuable learning provided data from which to develop new understanding about how students could learn in the Fulton environment.

The incidental learning scenario was probably not viewed as a valued contribution to Lisa or her colleagues' learning given this was a 'normal' practice they engaged in on a regular basis. Lunchtime discussions provided an opportunity for Lisa and her colleagues to focus on the differences and challenges of working in innovative ways. Teachers' work became the centre of daily discussions and the daily discussions reflected a culture of contesting views in collaboration. Very little of teachers' familiar routines and ways of working in previous schools was evident at Fulton and one way for teachers to make sense of their work was through dialogue with their TC. Such conversations represented an early but crucial stage of teachers 'noticing' specific things and through *sustained dialogue* collaboratively trying to 'make sense' of them (Moon, 2000). Darling-Hammond (1999) added support for such a process when she said "the time teachers spend with each other and other knowledgeable professionals – engaged in thinking about teaching and learning - is just as important to students' opportunities to learn as the time teachers spend in direct facilitation of learning" (p.33).

The power of learning with and from TC in such incidental ways provided a consistent focus on quality teaching and learning. However, as reflected in Moon's (1999) Map of Learning, teachers moved between 'noticing' to 'making sense', stages reflective of surface level learning. Surface level learning is often lost or not supportive of ongoing changes in practice, a possible reason for Lisa not to regard conversations with TC as important to her professional learning. To engage in deeper levels of learning teachers needed to move from the 'making sense' stage to 'making meaning' and 'working with meaning' and this required a more systematic and intentional process of reflection and action. Time for this was provided through the school's professional learning strategy (PLS), an organisational element of the explanatory model of professional learning and the outcomes of this affordance are considered in the section that follows. However, it is important to acknowledge the role of the teachers' daily conversations as even though they rarely led to deep learning they served as the foundation for a culture of collaboration between TC and a culture of *reflective practice*.

5.2.3 Collaboration in interdisciplinary curriculum teams: emotional and intellectual influences on learning

Lisa and her colleagues were involved in working in interdisciplinary curriculum (IDC) teams for the purpose of curriculum development and this afforded many opportunities for teachers' learning. Much of the IDC team process and its affordance for teachers' learning was introduced in Chapter 4 (see p. 139) however, the following section provides greater insight into the emotional and intellectual work (Hargreaves et al., 2001) required by teachers at Fulton.

Initially teachers did not view working in IDC teams as a professional learning process but once again as their 'work' and this work was a priority for the school to function effectively. In the early days of the school there was a very real and pragmatic need to work together to generate curriculum for the students to engage with. All teachers were under pressure to develop innovative curriculum through collaborating with peers and university partners. The IDC writing was central to achieving the vision of Fulton which included:

responding to current and future interests and needs of its students by establishing models of excellence in science and mathematics education; providing a learning culture for its students that develops deep inquiry in scientific studies in partnership with university and industry scientists and educators; preparing young people to be creative, critical, informed and motivated contributors responding to professional, personal and social issues and; be an agency for change and enhancement of science and mathematics education...nationally and internationally. (School Promotional Document, 2004, p.2)

Even with support from leadership, this was a significant undertaking for the teachers at Fulton.

Although the school had employed curriculum writers prior to opening, the newly appointed teachers needed to familiarise themselves with the curriculum and in many cases they wanted to make modifications or rewrite whole units. There was often tension between the original curriculum writers, the new teachers and at times the university partners (UP) about the type and amount of content in the curriculum. One UP made the comment in a meeting with teachers:

We really need to sit in on any discussions of reviews and changes in the curriculum as its very difficult for us to assist in planning other than what we have already contributed. Some of my colleagues are worried that you are not including enough cutting edge science and that there is a whole range of additional content needed. I tell them you are just trying to survive from one week to the next.

An original curriculum writer, who was subsequently employed as a CS leader, struggled with the criticism of some of the learning objectives and planned activities she had created. This teacher viewed the work to be very innovative, solidly based across disciplines and also rich in effective teaching and learning principles. Her sense of ownership and pride in the work was tested by the reflections of many of the new teachers. Her reaction was justified from her own perception and drew empathy from others who had spent long hours in the curriculum design process too. However, the views of those critical of aspects about the design were aired and noted as relevant as well. Lisa was one of the critics and justified her feedback with the following statement:

I believe in being appointed to any school and asked to teach a specific topic [in this case a specific section of a CS], I would be afforded the professional responsibility of being able to modify and teach in ways that I viewed as being more relevant.

The teachers at Fulton were caught between two worlds, their previous experience of senior secondary education, where they were in control, and their new world of innovative curriculum, the demand to work in IDC teams in a new learning space and at the same time meet the expectations of a range of stakeholders. Regaining some sense of control over their work and being valued for the knowledge and experience they brought to Fulton appeared to be at the forefront for most teachers. Many teachers found it difficult to shift from being a teacher to being a learner as well. Lisa and her colleagues shared their perceptions of working at Fulton in the first few months:

Lisa: One thing I said to my Year 10s in my last school is that if effort and attitudes go down this changes responses to things, I think this is happening to me too, I feel like I have hit the wall in trying to work out how it's all going to work, I'm worried about this, I just can't describe it, I need more detail.

(TC): To tell you the truth at this point in time I'm exhausted, I have never worked quite so hard yet felt so frustrated, there is just not enough time to get this together in a way that I can teach. I agree with all the philosophies of this place but at the moment the intensity and expectations are grinding me down.

(TC): I am conscious of thinking as if I was working in my old school, the emphasis is always on how to prepare kids so that they will be successful in Year 12 (Stage 2)...it's hard to shift away from that pattern but I'm trying to have an open mind and positive outlook.

The teachers' reactions reflected the emotional and intellectual work associated with change identified by Hargreaves et al. (2001). The use of the words 'exhausted', 'frustrated', 'hard to shift', 'hit the wall', 'worried' and from a counter position, 'open mind' and 'positive' indicated emotional responses to the challenges faced by working in a setting demanding change. Hargreaves (2003, p.60) warned:

Under intensive and insensitively imposed change, teachers also find their emotional worlds turned upside down. Instead of using their emotional intelligence to be more effective with their pupils, or having the time to invest in the relationships that build emotional understanding with those around them, teachers have to engage in what Hochschild calls 'emotional labour'...it's hard to remain authentically optimistic and enthusiastic when you are overloaded.

Perkins (2003) added weight to Hargreaves claim noting that, "In times of stress, when cognitive load is high, behaviour tends to regress towards simpler earlier-learned behaviours. And it's hard to be progressive when the other guy is being regressive" (p.167). Perkins's warning was reflected in several teachers' comments including the following:

We must be really careful that there is a firm foundation for success in Stage 2 topics. We could organize a committee to monitor what the students are doing and know as a result of this model and if it's not working consider changes to it.

I feel far more restricted about how I am teaching now than I ever have. I'd just like the opportunity to teach how I normally do.

Just give me a text book, any text book; it would make me feel much more secure!

Lisa too, made a reference to text books in her reflection on the early days of working at Fulton too:

...it's the structures that aren't in place...you know you don't have a text book to work with, you do not have a program to follow...all those things...you've got to start from scratch again and as soon as you do that then you get the freedom to do different things.

This comment provided an insight into the shifts in emotion from the earlier statement of 'hitting the wall' to the more enthusiastic possibilities of doing things differently. Lisa embraced the opportunities the school provided even if it did engage her and her colleagues in emotional work. Lisa's sense of personal agency appeared to be an affordance for coping with the emotional work required of the foundation teachers at Fulton. She said, "I've always... ever since I have been teaching, I've always wanted to do something better." She was not one to give up easily and although the innovative nature of Fulton proved confronting to preferred ways of working Lisa's *motivation* to be part of an improved model of schooling made the emotional work worth it.

The emotional work invested by Lisa and her colleagues in the early days of Fulton was matched by intellectual work as well. However, the work was recognised as a valuable learning opportunity and Lisa certainly made this link when she commented:

The structure (interdisciplinary curriculum, timetable, learning space etc.) will change the direction of the learning...so I reckon for me it was really getting my head around what this school really could be...from taking the high ideals that were written down from the first group and actually putting it all into practice...so the learning for me was the putting into practice.

Lisa recognised that her work was her learning and that both were well supported by the school's contextual conditions and organisation which included working collaboratively with colleagues on nearly everything she did. Lisa and her colleagues' emotional and intellectual work in IDC teams resulted in smaller learning communities within the larger learning community of the whole school with both contributing to the quality of each other. The processes and outcomes connected well with Wenger's (1998) theory on communities of practice. Social learning theory underpinned Wenger's beliefs and he proposed that it is neither individuals nor the organisation that is central to learning outcomes but the 'communities of practice' that emerge as people engage in pursuing a common outcome or enterprise. Wenger suggested that learning results as an outcome of social participation around issues of community, social practice, meaning and identity. Lisa and her colleagues' stories of tension and shifting emotions as they engaged in the shared process of curriculum development reflected Wenger's (1998) contention that:

Most situations that involve sustained interpersonal engagement generate their fair share of tension and conflicts.... Disagreements, challenges and competition can all be forms of participation. As a form of participation, rebellion often reveals a greater commitment than does passive conformity. A shared practice thus connects participants to each other in ways that are diverse and complex. (p.77)

Wenger's research and the stories of Lisa and her colleagues highlighted the importance of explicitly acknowledging the emotional and intellectual work of teachers working in collaboration as 'diverse and complex' but also as a powerful opportunity for learning in community. The following section expands on the type of learning that was generated through the affordance of learning in communities of practice known at Fulton as IDC teams.

5.2.4 Interdisciplinary curriculum teams supporting strategic and deep learning

The work of the IDC teams was not initially a feature of the professional learning strategy but time was made available for teams to meet on a weekly basis. The distinction between the professional learning strategy that planned specific learning opportunities for teachers and the IDC team's 'work' led to a perception that curriculum writing in teams was not a part of teachers' learning, rather it was part of their work. Yet, as Lisa experienced, and as reported by many other teachers, much learning occurred through the affordance of working in IDC teams. In recognition of teachers' acknowledgement of the learning that was occurring through the 'work' of IDC teams it ultimately was included in the school's professional learning strategy and the outcomes of the learning provided for surface, strategic and deep learning.

Working in IDC teams proved a significant affordance for learning as it reflected many of the condition identified by Brandt (1998, cited in York-Barr et al., 2006, pg. 34) as supportive of powerful learning including:

- What they learn is personally meaningful.
- What they learn is challenging, and they accept the challenge.
- What they learn is appropriate to their developmental level.
- They use what they already know as they construct new knowledge.
- They can learn in their own way, have choices, and feel in control.
- They have opportunities for social interaction.
- They get helpful feedback.
- They acquire and use strategies.
- They experience a positive climate.
- The environment supports the intended learning.

Lisa's story described in Chapter 4 (see p. 160) provided evidence of these conditions being met. While the conditions were important to the quality of the learning experience they did not always lead to deep learning as this often depended on the purpose for the learning and the time available. Much of the IDC team's work in the early days of Fulton was completed with limited time between the design and the delivery. Fortunately teams consisted of teachers with different levels of discipline expertise and design, meetings often resulted in some team members 'learning' on the spot to cope with teaching a class the next day. Lisa and other teachers not familiar with new content generally learnt from TC on a 'need to know' basis without deep understanding really being achieved. Such learning required a strategic approach as the teachers needed to facilitate students' learning rather than 'teach' it to them. Fulton's vision of inquiry-based constructivist learning and the open space environment that led to close physical proximity for teachers and the availability of a discipline expert being close at hand if required led to teachers feeling more secure about acting as facilitators of student learning rather than the experts. These affordances all helped to support and sustain teachers' learning and also afforded teachers the opportunity to be strategic about their learning and invest time on priorities for deep learning.

Biggs (1999) suggested that learning should be viewed as more than the acquisition of knowledge, a concept he considered a surface approach to learning. He suggested that learning should promote a level of understanding that results in *conceptual change* – an outcome of a deep approach to learning. Biggs (1999) also said that to, "*Really* to understand is to have one's conception of phenomena changed" (p.36). It may be that to *really learn* one's conception of phenomena is changed and to really understand is the ability to use the conceptual information in different ways. Lisa's reflection that follows provided an example of how working with a colleague from the IDC team in the open environment of Fulton afforded an opportunity to not only "really learn" but to "really understand" as well.

We had a philosophy unit in the CS and I remember trying to ... thinking...oh well there's got to be a body to teach this and it looks like it's me...and thinking what in the dickens am I going to do here...and in that scenario we started of with [Trevor] taking them and me watching him...you know he would take the whole lot [students] and I would watch and gradually I got the confidence to do some of the things and then I started flowing and I got that confidence of working with the kids in the subject area and then I started developing material and you know...going off and bringing in stuff I had and developing that...so the confidence was there and I really loved it...I never saw myself as a philosophy teacher!

Lisa's opportunity to learn from her colleagues shifted her from being a professional educator with over 29 years of experience in her discipline area to that of a professional student energised by the opportunity to learn and understand something new through her colleagues. Peery (2004) suggests:

Revitalizing one's creativity and intelligence can come from being a true student again. Educators need time to be students in several different ways... being a student again creates greater empathy for students in our own classrooms while deepening our understanding of subject matter. (p.36).

The demands and opportunities presented by working in IDC teams in the innovative environment of Fulton interacted to provide rich learning opportunities for Lisa and her colleagues and provided evidence of why such affordances were included in the explanatory model of teachers' learning.

5.2.5 Deeper learning through access to expertise

The nature of the requirements of teaching at Fulton engaged Lisa in many learning opportunities, incidental and intentional in nature, but when Lisa found herself in a position of leading the curriculum design team for Nanotechnology, a 'new science' for which Lisa had limited background she engaged as a very intentional learner. Lisa felt the need for structured content learning both independently and with her curriculum design team. Her approach to learning was well considered and she engaged in reading, seeking out experts, trialing her ideas on other colleagues and scanning the Internet for relevant conferences. She attended one such conference with a University partner and teacher colleague prior to teaching in the unit. Through ongoing interactions with a range of experts in the field and her desire to apply such concepts in the new central study, Lisa engaged in much deeper content learning than she had in previous curriculum writing. However, Lisa also recognised, the learning process did not automatically result in deep learning, it was a matter of being strategic to 'get by'. She stated:

Well I certainly engaged in much intentional professional learning for nanotech. Initially I worked with Brian¹⁸, we talked a great deal about the field, and he was really helpful in the early stages in making me feel comfortable about the concepts and ideas for teaching the material. I went to the show dome and a conference with Brian as well...all of this helped but I never planned to put myself in the position of expert anyway as I was far from this and it was much more about feeling comfortable, drawing of the experts from the university and beyond and just finding a way to engage the kids in the ideas. To start with I really just wanted to get by and I guess I could do this as the uni people were on hand.

Lisa, although the leader of the curriculum writing team for the Central Study of Nanotechnology, never viewed herself as needing to be an expert based on her belief in the inquiry model of learning and the support of colleagues. She was aware the field was complex and deep learning would not occur over night. She commented:

Oh well, I'm not going to get all that just at the moment...maybe never (laughs)! But it does not really matter right at this moment because what I do get is that the kids will have access to these experts and it will be great for them to see me

¹⁸ Brian was an academic with expertise in nanotechnology

learning alongside of them as well. What's also important is my ideas of how to design the Central Study so it flows for the kids...you know take ideas they will get without too much stress and then move to more complex ones.

The learning affordances provided by the opportunity to work with academics as professional partners was described in more detail in Chapter 4 (see p. 164) and while there was much evidence that this was significant in developing teachers' content knowledge Lisa's response provided insight into additional understanding of her role at the school. Lisa recognised her learning was not just about new content but about how to ensure that students could access the content in a meaningful and cohesive way. She acknowledged the importance of effective curriculum design and her opportunity to develop skills in this area. Lisa was afforded the opportunity to understand more deeply the teaching – learning process and challenge the notion of the need to be an expert in all things if the appropriate processes and resources for learning were accessible. Lisa came to understand the importance of her role as curriculum designer as well as teacher. One outcome of such learning opportunities resulted in Lisa's subsequent engagement as a curriculum designer at a national level (described in more detail in Chapter 6, see p. 265).

Lisa continued to extend her content knowledge in the area of nanotechnology and was well supported in this through a scholarship she won. Lisa was encouraged to apply for the scholarship and supported in her application by the leadership team at the school. Lisa travelled to the United States of America to participate in a professional development for teachers of nanotechnology. On her return from this trip she presented her learning to colleagues and other interested parties providing a written and photographic summary of her learning. The focus was on deepening her understanding of content in this field so that this could be incorporated in the curriculum design for Nanotechnology when it was next delivered. Her new knowledge could also be shared with other teachers in the school and academics as well. Lisa's presentation focused specifically on content rather than pedagogical aspects associated with teaching the CS. However, another important factor in Lisa's learning about pedagogy was afforded by the students at Fulton.

5.2.6 Deeper learning through interactions with students

Lisa's learning continued as the Central Study (CS) on Nanotechnology progressed and she gained feedback from students (STU), listening to their own discoveries and sharing these with other colleagues assisted her learning greatly; indeed it transformed many of her perceptions about the more traditional teacher-learner scenario. Lisa had always felt confident in her knowledge base for other CS, but Nanotechnology was very new to her and resulted in Lisa learning alongside of the students. She initially felt anxious about this but recognised the

perception was based on her existing sense of professional identity where the teacher held expert content knowledge. The perception shifted with Lisa's time and learning at Fulton but was transformed following her work on the Nanotechnology CS and the influence of students on her sense of professional role was evident in the following reflections:

I just like the excitement of the kids saying...hey Lisa I read this and such and such and such...and oh yeah that makes connections with that stuff you talked about...they'd add more to the stuff I had and it was them sharing their excitement with me that I really enjoyed...and really they were teaching me new stuff as well. Oh, another really exciting thing was with designing the nano products because the products were so huge and widely varied....you know they were pretty amazing ideas...these were incredible things and I'd be saying...'are you sure you can do that' and they'd say, 'yeah, yeah come and have a look at this website'... I was so excited by their ideas and I guess they sensed this excitement as, 'wow I taught my teacher something'...I guess that's what Fulton was really meant to be.

In the CS the students themselves decided what they wanted to do was come to the lessons prepared with the questions that they wanted more help with and wanted to do more on...and most of them wanted to do it in groups. This was something we had been working towards in previous CS but it really seemed to be working well in Nanotech...I kept wondering whether this might be because I didn't come across as the expert and because I got excited about their new findings and ideas they kept driving the learning instead of me trying to excite them by my understanding of a topic.

Students' feedback and behaviour throughout the Nanotechnology CS acted as an affordance for Lisa's ongoing learning about her role as a teacher and the factors that supported students' self-directed learning. Lisa also commented on how students proved to be a powerful influence on her understanding of the link between collaboration, quality relationships and effective teaching and learning:

I've learnt to listen to the students...Collaboration was something I had given lip service to in the past but I really understand the power of it now, both between teachers, students and teachers learning with teachers.

5.2.7 Learning through reflective practice and action research

A further aspect of Lisa's learning that proved significant was supported by school's professional learning strategy (PLS). The PLS provided an option for all teachers to engage in tertiary study leading to either a Graduate Certificate in Education or a Master of Education. Some topics in professional learning were purposely designed for the teachers at Fulton and others were selected from the existing topics on offer at the University. Lisa selected a professional learning topic that engaged teachers in action research and keeping reflective journals. Lisa was in the first group of teachers to undertake the topic. The outcomes of Lisa's learning in the topic had profound implications for ongoing assessment practices at Fulton and provided valuable data for this thesis as well. Elements of Lisa's learning were initially shared in Chapter 4 (see page 160).

Lisa and her colleagues had spent considerable time in discussion about the purposes of assessment and how to manage assessment of the interdisciplinary curriculum. They debated which assessment processes would satisfy the requirements of the state-based assessment board. The following extract indicated the challenges teachers faced as the school commenced operation.

Lisa: In reality SACE¹⁹ started out as an outcomes-based model but it has changed from that, we can now determine the activities first and then link them to the outcomes.

TC: There is no way we can supply the number of assessment tasks required for the year as we haven't designed them yet.

TC: But we really need to move on this quickly as the students really need them.

TC: There seems to be several different ideas about assignments but we really need to be grappling more with the learning/assessment link.

While the conversations about assessment practices continued between teachers, Lisa was the only person to follow through on this area in her action research. Lisa's interest in assessment was based on a number of factors including previous experiences in other schools and the challenge of doing something new at Fulton. The following extract from Lisa's journal indicated how previous experiences with state wide requirements for assessment contributed to her understandings:

In my teaching career I have gone through many different styles of assessment in senior schooling. It is great that we have moved away from the exam being the complete decider of pass or fail. I have taught school-assessed Biology when mastery of learning was important and been frustrated on the 8th attempt when students still could not do a task. I've been through the ticking off the objective – giving two chances for each with the students only having to achieve the standard once (this resulted in the students getting a satisfactory achievement for SACE and yet failing Stage One Biology because they had decided not to work after meeting the SACE objectives). The reality was that even though each teacher was supposed to be keeping a close record of each objective it was just too cumbersome. I was shocked to find out of 7 Stage 1 Science teachers at my previous school I was the only one following the prescribed procedure. This was one reason why the Stage One procedures for determining SA, RA, and RNM²⁰ were changed in 2002.

This extract indicated that Lisa has had many experiences of different approaches to assessment, could see the pitfalls associated with different practices but was diligent about following required practices to ensure her students were not disadvantaged. Lisa recognised that assessment practices were an important issue in the teaching and learning process and brought this belief with her to Fulton.

¹⁹ SACE represents the South Australian Certificate of Education, the formal certificate achieved on successful completion of secondary school.

²⁰ SA represents Satisfactory achievement, RA; Required achievement and RNM; requirements not met.

The following journal entry was based on responding to a series of questions to help Lisa define her area of focus for the action research from the perspective of trying to define an area for her action research project. Questions included: “What do my practices say about my assumptions, values and beliefs about teaching?” and “Where do these ideas come from?” (Smyth et al., 1999).

I like to be very organized. I see that assessment is an ‘end product’ of the teaching process so that the students have every opportunity to be successful. This means a lot of emphasis is placed on scaffolding of the learning and the tasks. Ideas have come from being disappointed in students’ work then analysing why. Often it is because I have not been explicit enough about what I was after. Setting PES Biology exams brought home to me the power of language – seeing how people interpret words in very different ways. It is a worry that a transforming school has to be so caught up with SACE but we have always said that our students would be able to achieve the SACE. We want to be at the leading edge creating our own assessment style yet our students need to meet SSABSA requirements to get the SACE.

The entry provided some insight into Lisa’s perception of her role, in particular she does not choose to blame the students for disappointing work but queried the influence of her own practices on their outcomes. Lisa’s perceived her role as teacher influenced the quality of student learning outcomes.

Lisa also labeled the school as a ‘transforming’ school – suggesting that teaching and learning at Fulton was different from her work in previous schools. She commented on the challenge of trying to change existing ways of working while still being required to meet current state-wide assessment criteria. However, Lisa was keenly aware that students’ needs were the priority and therefore finding a way to meet existing criteria within an innovative model of schooling was a challenge to be addressed. Lisa went on to complete a very comprehensive action research project analysing the value of using assessment rubric for students at Fulton. The outcome of the project resulted in teachers at the school all using rubrics to provide transparency and clarity of expectations for students’ learning. Lisa’s project is referred to again in Johann’s story in this chapter to highlight to value of teachers engaging in such learning on policy and practices in the school. Lisa’s learning was self-directed and comprehensive, she presented her findings to colleagues and displayed deep knowledge about assessment processes that would best support their approach to learning at Fulton and meet the state-based criteria.

5.2.8 Learning from Lisa’s story

Lisa was clearly a highly motivated learner who acted as a leader for other colleagues’ learning as well. She engaged with a variety of affordances that resulted in some very significant learning for her and the school as an organisation. Her work in Nanotechnology

provided the impetus to offer professional development workshops for teachers from beyond the school and internationally as well. Lisa led a group of students and other teachers to India to work with teachers and students on interdisciplinary curriculum and nanotechnology. She was engaged as a project officer in a national curriculum writing project while maintaining a part time position at the school. She completed her Master in Education and then commenced studies in a professional Doctorate. She was an inspired learner and inspired other teachers and her students to engage in deep learning as well. Such outcomes were certainly attributed to Lisa's own affordances of motivation and openness to new ideas but one of her reflective journal entries also highlighted the very critical role working in such an innovative school played in her learning and that of her colleagues as well. She wrote:

Teacher research is part of three things that go together to make change: restructuring, reculturing and pedagogical change. We are very lucky at Fulton because the restructuring has been done for us. The reculturing is occurring because many of us want a change in culture. We are now doing the pedagogical change that is necessary for us to work in this very different environment. This is different from trying to make pedagogical change in my previous school. When you have to do the restructuring and reculturing at the same time with people who are not ready to change it is very different.

Lisa was aware of different factors associated with change and appreciated the opportunity that Fulton represented including working with others interested in change and working within a restructured timetable and curriculum model that allowed for different approaches to teaching and learning. She acknowledged that Fulton provided affordances for learning that her previous experiences in schools did not. There was a sense that the many innovative aspects of the school, while at times demanding great emotional and intellectual work, ultimately generated enthusiasm in teachers for learning. And that the outcomes of teachers' learning contributed to the ongoing innovations and change processes that situated the school as a model of excellence in science and mathematics education. Scott's story to follow connects with many affordances for learning identified in Lisa's learning journey but it is also unique in many ways too, commencing with the fact he was a graduate teacher without the background knowledge of more experienced teachers.

5.3 Scott's story

Scott's story was selected to illustrate how teachers' prior knowledge, beliefs, experiences and sense of personal agency influenced teacher-located affordances such as *motivation* and *openness* for learning. The alignment of teacher-located affordances with contextual, organizational and relational affordances including in this case, *sustained dialogue*, *being innovative*, *physical proximity*, *teacher colleagues*, *students* and, *distributed leadership*, resulted in valuable outcomes for the teacher and school. The case is based on Scott, a young

graduate teacher whose only teaching experience was as a student teacher in two quite different secondary settings. However, Scott was completing his doctoral studies at the time of his employment at Fulton and had deep content knowledge in the field of chemistry. His background story captured Scott's passion for science and his previous learning experiences and preferred style of learning. The combination of Scott's *motivation* and *openness* to new ideas and challenges and in particular, the affordance of *distributed leadership* led to a graduate teacher becoming a leader of pedagogy and change in just over a year at the school.

5.3.1 From research scientist to teacher

Scott was one of two young graduate teachers appointed to Fulton several weeks prior to the school's opening. He had completed a Bachelor of Science (Honours) in Biotechnology and then went on to Doctorate level study. In an interview shortly after his appointment at Fulton I asked Scott why he decided to become a teacher, he responded:

Boredom...All through school I just wanted to go to uni, get a PHD and be a research scientist. But having experienced what it would be like it was just, 'Oh I don't want to do this after all'. I loved the idea of science and I figured it would all be full of discoveries...I enjoyed studying and learning new stuff all the time...once you get to the research that sort of stops, then it slows right down and it goes onto...learning about this tiny little area really, really well. Whereas I was looking up stuff on physics and astronomy but you can't waste your time on that. You focus on this enzyme type and that's it.

Scott's response provided some initial insights into his personal characteristics. He was a motivated learner who knew what he wanted to do, he liked to be challenged and he was motivated by science of all kinds. This interest was also reflected in his comment made prior to the school's opening on what he liked best about the concept of Fulton:

I like the Science, I think is the best bit...they have a constant Science focus [which] is good because I mean you may as well just keep it in my interests there's nothing really outside.

At the point in time, Scott was mainly engaged in supporting the interdisciplinary curriculum writing process and loved the opportunity to engage with different discipline areas. He had yet to commence teaching and the focus of his work was primarily on getting the curriculum in shape for teaching. The comment was important as it captured a young graduate with a passion for science but little experience of the complexities of being a teacher. The shifts in Scott's thinking about his teaching and the school, and how they were influenced by the affordances generated by the school's professional learning focus, are elaborated in this case.

5.3.2 Previous experiences of learning and sense of self as a teacher

Scott's previous experiences of learning as a research scientist and as trainee teacher provided an insight into his preferences for, and understanding of, the learning process. He reflected:

I walked into the PHD and it was already set up. I didn't really have a choice. I was interested in what the topic was so I wasn't fussed there but it's hard to add your own interests...I directed my learning through reading journals, sort of finding out new information and taking stuff to my supervisor and likewise he was going, 'Yeah, you might like to read this'. But when I was coming up with experiments like, 'We should do this' I got the response... that's how you have to do it, that's how it is done, there's no sort of changing the process...

Scott went on to contrast his perception of the one year teacher training course he completed:

It was frustrating at the start because I was used to not so much choice...from a Science background people tend to say here's your list of assignments, here's your list of where you have to be and this what you have to do and this is what it's worth, and so you sit there and you know exactly what it is. I'm not having a go at the Grad Dip Ed but nothing seemed really clear to me...like what did I have to do to pass...you walk out of there going, 'Oh, how do they function?'

The response reflected Scott's preference for clarity in learning expectations and processes to get to the desired outcomes. This preference appeared at odds with Fulton's focus on inquiry-based and self-directed learning and as such the opportunity to spend time on understanding Fulton's philosophy proved a critical element in Scott's professional learning. Scott participated with other staff in completing the Hermann Brain Dominance profile and reflected on the outcome, "I know that I am strong in the blue and the green and that's how I like to learn. If I'm making notes for myself to learn, that's what I do but I know other people are different...I'll need to think about that in my teaching." He was very focused on his role as a teacher, and given his expertise in many areas of science and limited teaching experience this was to be expected. He commented:

For me teaching is a serious role, so you have to take it seriously and think what do I do here...there's a voice in my head going, 'No, no you're the teacher, no, no, no you've got to teach. You can be friendly but you can't be their friend' and that sort of stuff.

Scott, like many graduate teachers, was trying to determine the types of relationships that were appropriate and supportive of his position as teacher. For this, he could draw on his own experiences as a school and university student and his teaching practicum experiences. In general, this was based on teachers as the authority who directed how much of student learning would occur. Scott, as with many young teachers needed to "find his feet as a professional" (Hargreaves, 2005) and do this within a school which was very different in its environment, organisation and expectations. Scott faced a situation where the vision for teaching and learning

at Fulton was quite foreign to his own experiences and existing beliefs. The explicit focus on teachers' professional learning was critical for Scott as it provided opportunities to engage in *sustained dialogue* about effective teaching with colleagues and experts and to challenge his existing beliefs. He was fortunate that the school was new and innovative and many teachers' existing beliefs and practices were called into question. Hargreaves (2005) said that when young teachers commence at a school they are often faced with an "adult culture that is centred around the demographically and politically dominant group of experienced colleagues (Johnson et al., 2004) quickly [finding] themselves isolated and unsupported, prone to concentrate on survival and compliance with the existing culture" (p. 971). Scott was fortunate that there were no existing dominant paradigms, everything was new and the presented opportunities to develop a school culture that looked very different to schools that are more traditional.

5.3.3 *New culture and new learning opportunities*

Although there was no history to teaching and learning practices at Fulton, or an ingrained culture, there was a vision. To fulfill the vision, *sustained dialogue* about the purposes of the school was required for all teachers, new and experienced. A new vision did not stop more experienced teachers bringing familiar patterns of thinking about schooling and students and as such, *teacher colleagues* were an influence on Scott's developing sense of his identity and work. However, the sustained dialogue and affordance of *being innovative* engaged teachers in focusing on new ways of working. Scott's inexperience possibly worked in his favour as he had not established familiar practices and his *motivation* and *openness* found him constantly observing how other teachers worked and interacted with students. Location of teaching stations and Central Study (CS) team members translated to affordances of *physical proximity*, *interdisciplinary curriculum* and *teacher colleagues* that all influenced Scott's learning. There were multiple opportunities for Scott to learn and feel a part of a new and dynamic culture but his reflection on learning through the affordance of physical proximity highlighted the importance of his own theorising on outcomes.

I think the environment's been one of the biggest contributors, purely because you can't escape it, but I seem to notice some things and not others, I notice the stuff that interests me...like [Philip] is really, really good at that questioning...like he'll have the whole class and they'll do most of the talking while he's questioning...I watch and think ... 'I get why he is doing that...I could do that too even though I want to just tell the important stuff first'...even if it's a small idea or activities...it can a big difference to teaching.

The reflection provided a sense of the struggle Scott was having with his preferred and familiar ways of learning and the learning he was gaining from the sustained dialogue about how to support deep learning. Scott was aware that one of the processes to support deep

learning involved open ended questions and his teacher colleague provided a concrete example of how this was done. Such learning opportunities were incidental and occurred within Scott's daily work but such a connection required a foundation and this appeared to be the sustained dialogue about effective teaching and learning at Fulton. Such processes for supporting teachers' learning could not be designed or perfectly timed but required a foundation built by exposure to such ideas, in general through the school's professional learning strategy, together with teachers open to learning and opportunity to see such ideas in practice. Such interaction of processes that supported and sustained teachers' learning was fundamental to representing the explanatory model of professional learning at Fulton as being connected across contextual, organisational, relationship and teacher domains.

Scott was part of a CS team and he acknowledged that this opportunity was also a valuable affordance to his learning, particularly in its influence on increasing his content knowledge in less familiar disciplines. However, the content learning was not the problem. Teaching material designed by other teachers was a bigger challenge. He reflected:

I think I like working in a team but I don't like teaching other people's stuff. Maybe I'd like to get it beforehand and have time to read it and even if I have to adapt it slightly to suit my style. I don't feel comfortable teaching their way. I guess the way or style they planned is still good teaching but maybe the language of the activities is not something that I think will work as well as another idea I have...you know doing it in a slightly different way.

The reflection provided evidence that pedagogy was clearly a priority on Scott's agenda. He wanted to make sense of content from a perspective of how he believed students would best engage and learn. The level of reflection and desire to adapt and modify plans from more experienced teachers suggested Scott was committed to developing his own deep understanding of what works. More experienced teachers did not intimidate him and this appeared connected to the innovative environment, and a generative culture built on trust, respect and collaboration. Scott's ideas were as valid and valued as any other teacher's even if he was a novice teacher. The open nature of the school provided scope for others to notice what Scott was doing and the leadership team recognised his ability to support student learning through designing highly relevant and engaging sessions. I observed on many occasions his highly creative use of media, analogies and authentic learning experiences. I also noted Scott's popularity with students as he engaged in lunchtime sport and student generated conversations. Scott proved to be a very effective teacher and acknowledged the supportive and collegial environment, the leadership team's belief in him and the many and varied incidental and intentional learning opportunities as critical to his success.

5.3.4 Learning through the affordance of distributed leadership

Scott cited the opportunity to take on the role of Year 12 teacher of Psychology, a subject being offered for the first time at state and school level, as one of his most significant learning experiences in his early years at the school. The option to take on this challenge was provided for Scott through the leadership team's belief in *distributed leadership* and the recognition that Scott although only moving into his second year of teaching was ready for this challenge. The leadership team constantly promoted leadership of pedagogy and believed Scott was emerging as a leader in the area through his innovative ways of engaging students. The vision for *distributed leadership* proved a significant affordance for many teachers at the school and the outcomes also served to support the leadership team's vision as captured by Davies, et al. (2004):

Leadership of learning demands the creation of an ethos and culture about learning throughout the school and is not an activity to be vested in a few. It is generated by leaders who consistently demonstrate an overwhelming confidence in their own ability to learn and to lead the learning of others. It is the development and establishment of an attitude that is contagious. It's an activity that needs the attention of all in the school community and a pattern of leader behaviour that demonstrates confidence and trust in others to demonstrate their leadership.

The leadership team *trusted* Scott to be a leader in the Psychology topic and was confident in his abilities to design and develop the topic in accordance with the state-mandated requirements but also to fit the culture of learning and teaching at Fulton. This was not an easy task and required attending a two week intensive course offered by the university to teachers across the state teaching the topic for the first time. Most teachers at the course were highly experienced but once again with limited content knowledge. Scott reported he spent much of his summer vacation planning the course. He consulted other colleagues and people from the university but as he realised, needed the topic to make sense to him before he thought he could teach at the high stakes Year 12 level. He commented on his planning process:

I guess at the start of the year I ended up with this massive list of all the possible things I could do. I had the first 4 weeks planned out before I even started and I was so focused on doing the right thing that I used the text book we were provided with...I mean this was familiar for me and I like using text books to learn but at [Fulton] we did not use them at all but this was year 12 and the first year so I followed what teachers in other schools were doing...I found out about 3 lessons in that the text book was useless so I had all these lesson plans that needed changing but then I thought this is all based on scenarios and I could use stuff from the [newspaper] and even the Simpsons...like Homer has all the definitions of mental health issues and I'd pose the question...what would he be diagnosed as? Would it be a personality disorder? It's was pretty clear to the students that the Cookie Monster was obsessive compulsive and so on.

At this point Scott was engaged in quite intentional learning as a result of the pedagogical leadership opportunity he had been provided with. He certainly had *access to expertise* but it

was leadership opportunity that aligned well with Scott's own level of *motivation* for learning and doing new things.

Scott attended a state-level forum for teachers of Psychology during the first semester of the subject being offered. The forum was designed to share experiences and debrief about issues of concern. The lead author of the text book specifically developed for the topic was present and although Scott was a relatively inexperienced teacher he willingly shared that he found the text book unhelpful. He said:

I explained that I didn't really use a text book and gave examples of movies and bits and pieces I used that the kids connected well with. Three or four questions were asked like, 'how can you not use a text book?'...they said, 'how can you control what the students are learning then?' I thought who wants to control their learning other than to make sure they have the big ideas well in place...and as for the text book...I had always found them useful but now I saw how restrictive they were of what I could do...I think this came together for me...that's what was really different about being at [Fulton]...learning can be much more interesting if you really think about it.

The reflection captured the vision of Fulton to open up the opportunities for students' learning rather than confine them to text books. It also captured how a leadership opportunity provided for an inexperienced but highly motivated teacher resulted in a lesson on learning and curriculum design being afforded to more highly experienced teachers and professionals outside of the school.

Scott became the expert in teaching Psychology at Fulton by the end of his second year at the school. Although the subject was externally assessed which added pressure to the content Scott needed to cover he continued to adhere to his emerging belief about deep learning. He stated in reflecting on the experience:

The problem was I wanted to encourage their learning as much as possible, to go deeper, ...we got into some great discussions but at the end of the day they were only getting assessed on a certain part of the stuff we were getting into...it was great to have all the other stuff but I had to balance what was going to help them pass...I guess you need to keep it in perspective but it made me realise how restrictive exams can be.

Scott's students' results in the exam were above the state average. However, he continued to talk at length about how he would modify the course for the following year. He was well on the path to leadership through the trust placed in him by the leadership team, the supportive environment and the mindset of being innovative. The vision and affordance of *distributed leadership* at the school generated an intentional professional learning opportunity that resulted in positive outcomes for Scott, his students and teachers at other schools as well.

5.3.5 Ongoing intentional learning for pedagogical leadership

Scott's experiences and his constant desire to learn about new areas resulted in the completion of tertiary studies in professional learning and neuroscience as part of the more formal professional learning strategy at the school. He emerged as a key presenter of professional development in these areas for visitors to the school. In addition, he had primary role in mentoring undergraduate students studying to become science teachers. In Scott's few short years of teaching at Fulton, he had become a leader of pedagogy and curriculum design and development. Such outcomes contributed to the scope of professional learning options that could be offered locally, nationally and internationally as well as Scott's sense of professional identity. The interaction of several teacher- and school-generated affordances provided for learning outcomes well beyond initial expectations, as was the case for many teachers at Fulton.

5.4 Jackie's story

Jackie's story was selected as a case study as her detailed reflective journal completed as part of her intentionally planned professional learning provided an excellent example of a number of affordances for learning including, *action research* (via the professional learning strategy), *reflective practice*, *language for learning*, *writing to learn*, *teacher colleagues* and *students*. The journal also provided evidence of the outcomes of Jackie's growth in pedagogical and content knowledge and the development of her professional identity. Jackie's story, although focused on specific affordances for learning portrayed the influence of interactions between contextual conditions, organisational elements, relationship factors and a teacher's individual characteristics. Jackie's intentionally planned learning was made possible through the school's culture of learning and supportive leadership, the professional learning strategy which made access to the tertiary topics possible and the relationships that developed between Jackie, university partners and her students. Jackie's own motivation and level of reflection aligned well with these factors to generate many positive learning outcomes.

5.4.1 Jackie's background experiences and beliefs

Jackie completed a pure mathematics degree before commencing her post graduate teaching qualification. She went from high school to university and back to teaching in schools. She had been teaching senior secondary mathematics for seventeen years when she applied for a position at Fulton. Her application was based in part on another colleague at her previous school also applying for a position at Fulton. Jackie acknowledged that this colleague has been a great mentor to her. Jackie was enthused about the opportunity to teach at a school that valued and prioritised mathematics and she was prepared to forego the five minute journey to her existing school and make the hour long journey twice a day to teach at Fulton. Jackie was an active

member of the State Mathematics Teachers' Association which provided her many opportunities to engage with mathematics teachers beyond the school. Jackie was a mid-career teacher with strong discipline knowledge, she was the only female teacher in the Mathematics and Abstract Thinking (MAT) team and her primary focus was on teaching students rather than leadership positions or curriculum writing. She had very little to do with the other Central Study teams and their curriculum development as, even at Fulton, specialised mathematics teachers were in short supply.

Jackie was part of a very dynamic team led by Barry (introduced in a case study to follow). She also co-taught with Johann in some Year 12 topics. She was content to let others lead as she concentrated on teaching and learning in a new environment. Her professional identity was located very much in the role of teacher of mathematics and supporting students to be successful although she believed higher order mathematics was not for everyone. She commented that what she liked most about her work was, "Watching students getting really involved in their learning and asking questions that indicate they are moving to the next level of understanding" and what she liked least about her work was, "working with students who have no interest in the subject they are studying." This is was an interesting comment as it indicated that Jackie either believed students were responsible for their lack of motivation for mathematics or the mathematics curriculum lacked relevance. Her reflection did not refer to her teaching as being an influential factor in students' ability to be motivated in mathematics. This was possibly because Jackie felt very confident about her content knowledge and she had many students who had previously achieved great success in their final year examinations. However, the belief that students are responsible for their failures and that this generally occurs through lack of motivation is a belief held by some teachers (Brophy, 1998, Westwood, 1995). Given Jackie's perceptions of her role and the role of students I was interested to follow her professional learning pathways and in particular the outcomes of her learning.

Jackie voluntarily completed three surveys and an interview for my research. She also participated in the tertiary topics offered as part of the professional learning strategy although she did not enrol until the third year of her appointment at Fulton. One of the topics involved keeping a reflective journal and this also provided a rich source of data to develop an understanding of the processes and outcomes of her learning at Fulton. Although I worked closely with Jackie through the professional learning topics and she worked with a number of other university partners around content knowledge she never made mention of university partners as an affordance to her learning. Rather she consistently mentioned the affordances of the Fulton environment, her colleagues, the students and the leadership opportunities that ultimately came her way. However, the focus of the case study is on her *reflective practice* and

writing to learn as significant affordances to transforming her sense of identity and role in the school.

54.2 Reflective practice and writing to learn as an affordance for learning

Sustained dialogue was a common feature of the Fulton environment and teachers engaged in lengthy discussion with each other, university partners, the leadership team and students about any number of issues associated with teaching and learning. The dialogue played an important part in teachers' learning however without the opportunity to reflect in a prolonged way learning may be surface level and have little effect on changing practices and beliefs. Moon's (1999) Map of Learning (see Chapter 2 page 31) highlighted the importance of quality reflection processes on supporting deep learning. Prolonged reflection that involves the use of protocols and documentation can result in deep learning (York-Barr et al., 2006). However, reflection through writing provides a more considered process to support learning. Atkinson, (1994) said,

It would seem the process of writing actually helps the 'reflective process' (Rowland, 1982, cited in Walker, 1985, p.185). Writing is a way of thinking that has the power to externalize something, to take it out of just thought, into a form where it can be considered in more depth and related to other aspects of the research. (p. 387)

Jackie's writing provided a foundation for her own learning and evidence of the influence of background and exiting beliefs on her practices and alignment with affordances that supported her learning.

An early entry in Jackie's journal captured an insight into her perspective on teaching and through reading some research on novice and experts learners, (Bransford, Brown & Cocking, 1999) an opportunity to reflect on her beliefs and understand herself as a learner.

I could relate to the statement that "experts" forget what is hard. There are many parts of the school maths curriculum where I find it hard to understand why students have difficulties. The concepts and practices are second nature to me and I cannot remember ever finding them challenging although I probably did.

I think that I am probably an artisan rather than a virtuoso as I can usually do a task given to a high standard but find it difficult to be more creative and develop that task further.

Jackie's acknowledgement that she was an 'artisan rather than a virtuoso' was possibly linked to the fact she was working with people like Barry and Johann who were constantly developing new and interesting curriculum and ways of working with students. Teachers who perceived they had less flair for some of the work at Fulton were constantly working with teachers with great skills and creativity for such tasks. Such a situation could act as an inhibiting factor to teachers' learning and leadership possibilities. However, it appeared that

Jackie was happy to leave this work to others and the leadership opportunities it brought with it. I was interested to see whether this position was maintained over time, what factors shifted Jackie's perceptions of her abilities and how these were linked to the explanatory model of professional learning.

5.4.3 Tracking shifts in Jackie's thinking

The following lengthy reflection, divided in to several sections, was completed a fortnight after the entry detailed in the previous section, and in many ways it captured a shift in Jackie's level of responding from a personal perspective to the identification of bigger issues associated with education. However, she then acknowledges the value of a deepening understanding of her beliefs and practices and identified that teachers can and do make a difference to students' learning. This revelation appeared at odds with her initial beliefs about students' performance in mathematics being based on their own levels of motivation.

I thought it interesting that we as teachers want to have the general public regard us as professionals while many teachers do not always approach the task of teaching in that way. The teaching force is aging and some older teachers are unwilling to reflect on what they do. If we are to be thought of as professionals then we must be accountable in what we do and to be able to provide credible reasons as to why we do it.

Having a language to describe what teaching is and how it is done is important. A mathematician has access to a very formal and codified language with a large body of symbols and vocabulary that is recognised by all mathematicians. It is possible for a Russian speaking mathematician to write a problem in Russian and an English speaking mathematician would have a fair chance of being able to solve the problem.

Teachers, on the other hand, do not always agree on the names given to the same activity or will have several different interpretations that can be quite diverse for the same term. What is "Constructivism"? What is meant by "Deep Learning"? These terms have different meanings for different teachers not only in different education systems across the world but often within the same school. This lack of consistency means that it is not easy to adapt what others may indicate is a very worthwhile task to your own situation. You will not only have a unique group of students that will not react in a the same way anyway, but you will not carry out the task in the same way if the language used is not agreed upon within the profession.

The last reflections provided evidence of the influence of, not only the readings Jackie was engaging with through the topic, but of the explicit focus on learning that generated constant conversation among members of the school community. Jackie does not refer directly to these conversations but the use of terms such as deep learning and constructivism together with the observation that consensus is hard to reach even within a school is a direct connection to her experiences at Fulton. The ability to connect concepts and understandings across different professional learning experiences and opportunities was an important element from two

perspectives. Firstly, it served as evidence of the system-based foundation of the professional learning strategy and secondly, it resulted in deeper understanding of learning and the complexities associated with teaching for deep learning. As Jackie continued to read, write and reflect, her previous perceptions of students' and teachers' role in learning were transformed.

5.4.4 Clarifying beliefs to develop new understandings supported by the affordance of physical proximity

Jackie continued her reflective journal and it was a reading that acted as a catalyst to shift her attention to defining effective teaching and the challenges associated with this reflective process.

From the reading "Thinking about Learning and Learners" I was asked to consider a series of questions that reflected on teaching practice and beliefs. The first section, with more directed questions, was probably easier to complete because there was less need to dig deeply into your thoughts. The more open nature of the second question meant that there had to be a greater degree of self awareness. It is always a good thing to do because it forces you to re-analyse and re-evaluate your beliefs and practice.

I thought it interesting to consider the idea that a large amount of knowledge is gained incidentally. I have always known that there are students who will learn almost in spite of the teacher and will always do well. These students are able to gain some insight into what the teacher is presenting and to go beyond that to internalise and construct their own meanings around what is delivered. The method of delivery is fairly unimportant to these students. While they will perhaps learn more and faster in an environment that is conducive to their learning style, they will still obtain the required ideas and processes that they need.

There are also students that will pick up on unconscious actions of teachers. The ways that they interact with other staff and students will indicate a great deal about values and beliefs that they may never have thought to impart.

A "good" teacher will be aware of opportunities to use this incidental learning to the benefit of their students. It can be as simple as being aware that a particular student has a particular interest and the teacher will try to include examples that involve that interest. It may be that a topic is introduced by a student that only has a tenuous connection to the current topic. With careful direction of the conversation, the teacher may be able to use this detour to inculcate an important idea, whether about the topic or on a quite different but equally important area.

It is obviously important that a teacher has a good knowledge of their subject. It is also important that a teacher is aware of the ways in which it is best to convey the important ideas and processes in that subject. One teacher that I would consider to be exemplary is able to encourage, engage and enthuse his students. He is able to relate the work that they are doing to many different situations that so they are able to see the relevance to their own lives. He is able to get the uninspired and disinclined students to at least attempt the work and do their best.

Jackie's perceptions of what it meant to be a good teacher were generated by connecting her own perceptions with the reading and reflective writing process. However, in the final paragraph of her journal entry there was direct acknowledgement of a colleague as an effective

teacher who was able to inspire students. Jackie's opportunity to make this connection in her learning was based on the affordance of physical proximity. The addition of this affordance served to enhance Jackie's learning. She made the connection between teachers' skills and abilities as being pivotal in engaging disinclined students. She read about it, she reflected on it and more powerful still, she could see it in action. The processes that supported and sustained her learning reflected interaction between context, organisational elements, relationships and teacher domains again reinforcing the system-based complexity of the explanatory model of professional learning at Fulton.

5.4.5 Use of specific language to describe the learning process

Jackie completed her reflective journal entry making use of Moon's (1999) Map of Learning to track her own learning. The availability of a specific language to describe her learning proved powerful as she was able to note the difference between her learning about pedagogy and her learning about content. Jackie recognised the need for more concrete experiences when learning new content but through the use of Moon's language for different stages of learning she could clearly identify where she was at and where she needed to go next. Such clarity of understanding about the learning process was not always forthcoming in the teachers at Fulton prior to the use of Moon's Map. The accessibility of the language and the connection teachers made with the stages provided an excellent tool to deepen understanding of the learning process for students as well. The identification of this affordance for teachers' learning proved to be a significant finding in the thesis. Jackie's following extract provided evidence of the value of the *use of specific language*.

I think that with this topic I am at the "Making Sense" stage of learning. I am being presented with new ideas or renewing and revisiting existing knowledge and I think that I am processing and organising that information into a cohesive system.

With many areas of Mathematics I am at the Transformation stage. I am able to use my knowledge in a variety of situations, whether I have seen them before or not. I can recognise types of problems and the patterns that are associated with them.

An area that requires a more concrete approach at the moment is the area of Statistics. This is a topic that has only recently become of greater importance in the Secondary School Maths Curriculum. As a result, I and many other maths teachers in this state have had to learn or relearn the mathematics associated with this topic. At this stage I believe that I am probably at the Making Meaning stage in that I can set and complete the problems required of the students at this level but I am not able to extend the ideas very far beyond this point.

Of the three Thought Processes in Teaching presented I am probably more focused on, perhaps too focused on, the "how" rather than the "why". I concentrate on the processes and theoretical knowledge that is required rather than on developing the ability in students to see for themselves why it is important.

Again I have been shown that it is important to reflect and analyse so as to improve practice.

5.4.6 Outcomes of Jackie's learning; transforming practices and professional identity

Jackie's decision to focus on explicitly helping students to see the purpose and/or value of their learning is well supported by research on effective teaching practices. Assisting student to understand why they are learning something has been associated with increased effort (Brophy, 1998, Feather, 1982 cited in Barry & King, 1998). Jackie went on to complete a very focused and comprehensive action research project as part of the university topic. The focus of her project was how to engage students more in a very structured CISCO²¹ qualification course offered by the school. Jackie had only just trained in the area and by her own admission felt 'only one step ahead of the students'. She realised to be successful much reading was required and worried about the impact on students' perceptions of the course and their levels of motivation. Jackie employed the knowledge she had already generated about motivation but she also conducted surveys with the students prior to the course as to their expectation and desired outcomes. She made some specific instructional changes to the course she had experienced and documented the outcomes over time. She completed a final survey gaining students' feedback and was encouraged by their responses. A final task of her action research was to share the findings of her project with others in the topic and interested colleagues. Her journal reflection about this requirement provided interesting evidence of her sense of professional identity and the subtle shifts that were occurring based on her engagement in the topic and the influence of students and colleagues on her learning.

I have started to write up the final report and I'm finding it hard to think of ways to show how I have changed and what I have learned. I can describe the changes that I have seen in the students and report their anecdotal comments but I am not sure in what ways I have changed. I have spoken to others and they have provided some suggestions so hopefully I will be able to use their ideas to build on.

Jackie's reflected on the ease in which she could describe changes and development for students but the challenges associated with her describing her own learning. This was a common theme for teachers when they were asked to describe changes in practices and reasons for the change. It appeared easier for other teachers to see changes in colleagues than in themselves. The process of writing about learning and having a language with which to describe the difference stages in learning was beneficial to Jackie and Johann, as detailed in his story. Jackie went on to reflect more closely on changes in her practice as a result of her learning. She used the word 'noticed' which was a specific link with Moon's (1999) Map of Learning.

I suppose the biggest thing that I have noticed is that I am looking at what I do more thoroughly. I am reflecting more on what I do which is something that I never really used to do in any formal sense. I suppose everyone finds it a challenge to look at themselves and to decide what is good and what needs improving. We

²¹ CISCO was a industry based computer networking qualification that required successful completion of external based examination for certification to be granted.

either decide that we are already perfect and can see no faults at all or are perhaps overly critical and feel that everyone else could do a better job than we can. I definitely fall into the second camp. While I can see that there are a lot of things that I do quite well I always think that someone else around me could do better, or knows more.

I have become more willing to see that there are good things in what I do and to be more open to seek advice and in some cases to give it. If nothing else this course has allowed me to achieve this.

Jackie had made significant shifts in her thinking and ways of working and yet in this final sentence she is almost apologetic about her outcomes of feeling more competent about her knowledge and understanding of students as learners. The tone of her response highlighted the link between professional and personal identities. Although Jackie experienced successful outcomes her connection with a person identity that she defined as 'overly critical' acted a roadblock to viewing her learning as important and worthy of recognition by others. As Hargeaves et al. (2001) said, the work of change is both intellectual and emotional work and Jackie's story provided an excellent example of the importance of acknowledging the emotional investment teachers have in their identities and work and how they can be supported through change initiatives. At Fulton support was provided in many ways but particularly through high quality relationships with colleagues and the leadership team. Such support provided a positive emotional climate in which teachers felt safe to share their anxieties and successes.

Jackie's final entry in her reflective journal provided evidence of a significant transformation in the belief that the least enjoyable aspect of her work "was working with students who have no interest in the subject they are studying" to finding this a challenge that she enjoyed. She had also developed a belief that recognition of students' perceptions of work was beneficial to her ability to support their learning. She comments on changes to her practices and management of content in the CISCO course but more importantly the impact the action research and reflective practice had on her relationships with students and her practices in general.

In summarising the work that I have done I have made several general observations. I have become more aware of the way that a student may perceive a task as opposed to the way that I might. In the past I have usually looked at a task from the point of view of how I would like to learn the concept associated with it. This is not always going to be the best way for students to learn the same thing. My perspective is going to be coloured by the fact that, like all teachers, I succeeded in the system. I managed to pass and go on to further study. This indicates that I knew how to, and was willing to, "play the game" at school. I saw good results and positive feedback from teachers and parents to be incentive enough to do my best. A large number of students look at school as a huge imposition and would rather be doing almost anything else. As teachers we need to find ways to engage as many students as possible. We must look at a task from their perspective and not be too quick to assign blame for lack of results. It may be that a student is not achieving because he/she isn't trying. The question that a teacher must ask is why that student

is not trying. Is it because they are not interested? If this is the case then the teacher, within reason, needs to find ways to make the work more interesting. It may be that the work is too difficult for the student, or they may have some form of learning difficulty that has gone un-noticed. If there is a known problem it is up to the teacher to adapt the tasks and the level of the work accordingly and not assume that every student will cope with the one level. If we can find out why a student is not trying as hard as they might and take a proactive role in assisting them with their learning, then the outcome for the students should be better and it is also possible that a disruptive element in a class made be removed. Students are often behaviour problems if they have learning problems of any kind. They feel that it is better to be perceived as the class clown or trouble maker than to admit that they have a problem.

I have now finished my write up. Throughout the course I think that I have made significant inroads into analysing the issues relating to the CISCO on line courses. I have made changes to the way that I approach the class and present the material. I also think that I have made changes to the way that I work in general.

My ability to look critically at what I do has improved and as a result I feel that I have become a better teacher. I am more willing to listen to students' opinions as to what they think and how they want to learn. I have developed better relationships with my students as a result. This has in turn led to more informative discussions with them in order to determine what they know and what aspects of their learning need to be further developed.

Through the action research opportunity Jackie built on her body of knowledge about attitudes and approaches to teaching that support improved student performance. She also learnt more about her professional self. Her engagement in the reflective practice as part of the tertiary topic was a critical catalyst in shifting her sense of professional identity. It is difficult to determine whether similar learning would have occurred if she had not engaged in the structured and intentional learning opportunity. However, the explicit focus on teachers' learning at Fulton provided her with this option and the outcomes acted as a catalyst for additional learning opportunities. Through the opportunity to share her learning with other colleagues and receive positive feedback and recognition she believed she had knowledge that would be valued by other teachers as well. She was offered the opportunities to act as a facilitator of the outreach professional learning program offered by the school for other teachers. She took up the option and although I do not have the scope to discuss how this in turn acted as an additional affordance to her learning and sense of professional identity it provided evidence of the connection between one experience of professional learning at Fulton that led to another.

5.4.7 Learning from Jackie's story

Jackie's story provided another example of how the interaction of specific affordances generated valuable learning outcomes teachers, students and the school as a learning organisation. In addition, two aspects of interest to the thesis emerged from the story, 1) the value of action research as a process for teachers' learning and, 2) the influence of teachers'

identity of their learning. Each aspect is addressed briefly here but again in more detail in Chapters 6 and 7.

Action research has long been recognised as a powerful process for teachers' learning (see Reason & Bradbury, 2001) as the learning is situated directly in the teachers' work and domain of influence. The action research process replicates the learning cycle, generally involving reflection on past experiences to generate new ways of working. Senge and Scharmer (2001) note, "the temporal source of reflective learning is *the past* – learning revolves around reflecting on experiences of the past" (p.246). This notion is of particular interest in the case of Fulton and Jackie's story as much of what teachers were required to do did not enable them to draw on past experiences. Of course past experience were influential in their thinking as they were entwined with personal and professional identity but the constant demand to work in new ways with new curriculum provided an opportunity to engage in 'emergent learning'. Senge and Scharmer (2001) proposed that:

The temporal source of emergent learning is *the future* or, to be more precise, the *coming into the presence* of the future. In emergent learning situations, learning is based on a fundamentally different mode of cognition, which revolves around sensing emerging futures rather than reflecting on present realities (Bortoft, 1996). The basic sequence of the emergent learning cycle is (1) observe, observe, observe, (2) become still: recognise the emptiness of ideas about the past or future, (3) allow inner knowing to emerge (presencing) (4) act in an instant and observe again (Jaworski and Scharmer, 2000). (p.246)

Fulton was an ideal environment for teachers to engage in the cycle of emergent learning described by Senge and Scharmer. The innovative nature of the school provided abundant opportunities for teachers to notice and observe and either through personal or collective reflection envision new possibilities. As the culture of the school embraced innovation, the environment was ideal for the emergent learning process. Step two in Senge and Scharmer's model often proved the most challenging as teachers were action-oriented with a desire to get 'things' right. The ability to 'suspend' (Senge et al., 2004) is a challenging task that required time and space and almost a meditative state, something rarely found in schools. Periods of silence within meetings was foreign and required explicit attention. Fulton at least provided permission to focus on the new in preference to the past but 'letting go' (Senge et al., 2004) was not always an easy task. Writing a reflective journal provided an opportunity for 'letting go' of past experiences and thought processes and allowing 'inner knowledge to emerge'. Jackie's journal provided an example of the process and Johann's does the same.

The model proposed by Senge and Scharmer also reflected the learning process and language used in Moon's (1999) Map of Learning which engaged teachers in noticing, making sense, making meaning, working with meaning and transformation. Both models supported the

process and documentation of action research that resulted in deepening teachers' knowledge, enhancing their practices and contributing to the school as a learning organisation in a multitude of ways. The action research process was also of influence on teachers' identities.

York-Barr et al. (2006) proposed the teachers' identities are 'operative influences' on thought and behaviour patterns. They also claimed that identities are shaped by the context and environment in which one works. Fulton's explicit recognition of teachers' as learners being fundamental to the success of the school positioned teachers as valued members of the community and as such created a context whereby teachers viewed themselves in a new light. Wenger (1998) proposed that, "Education concerns the opening of identities, exploring new ways of being that lie beyond our current state" (p.263). Teachers at Fulton were able to explore new ways of being and through the process of 'emergent learning' as described in the previous paragraphs the professional identities of many teachers at the school changed. The changes resulted in more confident and insightful teachers who recognised the importance of their role in the school and in enhancing students' learning. Many recognised the difference they could make to other teachers' learning. Jackie achieved such an outcome as did Johann who is introduced in the following case study.

5.5 Johann's story

Johann was the only case study teacher who was not a member of the original staff. He commenced at Fulton as a relief teacher early in the second year of the school in operation and was offered a permanent position the following year. Johann's story once again instantiates the interconnections between various affordances for learning but specifically *being innovative*, *access to expertise* (via a teacher mentor), *writing to learn*, *students*, *teacher colleagues* and *professional partnerships*. Johann's background provided valuable insight into the choices he made in professional learning at Fulton and the subsequent outcomes of his learning. His story has strong links to Jackie's in that both were members of the Mathematics and Abstract Thinking (MAT) team and both completed a tertiary topic that engaged them in action research and keeping a reflective journal. However, the difference in each teacher's sense of identity and in their action research foci resulted in different outcomes.

5.5.1 Johann's background

Johann has over 30 years experience as a mathematics teacher but just prior to arriving at Fulton he was the acting principal of a small independent school. The school was a member of the Australian Association for Progressive and Alternative Education (AAPAE), its website said that, "Students wherever possible, work by individual progression . . . The educational climate of the school is particularly suitable for gifted children although all can benefit from the individual

progression methods.” A student of the school reflected that the school had “changed his delusions about, and rebellious attitude towards school, into a love of learning to the point of choosing an extra year at school in order to achieve his goals.” No doubt, Johann’s values and beliefs about education had been shaped by his experiences of working in such a school; however, the school experienced a down turn in enrolments resulting in a decision to close. Johann experienced the challenges associated with an organisation under the threat of closure and carried a sense of responsibility for this outcome. He commented, “Coming here [to Fulton] freed me from all that sense of responsibility for the big picture of schools. I was just here to teach and I had sufficient confidence in my abilities as a teacher to make the transitions in schools and roles quite comfortably.”

5.5.2 *Just here to teach...a focus on pedagogy*

Johann’s comment that he was at Fulton ‘just to teach’ was of interest to me. He wrote in his reflective journal:

After 30 years as a teacher of Mathematics, I had the opportunity to focus on my mathematics teaching in a new school committed to innovative approaches to teaching and learning. This contrasts to my previous position (in a small independent school) where I taught across a wide range of subjects as well as having many other responsibilities. Despite having several students achieve “perfect scores” in their South Australian Certificate of Education (SACE) and others working at world class levels in their chosen field, I felt there was some scope for a real change in what I do and how students learn in my Mathematics classes and ultimately throughout their lives.

Johann’s explicit interest in the pedagogy of mathematics was a result of arriving at Fulton following the development of much of the MAT curriculum, his success and familiarity with the Year 12 curriculum and the constant discussion on *being innovative*.

Johann had deep knowledge in the area of mathematics and displayed much passion for the content. He was excited at the opportunity to work with *teaching colleagues* (TC) who displayed a similar passion for the field. Johann felt comfortable with the demands of the curriculum noting that “there is not so much that is new in the field of mathematics, rather it’s about new and novel ways of applying existing knowledge.” This contrasts to the area of science where teachers were faced with developing new content knowledge and teaching across disciplines. Johann’s teaching was primarily restricted to the MAT central study and therefore his opportunity to work across other discipline areas was limited. He did not experience the anxiety of having to teach unfamiliar content. Confidence in his own content knowledge and success with many students in previous years suggested that Johann’s pedagogical approach was sound and required little attention. However, it was Johann’s confidence and expertise in content knowledge that allowed him to turn his attention to pedagogical content knowledge. This focus occurred for others in the

MAT team, including Jackie and suggested that confidence in content knowledge appeared to be a prerequisite to teachers focusing on pedagogy, an outcome that will be considered in more depth in Chapter 6.

Johann was enthused about the MAT central study (CS) and its opportunities for students to learn in more collaborative ways. At Fulton Year 10 and 11 students participated in the MAT CS for 250 minutes per week. Johann provided an overview of the MAT CS from his perspective:

A feature of the school was the creation of curriculum that did not rely on working through traditional textbooks. The MAT curriculum was designed by teachers working in the school, and used constructivist and inquiry based approaches to mathematics learning. A core and extension set of investigations provided the basis for students to construct their own mathematical understandings. All students in both years 10 and 11 had access to the same materials that were written around the topics and sub-topics of the SACE [state based certification] Stage 1 curriculum statements. By engaging with these investigations students are expected to reflect upon what they have learned and to record their understandings in notebooks, in effect their personal reminders, notes or textbook. The most common working mode was small, informal groups.

The MAT program is organised into units of approximately four weeks duration. Apart from the introductory unit at the beginning of each semester, each unit is completed with a Public Presentation Piece. This is an individual student response to one of the extension activities in the unit. Students are expected to write this up so that it can be read by a peer from outside the school. It is word processed with appropriate typesetting of the mathematics and is submitted electronically.

Johann's description of the MAT curriculum focused almost exclusively on processes to support student learning highlighting his attention to issues of pedagogy. The description highlighted areas that aligned with Johann's own beliefs and values about effective student learning including a focus on constructivist and inquiry based approaches. Johann reported feeling 'at home' and although Fulton differed from his previous teaching environments and experiences, at the heart of his work remained confidence in his content knowledge and teaching abilities and a priority on building positive student relationships. This was a point in difference to Jackie who held a critical view of her abilities and knowledge. Johann always presented as relaxed and confident about his work.

Johann valued the work that had been done before his arrival at the school by the leader of the MAT team, Barry, and recognised this provided scope for him to focus on new pedagogical approaches. Johann commented, "I felt inspired by the way Barry presented the MAT curriculum, it provided scope for working in different ways immediately as it was based on students locating what it was they needed to learn." Johann's reflection indicated his interest in the design of the authentic problem-based curriculum was not so much in the mathematics but in the opportunity to teach in new ways. Johann's interest in pedagogy could be viewed as a

combination of his disposition and interest in effective teaching, and his alignment with the affordances provided by an innovative curriculum and a school culture that focused on *being innovative*. However, Johann often made mention of the role played by Barry and referred to him as a mentor to his learning.

5.5.3 Access to expertise...the influence of a mentor

Barry was a highly experienced mathematician and teacher who confidently led the MAT CS teaching team. In Johann's reflection on working with Barry he commented:

There's the model, there's the ability – he's a very interesting man because on one level he likes to control but I don't feel controlled. I feel my ideas are listened to and considered and it's ok for me to do my thing, so there's sufficient confidence in me. I kind of see that in a lot of what he does with other people too, so it's almost like there's a demeanor but there's a reality that is slightly different. I found that very supportive. The other aspect of him as a leader is his mathematics is fantastic and so you can always ask have you got any ideas about how to do this, and he has some great suggestions.

Johann's reflections indicated he felt well supported by the leader of the team and at the same time, he felt great *respect* for Barry as a leader, and that Barry had confidence in his work as well. Johann reflected a sense of security in his position and the support that was available which allowed him to think more deeply about other aspects of his work, specifically, pedagogical aspects. Barry acted as a model for Johann's thinking about pedagogy, afforded once more by *physical proximity*. He noted in turn, a reciprocal influence:

When I first started as a relief teacher I was always looking around to see what other people were doing, Barry in particular, as I admired his thinking so much. I noticed how he explained certain concepts but challenged the kids to think for themselves, he seemed less helpful at times and frustrating to some kids but I got why he was doing this. It reflected what I had been thinking this school was trying to achieve. When I started on contract I was teaching as part of the team for the first time, Barry gave me the opportunity to lead a section of the CS for the first five weeks, I felt great that he had that confidence in me so I worked in that way. He was part of the team and he readily listened to the ideas that I wanted him to do, I did the first part of the course and he did just the materials that were statistics and he did it his way and I was doing it my way, then I saw him do it my way as well and that built my confidence to contest some of the other ways we were working. In the end I was basically running the course and I knew this occurred through the way we worked together and he could let go and acknowledge my ideas...but he also expanded these so it was back and forth in the end. His belief in me was important particularly when students seemed frustrated by my approach at times.

Very few teachers in the school spoke of their colleagues as a mentor even if that colleague was in a leadership position. Many spoke with high regard of their colleagues and the role they played in their learning however, Johann was the only teacher who referred to a colleague as a mentor. Johann was a highly capable and experienced teacher and acted as a mentor for other teachers in the MAT team. Yet he highly valued the conditions that provided

him with access to such expertise and mentor. From Johann's perspective, and his final reflection on his time at Fulton, it was clear Barry played a significant role in his development as an educator and curriculum designer. Such a scenario was made possible by a number of affordances in the explanatory model of professional learning. However, Johann also looked beyond Barry to support his learning and acknowledged that his students, particularly those undertaking the high-stakes year 12 mathematics topics also supported his learning.

5.5.4 *The influence of students*

Students proved to be an affordance for Johann's learning. He prioritised strong relationships with his students and as in the model of emergent learning proposed by Senge and Scharmer (2001) he observed students closely. Johann said:

I liked the level of student engagement I saw demonstrated by many students in the MAT program. It provided a relaxed informal atmosphere and the students' attitude to doing mathematics was positive. The, "Oh not maths again," comment just didn't seem to be around. I found the quality of mathematics evident in student solutions to the Investigations exciting and impressive. Consequently I wanted to undertake the challenge of carrying these attitudes, levels of engagement and quality of mathematical thinking into the exam-based Year 12 Mathematics courses.

The reflection suggested that the students' behaviours during the MAT sessions were different to that of Johann's previous mathematics classes and provided the evidence he was seeking to implement a similar teaching approach in the exam driven Year 12 classes. Year 12 teaching at the school was in its infancy and the high stakes nature of the final exam created pressure to work in more traditional ways. Scott's story highlighted his need to make changes to how content was delivered too. However, his focus was more specifically on personally making sense of the content given it was the first time he had taught the topic. Scott's link between content and pedagogy and his experience of working at Fulton supported the use of scenario based learning for the student but, his focus was on restructuring content rather than changing his pedagogical approach. In contrast, Johann was extremely confident with the content in the Year 12 topic but believed the teaching and learning focus had the potential for change. The goal of making changes was to enhance the depth of students' procedural knowledge so they could successfully apply their factual knowledge in ways that were more complex. His 'inner knowledge' (Senge & Scharmer, 2001) of the teaching and learning processes that supported deep learning, and his belief in students' capacities were central to moving forward with the idea of change in pedagogy at the Year 12 level.

5.5.5 Intentional learning through action research

Johann, as part of the school's professional learning strategy, enrolled in a tertiary topic designed specifically for teachers at Fulton. The topic engaged teachers in action research and keeping a reflective journal. Many other teachers at the school had completed the same topic in previous year, including Lisa and Jackie. Most teachers focused on some organisational aspect of the school and this was understandable given the many pressing issues at hand. However, Jackie and Johann, both MAT teachers working with a well defined curriculum focused on pedagogy. As identified in a previous section, Johann was not 'overloaded' with the need to teach unfamiliar content, with the stress of working in a tension filled team or with students who were disengaged. All these factors positioned him well to inquire into what many educators believed to be the core business of teaching – the actual act of planning for, delivering, managing and facilitating deep and meaningful learning for students (Munro, 2003, Stoll et al. 2003). A focus on new pedagogical approaches associated with the act of teaching was fundamental to achieving the school's vision of providing, "a strong emphasis on the disciplines of science and mathematics through innovative teaching and learning methodologies" (School promotional material, 2005).

The topic in which Johann participated had five other participants; three were colleagues from Fulton and the other a teacher from outside of the school. In previous groups there had been up to 16 participants but given that many teachers at the school had completed the topic and there had been little turnover of staff the group commenced with just five 'students'. The small number of participants provided an excellent opportunity to engage in some in-depth discussion and for an outsider's perspective to be considered.

Enrolment in the tertiary topic provided an opportunity for teachers to reflect on self as a learner, undertake a meaningful action research project individually or in groups that could contribute to the development of the school, and provide teachers with recognition and accreditation for the work they were engaged in on a regular basis. As detailed in Chapter 4, the topic was designed specifically to meet the needs of the teachers at Fulton with outcomes pivotal to policies and practices at the school. Lisa's outcome was influential in the assessment practices in the school while Jackie's outcomes were personal in nature but resulted in her contributing more to the school's outreach professional development program. However, for Johann what started as very personal focus on his pedagogy became "an exercise in public influence" (Whitehead & McNiff, 2006, p. 160) made possible by the written account of his learning process. The powerful affordance of *writing to learn* is addressed in more detail shortly.

Johann provided a brief précis of his action research process during a presentation to fellow colleagues as follows:

I feel very fortunate to have had the opportunity to take this learning journey. In particular, I have been able to focus on the Year 12 Mathematics courses as my primary responsibility and enjoy the support and encouragement of the mathematics staff. Data has been collected in a reflective journal accompanied by an ongoing discussion with a critical friend, a survey of student attitudes to studying mathematics and videotape of teaching sessions. Furthermore [Fulton] provides direction for curriculum development in the form of teaching and learning principles. Constructivist and inquiry based approaches are part of these principles as they have been part of my action research. It is my contention that such pedagogies can be effective as measured on traditional performance (e.g., Tertiary Education Rank) grounds while allowing greater development of positive attitudes to learning. In this way we can contribute to the development of life-long learners as is an aim of the school. However, the achievement of such outcomes was not just dependent of me changing my beliefs and practices. The students were a pivotal part of achieving such outcomes.

Johann's went on to explain why he had focused on pedagogy and identified the strong alignment between the school's teaching and learning principles and his own beliefs about effective learning. He also focused on the role of 'text-book driven' teaching as inadequate for developing deep learning (a belief reflected by Scott's learning experience as well). Johann said in his presentation:

I was dissatisfied with the textbook approach to teaching mathematics. Previously I had used a textbook as the basis of my course, the source of problems and support material for students. I felt that students were able to develop competence and the ability to solve certain problems in an examination but for too many it was little more than that. I wanted more students to enjoy what they were doing, not just gain a sense of achievement in being able to do year 12 Mathematics. In South Australia, I would be surprised if there is a class that does not use the Haese (Year 12) texts. The approach is the traditional; present some theory (theorem or result is shown) then worked example(s) followed by a set of problems. This approach does not reflect a constructivist view of learning (SACSA, 2004; Slee & Shute, 2002). While using such a text does not determine that a traditional didactic approach must be followed, it seems that one is continually drawn back to it.

Johann went on to describe in detail the process of his action research and the cyclical nature of his observation, reflection, action, observation, deeper analysis and so forth. The process reflected well Senge and Scharmer's (2001) notion of emergent learning. Johann documented the outcomes of his learning as a table of former and new, explicit and implicit beliefs and practices about areas such as accountability, curriculum, student engagement and relationships. Table 5.1 presents the table as developed by Johann.

Johann's documentation of his learning was comprehensive and provided sound evidence of the quality and significance of his learning, particularly considering he was a highly experienced teacher who would be categorised at late career (Hargreaves, 2005). The level of

documentation Johann engaged in provided a concrete evidence of transformations in his learning, and it also provided an excellent resource for engaging colleagues in ongoing discussion about teaching and learning at Fulton. Johann presented the outcomes of his learning (see Table 5.1) to colleagues and this acted as a catalyst for ongoing discussion about teaching and learning, particularly at the Year 12 level.

Johann's learning was an outcome of several affordances including his own level of motivation and sense of personal agency, the professional learning strategy which provided access to the tertiary topic and action research process. However, an additional affordance was Johann's connection with me as a *professional partner* in learning. Johann kept a reflective journal throughout the action research process and I became a partner in this journal through responding to his entries. The journal ran to over twenty thousand words by the end of the topic and an analysis of the writing provided evidence of various stages in the journal that reflected the influence of relational growth on the depth of the learning. Awareness of the shifts in roles from critical friend to co-learners emerged for Johan and me as we reflected on the power of the process on our learning. The notion of *writing to learn* was reinforced as an affordance for teachers' learning and their university colleagues at Fulton.

Table 5.1: Johann's explicit and implicit beliefs and implications for pedagogical practices across key teaching and learning areas. (The table continues over the page)

Syllabus Content		
	Former	Current
Explicit Beliefs	<p>There is too much content in the Curriculum Statement.</p> <p>I feel rushed in getting through the syllabus.</p>	<p>There are relatively few key ideas and there is time to develop understandings of them.</p> <p>In the past I expected students to do busy work.</p>
Implicit Beliefs	<p>The student is an empty vessel to be filled with objective knowledge.</p>	<p>The detail becomes easier and/or obvious when it fits within a framework</p>
Pedagogical Practices	<p>I do a lot of chalk and talk, I teach to the middle of the class.</p> <p>I push the students through the course.</p>	<p>I provide learning opportunities,</p> <p>I encourage peer mentoring and discussion.</p> <p>I encourage collaboration.</p>
Accountability		
Explicit Beliefs	<p>My students' results are a reflection of my professional abilities. That is if they do poorly, by school or my standards, then I feel I have failed.</p>	<p>Students construct their own understandings.</p> <p>When they engage with the course and me then they will do OK.</p> <p>My role is to provide opportunities for learning.</p>
Implicit Beliefs	<p>The teacher has the primary responsibility for the learning of each student.</p> <p>Students cannot be trusted to make the right decisions, i.e., to do what teachers/parents/society want them to.</p>	<p>Students have the primary responsibility for their own learning. This will encourage the development of life-long learners.</p>
Pedagogical Practices	<p>Highly teacher directed</p> <p>Bullying and cajoling, i.e., the use of sticks and carrots to motivate students e.g., "you need to do this as it is for assessment".</p>	<p>Allow space for individual approaches to learning. Be flexible develop a cooperative classroom culture.</p> <p>Accept and allow students to take responsibility for their own learning.</p>

Table 5.1 continued

Engagement		
Explicit Beliefs	I know that many students will not get it the first time through.	I know that many students will not get it the first time.
Implicit Beliefs	This is not a reflection of my teaching, rather it is a reflection of the students intellectual abilities or motivation.	It takes time to modify existing schema.
Pedagogical Practices	I set lots of repetitive exercises. I use drill and practice approaches. I repeat the same stuff in chalk and talk sessions. Teacher bullies students into working using extrinsic motivation. Lots of tests and marks.	I allow multiple approaches and time to engage Teacher acts as facilitator.
Pedagogy		
Explicit Beliefs	Students will only learn the stuff required to get good marks if I explicitly tell (teach) them	Students construct their own understandings.
Implicit Beliefs	Students are not naturally curious. Year 12 is hard work.	Understand key ideas and the rest follows so much more easily.
Pedagogical Practices	I do a lot of chalk and talk, I question them to probe their level of understanding. I explicitly tell them what they need to know .	I provide learning opportunities, I encourage peer mentoring and social interaction. I encourage sharing of knowledge.
Relationships		
Explicit Beliefs	I have a good relationship with my students. My enthusiasm and pleasure in doing mathematics will rub off on my students.	I have a good relationship with my students. When I manipulate students using extrinsic motivators then I diminish the relationship.
Implicit Beliefs	Students will do more of what I want them to do when they like and respect me. It is my classroom. I act as a benevolent dictator.	A good relationship will lead to the best possible long term outcomes. It is our classroom. I act as a facilitator.
Pedagogical Practices	I expect students to do as I wish.	I work with people
Authorities		
Explicit Beliefs	The text book is the <i>Bible</i> and past exam papers are the <i>New Testament</i> .	Working on problems is an excellent and efficient way of developing mathematics problem solving skills
Implicit Beliefs	Text book writers understand the course better than I do.	I have more understanding of my students than the writers of the text. I also understand the intention of the course.
Pedagogical Practices	I rely on the text book and past exam papers to determine the depth of treatment required	See above.

5.5.6 Exploring the affordance of writing to learn

Johann and I recognised that without the shared dialogue journal much of the learning that occurred through the action research process would have been lost to others and to us. Schon (1983) captured the importance of reflecting on action rather than just in action when he stated, 'clearly, it is one thing to be able to reflect in action and quite another thing to reflect on our reflection-in-action so as to produce a good verbal description of it; and it is still another thing to be able to reflect on the resulting description [of action]'" (p.49). Johann and I went beyond a verbal description to a written description of actions and beliefs so even though we met weekly with others in the topic the writing process was where more powerful learning ultimately occurred. And the powerful learning continued as we "reflected on the resulting description of action" (Schon). We engaged in a meta-reflection of how the relational aspect that ultimately supported mutual learning developed over the course of the topic. The extract below is a reflection on Johann's response to the dialogue journal process and captured his sense of ease with the process and the role it played in his learning.

Several years ago, I kept a journal to work through some professional and personal issues. I had a critical friend, who was familiar with my situation, and who read and commented briefly on what I was saying. It had been very successful in providing me with a means of intellectually working through these issues. So when the professional learning course provided the option of keeping a reflective journal it seemed a natural thing to do and to view Kerry as a critical friend through this aspect of my learning journey.

Approaching this course I expected the reflective journal to be a record of my thinking and planning and be very much centered on my classroom practice. As such it would lead to useful data when it came to writing up my action research project.

However as I started the course, Kerry's sessions included theoretical perspectives on learning and so it became natural to comment upon these and to consider how this might connect with my own classroom experiences. Deeper reflections lead to questions about how Kerry's sessions were being run. Did they match with the theory that was being presented? I suspect that this questioning sparked the dialogue as it was no longer simply my journal with comments but a dialogue on educational theory and what we were both doing in practice.

The writing process is a more considered response than a verbal dialogue. It was important for my learning to connect as much as possible with my own practice and test my thinking. In contrast to our oral discussions I consider what I say more carefully and it is more coherent as a result. I found it possible to challenge Kerry as to how consistent her approach was with the theory being presented and to refine my own beliefs and ability to articulate them. An important aspect of this was the ability to respond to many issues in the one response. With an oral discussion, I find there are many occasions where I want to say something but the conversation moves on and I lose that opportunity. It is a sequential communication and there are many points that may be of interest to explore further but it no longer fits into that sequence. However with the journal, it was possible to

address each and every point of interest, making it a very rich and considered set of thoughts. The subsequent learning has therefore been of a different magnitude.

The interaction with Kerry has enlivened the journal and lead to fuller entries. It is like a personal tutor or guide who is able to ask the "Socratic" question at the right time to enable a new direction, provide focus or enable me to see the direction that I wish to go.

I thought that I had no difficulty saying what ever I wanted in my journal. However, the nature of my entries has changed in response to the developing relationship between me and my critical friend. In retrospect it is not surprising that the acceptance that comes with the relationship enables more intimate or less filtered responses. It was as if I held an unacknowledged reserve that reduced as time went by. This applies to the context of professional learning just as much as in personal relationships. As social beings we care about how others perceive us.

5.5.7 Learning from Johann's learning

Writing to learn emerged as a significant affordance for teachers' learning as evidenced in Lisa's, Jackie's and Johann's stories. Writing to learn was not considered as a learning process in its own right within the professional learning strategy of Fulton but rather as by-product of learning. All teachers were certainly encouraged to present their work at conferences and publish if provided with the opportunity but the actual process of writing was not identified as an explicit form of professional learning.

Writing was a time consuming process and teachers often engaged in writing to document new curriculum and student learning outcomes. Spoken dialogue was more efficient in discussing issues of teaching and learning and as this occurred on a regular basis the act of writing to learn was rarely done in incidental ways. Yet the learning process was clearly enhanced for Johann through the writing process and it provided an opportunity to use the journal in other important ways. The paper Johann generated for teachers at the school was ultimately presented at a national research conference and finally published in a journal. The meta-reflection of the learning process and relational development generated by writing the journal also formed a conference presentation and journal paper. The value in the process of writing went beyond the sphere of individual learning to act as Whitehead & McNiff, (2006) said, "an exercise in public influence" (p.160). Part of Fulton's vision was to influence science and mathematics education locally, nationally and internationally and to do this through teachers' writing proved a powerful and authentic outcome of professional learning. It also added weight to the value of engaging in and prioritising writing to learn as an affordance for teachers' learning.

Johann's story also acknowledged the valuable role of a teacher colleague as a mentor, students as a primary source of a learning focus and outcomes that can be generated through

professional partnerships. These affordances are all situated in the relationship domain of the explanatory model of professional learning at Fulton and reinforced the importance of constant attention to building of quality relationships. Johann's relationship with Barry was the catalyst of many learning outcomes for many people and these are explored from a different perspective in Barry's story, the final case study in this chapter.

5.6 Barry's story

The explanatory model of professional learning at Fulton was complex and rich in opportunities to engage teachers in both incidental and intentional learning. All teachers could experience incidental learning on a daily basis courtesy of the school's contextual conditions. Teachers also had ample opportunity to engage in more sustained and intentionally planned learning through organisational elements of the school including the professional learning strategy and affordances of distributed leadership and tertiary level topics. The stories of Lisa, Johann, Scott and Jackie provided evidence of incidental and intentional learning processes and outcomes: however, the more significant outcomes were based on teachers' engagement in intentionally planned learning opportunities. Barry, a highly experienced mathematics teacher in the latter years of his career, chose not to engage in most of the sustained and intentionally planned learning opportunities provided at Fulton and therefore he was selected as a case study to determine how he fitted within the explanatory model of professional learning that emerged from the research.

Barry's story commences with consideration of personal characteristic and previous teaching and leadership as these appeared relevant to his level of engagement in professional learning and affordances he acknowledged as beneficial to his learning. As identified in previous cases, teacher identity and motivation were always a factor in preferred processes for learning and Barry's story was no different. He did not follow the path of many of the other teachers but he reported his learning at Fulton had been significantly enhanced in many areas. Given his extensive knowledge and experience, he found *access to expertise*, *teacher colleagues* and *students* to be primary affordances for his learning. He also offered a valuable learning affordance for others at the school through his consistent practice of *contesting views*, although this was not always viewed as helpful. Further consideration of this aspect and its connection with the explanatory model of professional learning at Fulton is considered in more detail in the sections that follow.

5.6.1 Individual characteristics and links to career stage trajectories

Barry's reluctance to engage in more structured forms of professional development and his readiness to contest some of the views and practices held by others in the school sat well with Humberman's (1993) description of the four dominant career trajectories of 'late' career

teachers. Of the four trajectories, positive focusers, negative focusers, the disenchanted, and those seeking continual renewal Barry aligned more closely with positive focuser and continual renewal. From a surface level perspective, others may have described Barry as a negative focuser for his resistance to some initiatives of the school. However, negative focusers and the disenchanted are identified by their high level of self-interest and Barry was far from this. He fitted well with Hargreaves's (2005) description of the positive focuser: "These teachers are not embittered, but have become wise and serene in deciding how in the autumn of their work life, to conserve their energy and pass on lasting wisdom to young and developing minds" (p. 974). Barry did seek to conserve his energy for some aspects of his work, as evidenced in the following paragraph. He maintained high levels of commitment and a sense of continual renewal for curriculum development and leading the Mathematics and Abstract Thinking (MAT) team.

Barry described himself as a 'control freak of just about everything'. He was frustrated by system- and school-level requirements and expectations that detracted from time that could be spent on issues that mattered. For example, staff were invited to voluntarily complete a survey (Mason's Self-Inventory, 2002 – see Appendix C) associated with my research. Barry chose to complete the survey and his responses to some questions left a clear impression that he was frustrated by the many meetings and tasks associated with being a foundation member of the school, or what he believed was inefficient use of his time. His response to the survey question, 'What I like least about what I do is...' was, "having to attend unstructured meetings and fill in surveys (Like this!)." I found this an interesting response given that completion of the survey was voluntary. However, it captured one of Barry's characteristics, his level of interest in all that was going on around him and taking opportunities to have his voice heard where possible. He also responded to two linked questions in the survey as follows:

Whereas I used to.....do my best with trivial work

I have recently begun to.....try and understand why it might be important and then do it as quickly as possible.

The responses again indicated a sense of frustration with the 'mundane' elements of his work and this was not unexpected given his passion for mathematics and working directly with students. The comment, 'try and understand' indicated recognition of seeing other people's perspectives but with an undertone of frustration. He commented in the survey that the thing he least liked about professional development was "having to work with people without vision/passion/ commitment to the major objectives." I was unsure whether he was referring to the major objectives of Fulton or of education in general. It provided some evidence of his level of commitment to change, particularly in the field of mathematics. Yet it also generated a concern that such levels of frustration with others might serve to undermine the quality of the learning culture that Fulton aspired to. Teachers at Fulton had diverse backgrounds and passions

and the challenge was to develop a learning culture and community where all teachers' stages of development, beliefs and future goals were recognised, planned for and valued, and that this tenet should be adhered to by all members of the community. Such a belief linked strongly to the affordance of *respect* for others and without this much of the professional learning model and vision for the school might be undermined. The consistent focus on teachers working in teams provided the key for the building of respect among Barry and his colleagues whereby his *contested views* were not considered as a threat but an opportunity to see from a different perspective.

5.6.2 Barry's background experiences and connections to affordances that supported his learning.

Extracts from an interview with Barry generated a picture of how his previous experiences, his interest in innovative curriculum and his style of learning led to alignment with affordances for learning that differed from other teachers but still fitted within the explanatory model.

The scenario is this; my previous school that I was at for any length of time was Jakarta International School for 9 years. We're talking about a school with 13 full-time maths teachers and obligations to at least two international curricula – that's the IB and the American system, an affluent conservative school. By definition it's hard to make changes. I think in the ten years that I was there, the biggest change that we collectively made in mathematics is that we got away from algebra and geometry and went to something called a combined algebra/geometry course. Instead of teaching a year of algebra and a year of geometry, we mixed them together in a way the European style does things. That was a magnificent achievement, even though it doesn't seem much to us. It had to be pushed through a bunch of conservative parents and school council.

Barry continued his account of his experiences and their influences on his approach to learning.

In between there was a period of time that I was writing curriculum for browser-based computer learning. It gave me a couple of years to think about how to deliver stuff when you can't actually see the student, things about how students learn. It was actually a Departmental Project, and I'm still doing the technology part of it. When I came here to write curriculum for [Fulton] I noted that we had a commitment to constructivism, I sought of said 'yeah, this is what I believe in' so I think we've created the only curriculum that I know of which is fully constructivist in the sense of, we pretty much don't tell the students anything – we get them to develop it all. While some of the schools do that occasionally, in part they essentially work from text books which start at the other end and so there's been a lot of on the job learning, and that's I guess where my learning has come, talking to people, seeing what works, seeing what doesn't work.

Barry's diverse experiences and positions provided a sound basis on which to lead the writing and implementation of the mathematics curriculum at Fulton. He was appointed the Coordinator of the MAT team and acknowledged by all members as an exceptional mathematician and leader. One team member commented:

'[Barry] has amazing knowledge in mathematics but he's very connected with how to engage kids in maths, his curriculum ideas are so good, I mean they are so interesting to me and the application of some quite complex maths in the investigations for students will be really interesting to see...[the outcomes]. It's just a great opportunity to be working with such a mind'.

Barry, as a leader and teacher colleague acted as an affordance for other teachers' learning but the question remained about what affordances supported Barry's learning and how where they manifested in the explanatory model of professional learning.

5.6.3 *The interaction of motivation, curriculum writing and access to expertise*

Barry chose not to join the majority of the staff in action research projects associated with postgraduate studies. He was a self-directed learner with an initial interest in extending his mathematics content knowledge through a process of constructing innovative curriculum for students. *Curriculum writing* was clearly an affordance for Barry; however, due to the organisation of the school, Mathematics and Abstract Thinking (MAT) was offered as a separate central study hence opportunities for learning across the disciplines were limited in comparison to teachers working in the interdisciplinary central study teams. Barry was already highly experienced in mathematics and I had expected him to report that his professional learning outcomes in the field were minimal. However, he reported the increase in his discipline knowledge was significant and the following response indicated the learning was linked to two specific affordances, his own *motivation* and *access to expertise* available through the university partnership.

Well I should point out that I've written this course called Mathsat, mathematics of satellite technology, of which I knew nothing when I volunteered to write it. I was basically looking for an area which was rich in mathematics and was a real and extensive application. I chose that one because it had the mathematics and then I was committed to learning the science behind it. It involved Sam²² and his information technology aspects and so I watched and learned while he delivered that. We took trips out to the Institute of Telecommunications Research at the levels. We went out to a data systems and logging private enterprise place. Their people came in and talked to our students. All of that constitutes learning for me.

Barry's willingness to take on something he knew nothing about indicated positive self-efficacy and a desire to create curriculum that was relevant and of value to students. The teacher-located affordance of motivation combined with access to expertise and the process of writing curriculum that would be used by others combined a number of factors that Pfeffer and Sutton (2000) recognised as minimising the 'knowing-doing gap'. They suggested that, "the answer to the knowing-doing problem is deceptively simple; Embed more of the process of

²² Sam was an associate professor of mathematics and computer science at the university

acquiring new knowledge in the actual doing of the task and less in formal training programs that are frequently ineffective” (p.27). It also served to reinforce Day’s (1999) belief that, ‘Teachers cannot be developed (passively). They develop (actively). It is vital, therefore, that they are centrally involved in decisions concerning the direction and process of their own teaching” (p. 2). Barry’s experience of identifying an area that had potential as curriculum for student resulted in him also identifying the best resources to provide the support and information he required to develop curriculum for school students. There was a defined work-embedded purpose for his learning that was self driven but afforded by the availability of experts from the university. The process was duplicated on many occasions for other teachers at Fulton specifically in relation to the generation of new curriculum for students which was based on content knowledge unfamiliar to teachers and as such these affordances were substantive elements of the explanatory model of professional learning. A similar process is captured in the following example as well, but contested views and collaboration featured as affordances for learning in this scenario.

5.6.4 Additional affordances that supported learning about pedagogy

The *curriculum writing process, collaboration, contested views* (with university partners) and the vision to *be innovative* were additional affordances for learning acknowledged by Barry.

Being at the school four months before it opened to write curriculum is about as good as situation as you can get...there were two of us and that helped with ideas...we added to each other’s thinking...more about how to teach it then the content. Sam helped at one stage...great knowledge as I mentioned before. Martin²³ was there and we agreed to differ on lots of things and he works at a much higher plane in mathematics than I do. I believe I know where the kids are but he was flogging this esoteric stuff. We wrote a couple of worksheets along the line that Martin was looking for but he really is looking at a different sort of student. Of the seventy odd students who went through year 12 only one or two wanted to tackle Martin’s stuff and that’s okay in the long term because we can incorporate it into our offerings and I guess that’s what we are here to do...stretch the boundaries of what kids can do at secondary level.

Barry reported on significant learning in a range of areas beyond discipline content knowledge including his approaches to programming and assessment. He suggested this was made possible by the affordances of curriculum writing and collaboration with teacher colleagues. However, the area in which Barry reported substantial learning was in pedagogy and he acknowledged quality *relationships, trust and respect, teacher colleagues, physical proximity* and *students* as affordances for his learning. These affordances were often cited by other teachers as supportive of their learning, particularly in terms of incidental learning about

²³ Martin was a professor of mathematics from the university

pedagogy.

The MAT team was small in comparison to some of the other Central Study teams and Barry commented on the personal relationships that had developed noting that “Jackie is a technical whiz and Johann’s the best thinker among us...more so about how kids learn.” He described the differences between members of the group and recognised their confidence in mathematics knowledge allowed them to focus more specifically on pedagogy. In particular, he made reference to Johann’s influence not just of his approaches to teaching but on his characteristics as well. He noted they were both open to listening to each other’s ideas, challenging each other’s thinking and more importantly learning from one another. Barry said:

He was impressed by my mathematics and curriculum designs and I was impressed by his teaching, I’d watch him work with students and thought...this is the essence of constructivism...what’s he doing that feels different...we’d talk about that...he encouraged me to be less of a control freak without using those words...I think as a team we achieved some significant shifts in the way we teach and the students’ reactions were interesting...I don’t know whether it’s because I’m old and ugly but in any school I have every been in, I’ve always heard kids say... ‘Oh, no not maths again’. You don’t hear it here because of what we do, whether it’s the maths or the teaching...probably both but kids seem to do better when they connect with teachers.

5.6.5 Teachers’ work as learning

Barry’s story was well supported by Johann’s and it provided good evidence of the affordance of teacher colleagues who developed a focus in an area that was then shared by another. Barry’s focus on curriculum writing and extended mathematics provided an affordance for Johann and in return Johann’s focus on his pedagogy provided valuable learning for Barry. This was made possible by the vision of Fulton that engaged all teachers in identifying an area of inquiry and sustaining a focus on this over time. Although Barry did not see himself as ‘selecting’ an area for sustained professional learning his curriculum writing was fundamental to his learning, so that his work became his learning. Such an outcome reflected well Stigler’s (cited in Willis, 2002) notion that professional learning should be, “site-based and long-term. It should be on-going – part of a teacher’s work week, not something that is tacked on” (p.7). At Fulton the need to develop innovative curriculum and work in a new environment with a new model of schooling ensured that professional learning was consistently linked to teachers’ work but the outcomes of the learning often led teachers in new directions in the work too.

Barry’s and Johann’s work as a team was extended to acting as facilitators of professional development (PD) in mathematics for teachers beyond the school. Barry’s reflection on the design used for the PD proved insightful in attention to the transfer of pedagogical approaches used with students to working with adults. It appeared the beliefs and knowledge Barry and Johann had developed through their collaboration in learning provided high quality learning

opportunities for others beyond the school and possibly these teachers' students as well. In essence, a ripple effect of their learning for other teachers, schools and students may have occurred although the scope of this thesis did not investigate whether such outcomes occurred. However, Barry's reflection provided a sense that this was a strong possibility.

We've run conference sessions for teachers, two massive ones...one on Environ MAT and the other conventional MAT. Johann and I decided that we had to be absolutely true to form and that is, since we don't tell the kids how to solve the problems without them working on it first we don't tell the teachers either...we get them to do it...it was pretty interesting and especially when we had the teachers shadowing the students as they went through their paces. We had a debriefing after the sessions and the feedback was very positive but most of all we were blown away with how well our kids reacted having a teacher from another school sit next to them and how open they were about what they were doing and what they could do. If you go into most schools as a visitor and when you say to a student what are you doing they usually turn the page of a text book and say 'this'.

Teachers' work as learning supports Fullan's (2008) contention that for improvement and transformation in organisations to occur "learning [must be] the work." However, it may be that learning as work is much easier to attain when teachers' are provided with work that requires them to learn rather than continue in familiar patterns of action and roles. Clearly the teachers at Fulton were well supported in their learning although this did not always occur in ways recognised as traditional professional development. Many, if not most, of the processes of teachers' learning were embedded in their daily work and professional roles, and for some teachers such as Barry this resulted in a perception that learning was primarily self-directed.

5.6.6 Recognition of the role of the structured professional learning strategy

Throughout the interview Barry reported that most of his pedagogical content learning was self-directed and influenced by colleagues and students more than anything else. He certainly acknowledged access to the expertise of university partners as the most influential affordance on his mathematics content knowledge. However, no mention of the weekly professional development sessions was made in his story so I asked Barry about the influence of these on his learning and he responded:

Like all good smorgasbords it brings to your attention things that might not have been deemed important enough or had time enough to go looking for that for yourself, which helps you get an understanding of the context for the whole school. Whilst I'd be quite happy writing an independent mathematics area, life's not like that, it's good to know what else is happening. We spend a lot of time hassling about the integrated sciences and the resulting problems of that which helps me formulate my ideas about what's good in mathematics, such things as have students been able to identify with a teacher. It's useful and it's necessary, basically the school's doing to me what I do to Johann when I institute systems over the top of him. Often he does it to me by saying you'll attend these PD sessions and you'll learn some things. I can see that it's a good thing. I wouldn't say that I've learnt some level three skills out of those sessions, more like level

one, things like passing information, feelings for how other people are working. I know some people who have learnt the drug policy that they wouldn't know otherwise.

This reflection captured once the again the affordance of a teacher colleague and positive relationships on Barry's learning. Although Barry did not regard the professional learning strategy sessions as significant to his learning, his reflection acknowledged that it certainly provided an opportunity for him to connect with other aspects of the school in action and the reflective process he engaged in as a result. As identified many times in this thesis and the literature (Atkinson & Claxton, 2000, York-Barr et. al, 2006) reflective practice was an important affordance to teachers' learning at Fulton.

5.6.7 Barry's contested views as an affordance for others' learning

Barry was a controlled and reflective man and I was somewhat surprised by the levels of learning he reported on during the interview process. My surprise was situated in the extent of the knowledge he clearly held before arriving at Fulton and his tendency toward critique on many aspects of the school. I came to value his probing questions of some of the more accepted beliefs and practices of the school as they certainly opened my eyes to seeing from a new perspective and while I did not always agree with Barry's perspective I acknowledged the discomfort generated in some interactions related well to the affordance of contested views that create learning opportunities. Barry's style of critical reflection often engendered emotional angst from leaders and teachers in the school but the level of respect for his work and the knowledge that he was committed to, rather than wanting to undermine the vision of the school, allowed his contributions to be heard and considered. It appeared that such an outcome required a combination of trust and respect among individuals who are also open to being challenged and ready to challenge. Such a scenario was important to the school given that a learning community always in agreement with one another is comfortable but not always conducive to good learning and change. As Sizer (1984) said, "Understanding ...[is] the development of powers of discrimination and judgment... Understanding is more stimulated than learned. It grows from questioning oneself and being questioned by others" (p. 116-117). The questions posed by Barry allowed others to apply their own judgment and discrimination to the issues at hand. Barry's level of reflection about all aspects of Fulton provided evidence of his own learning but also acted as an affordance for many colleagues as well.

5.6.8 Seeking evidence to support the value of the vision and learning at Fulton

Although Barry had less tolerance of the many meetings and the "instituting system of control' (his words) at Fulton he was clearly enthused by working with his colleagues and the students. Part of his critical and analytic approach was a desire to seek evidence to support the

work and learning he had engaged in which in turn provided evidence about achievement of the school's vision and outcomes of the professional learning model. He called me over one day and said, "Here's some interesting evidence for your research." He showed me several pieces of work, most from students who had been at the school for two years and one from a student who had only been at Fulton for a few weeks. The experienced students had created colourful, creative and detailed computer generated representations of their knowledge of a particular mathematical concept. The new student had completed a basic pencil and paper figures-based short report. The difference in presentation and quality of content was clearly evident and although it was unfair to judge the new student on one piece of work Barry said, "You see the difference is the integration of their ICT skills and the expectation we have that they apply their thinking in novel ways wherever possible so we can see they truly get it." He smiled and said, "This is why I'm here...we are making a difference."

Barry did make a difference, and his time at Fulton made a difference to him as well. He ultimately moved on from the school to commence work as a lecturer at another local university. He has not returned to the school but his influence is well embedded in the innovative curriculum and model of professional development for other teachers still in use in the school.

5.6.9 Learning from Barry's story

Barry's story was an important contribution to this thesis and the explanatory model of professional learning at Fulton. He followed a different path from the majority of other teachers in the school and yet he clearly acknowledged many of the same affordances for his learning that other teachers also did. The outcomes of the learning reported in this section were significant to Barry's but also for students, other teachers and the school as a learning organisation as well. He acted as a leader for learning displaying what Perkins (2003) described as the ability to, "raise consciousness casually in the natural flow of working together" (p. 219). His story highlighted the importance of flexibility in professional learning options and the recognition that teachers in different career stages may seek different paths for learning. Hargreaves (2005) also acknowledged that late career teachers resistance and outspokenness can be channelled towards positive outcomes if they are provided with choice and support from leadership stating, "With supportive leadership...outspokenness could be turned into an assertiveness that could give flexibility and latitude to the teacher while providing benefits for student learning" (p. 219). This is well supported by Barry's story with leadership support coming directly, but also through the flexibility and scope of affordances for learning.

The other learning that emerged from this story and the previous case studies was the importance of including the teachers as a key element in the explanatory model of professional

learning. Teachers' values, beliefs, capacities, goals and sense of personal agency form the 'source' from which they operated and from which teacher-located affordances were generated. The diversity in teachers' experience and characteristics led to a variety of sources in operation and yet two key teacher-located affordances continued to emerge, *motivation* and *openness*. These affordances were controlled by teachers but were continually influenced by school-located affordances for learning. Barry's motivation and openness to learning remained high as he had access to learning opportunities that aligned with his interests and needs. This was evident for other teachers as well. Barry's levels of motivation for learning may have subsided significantly if he was forced to do an action research project or write a reflective journal. The strength of the explanatory model of professional learning at Fulton was its complexity and flexibility to meet individual teacher's need in meaningful and powerful ways so that these teachers contributed to the learning culture of the school rather than undermine it. The model in essence was the outcome of answering the research questions, 'How was teachers' learning supported and sustained?' and 'What were the processes of teachers' learning?' However, understanding the complexity and richness of the model is more effectively captured in the teachers' stories and my additional theorising about teachers' processes of learning and their own reflections on these processes is addressed in the following and final section of this chapter.

5.7 Learning from the teachers' stories and their influence on the explanatory model of teachers' learning at Fulton.

The affordances for learning identified by the teachers' stories served as the foundation of the explanatory model of professional learning at Fulton. Many affordances for learning were evident in all of the teachers' stories and some featured more significantly than others. Although some affordances were identified as teacher- or school-located affordances there was evidence that origins for affordances were influenced by each other. An analogy for understanding the need for a complex and generative model to support teachers' learning at Fulton was found in the original concept of an affordance.

James Gibson (1977, cited in Wenger, 1998) defined an affordance by the example of a set of stairs assisting people to reach an upper level more efficiently. The explanatory model of professional learning at Fulton provided more than a set of stairs for teachers, there were ramps and elevators as well which provided for different teachers' individual characteristics, capacities and sense of personal agency. Often a teacher took a ramp and moved along this at his/her own pace meeting other people along the way and sharing experiences of their walk along the ramp. Some teachers took the stairs as they either had the resources to get where they were going more quickly or they realised the need to get there quickly to support students in taking their own

journey up the stairs. Some people took the elevator and depending on who was on board with them the outcomes proved significant or the journey proved too quick to make a real difference. However, swift journeys were often needed to support the needs of the school and its students. Finally, some people took a variety of all three depending on needs, goals and their personal characteristics. Variations of journeys based on such an analogy could go on to describe a whole range of options including the teachers' who went up a few steps and turned around again. The analogy highlights the number of individual stories that can be generated when variations in architecture provided for different options. The contextual conditions, organisational elements and relationship factors of Fulton provided the architecture of the explanatory model of professional learning and the teachers acted as explorers of the architecture. As their interests in certain aspects of the architecture waned, there were other features to explore and at times, their own explorations resulted in modifications to the architecture as well.

The teachers' stories provided the best evidence of the explanatory model in action and insight into the outcomes of their learning as well. The teachers' stories deepened the knowledge base on which to more fully respond to the research questions 1) How was teachers' professional learning supported and sustained in the context of an innovative school?, 2) What were the processes of teachers' learning in the context of an innovative school?, and, 3) How do the processes and outcomes of teachers' learning in this innovative context reflect and contribute to the literature on teachers' learning? The stories included in this chapter also provided evidence to respond to the research question, What factors, activities or situations associated with working at Fulton led to changes in teachers' beliefs and practices?, although this question is now more fully considered in Chapter 6.

In response to the initial question the explanatory model of teachers' learning provides some insight into how teachers' learning is planned for, including the appointment of an Assistant Principal (Professional Learning) and the professional learning strategy but it also appeared evident from the teachers' stories that learning often occurred as result of enabling conditions generated by the successful alignment of teachers and affordances for learning. The teachers' stories also provided evidence that the alignment of teachers with affordances varied so that there was not one set of factors, activities or situations that led to learning for every teacher. Fulton recognised that the trajectories of teachers' learning would be diverse and as such, diverse opportunities for learning needed to be identified, valued and supported. There was also some evidence that the learning was sustained over time as the data gathered from teachers occurred over a period of six years and rather than a reduction in motivation to learn there often appeared to be an increase. The increase was often associated with new roles and the affordance of

distributed leadership. Further consideration of how teachers' learning was sustained is reported in more detail in Chapter 7.

The processes of teachers' learning were strongly connected to the affordances identified in the explanatory model. However, the teachers' stories provided an in-depth understanding of how learning took place over time and that this involved intentional and incidental opportunities along with teachers' ongoing commitment to learning. The processes of learning reflected much of the literature on effective professional development (Darling-Hammond & Richardson, 2009, Hawley and Valli, 1999, Ingvarson et al., 2005, Timperley et al., 2007) but also the literature on learning as a process (Biggs, 1999, Brandt, 1998, Moon, 1999, Wiggins & McTighe, 2000). The processes were designed to deepen teachers' understanding of learning, pedagogy and content and as such were varied in nature and the outcomes they produced. Although the explanatory model that emerged was rich and complex in its possibilities for learning the research did not identify any processes of learning that could not be explained by previous literature on how people learn (see Bransford et al., 1999). However, the data gathered to answer the research question on processes of learning certainly provided a detailed account of the many varied processes, from extended and planned writing to incidental observations, that supported teachers' learning. In answering the research question on the processes of teachers' learning additional knowledge has been added to the field supporting the call for greater research in this area (Darling-Hammond, 1999, Little, 2008).

The teachers' stories provided much support for the existing literature in the field of professional learning but as detailed previously in Chapter 4 the processes that teachers reported as highly supportive of their learning varied from the literature as well. In particular, interdisciplinary curriculum writing teams and the close physical proximity of teachers are two factors not often mentioned in the literature on effective models of professional learning. Of course, this is possibly related to the challenges of implementing such models in more traditional schools. The implications of the findings in Chapter 4 and 5 on what supported and sustained teachers' learning will be discussed further in Chapter 7.

The processes of teachers' learning reported in this chapter led to significant outcomes for teachers as individuals but also for students and the school as a learning organisation. The planning for Fulton clearly acknowledged teachers' learning as fundamental to achieving the school's vision and developed an explicit professional learning strategy to support teachers' learning. However, the research supporting this thesis identified, in part through the teachers' stories, that the explanatory model of teachers' learning was far richer and complex than the initial professional learning strategy had imagined. The tacit and explicit elements of the model were all important to generating a range of outcomes that are reported in more detail in the

following chapter but certainly included shifting educators' paradigms of science and mathematics education in the 21st century.

6. Outcomes of teachers' learning in an innovative school

“I have made an escape from a raft of traditional paradigms about schooling as a process. I have been liberated from the school: classroom: teacher: class: subject: grades; reports constructs. I don't see schooling anymore defined by these confining delineations” Quote from teacher at Fulton

There is an important culture at [Fulton]... Learning is an expectation. That, in itself, is fundamental because what it does is to provide opportunity to search for new ideas and not be constrained by seeing the world as being known or as 'black and white'. Quote from teacher at Fulton.

6.1 Introduction

Dropping a pebble into a still pond creates ripples that move in an outward motion, the disturbance at a single point being felt in other areas of the pond. The dropping of several pebbles across a broader area of the pond at the same and/or continuous points in time results in the ripples from one pebble connecting with another and a complex array of patterns and effects is generated. This metaphor describes well the outcomes of teachers' learning at Fulton. The influence of teachers' learning on others associated with the school and the school itself served to support the school's vision and the foundational leaders' commitment to prioritising teachers' learning. The teachers' stories in the previous chapters provided clear evidence of learning for individual teachers and this chapter will expand on these stories to consider the outcomes of teachers' learning in general, and the influence of the learning outcomes on the generation of the explanatory model of teachers' learning at Fulton. A core purpose of the chapter is to provide evidence to answer the research questions:

- 1) What were the outcomes of teachers' learning for teachers in the context of an innovative school?
- 2) What were the outcomes of teachers' learning for the school and its students?

The chapter considers how teachers' learning in all its complexity influenced, 1) teachers' professional growth and change, 2) students' experience of school, 3) the school as a learning organisation, 4) other professionals' learning, particularly the academics and, 5) schooling in the 21st century from a local and international perspective. In this sense, others associated with the school and the school itself felt the reverberations from the processes and outcomes of teachers' learning. The outcomes also supported existing research that identified teachers' learning as

fundamental to achieving educational reform and change (Fullan, 1991, Ingvarson, 2001, 2002, 2003, Timperley et al., 2007, van den Berg, 2002, Wideen, 1992).

The chapter first outlines and discusses teacher-level outcomes generated by teachers' learning and how these supported or contested the literature on change processes. Following teacher-level outcomes, the influence of teachers' learning on students' perceptions of their experiences and satisfaction with the school are considered. A primary purpose of Fulton was to address the perceived crisis in the quality of science education on offer in secondary schools. Tytler (2007) reported, "there is clear evidence that the curriculum and classroom practice is failing to excite the interest of many if not most young people at a time when science is the driving force behind so many developments and issues in contemporary society" (p. 15). Therefore it was of interest to identify if the outcome of teachers' learning that resulted in the generation of innovative curriculum served to provide students with a more engaging and relevant experience of science education. The influence of teachers' learning on the school as a learning organisation and schooling in general along with its influence on professional partners is also examined in the chapter.

The data used to report outcomes of teachers' learning came from a number of sources including interviews and informal discussions. However, specific open-ended surveys focusing on the processes and outcomes of teachers learning were also used at different points in the research to document teachers' perceptions of their learning and changes in beliefs and practices. Table 6.1 presents an overview of the use and timing of surveys to gather data. Mason's (1999) Self Inventory (see Appendix C for complete inventory) was used prior to the school opening and again towards the end of the third year of the school in operation. Completion of the inventory was voluntary and the selection of most case study teachers was based in part on the fact they had completed the inventory at both points in the research process. Examples of some of the questions in the inventory are included in Table 6.1 and many of the quotes that open the following section are from the inventory. Staff were also invited to participate in two other surveys (see Appendix D) that asked questions specifically linked to the research. The initial survey was used late in the second year of the school in operation and the follow up survey in August 2007, during the school's fifth year of operation. The initial and follow up surveys were completed using the web-based tool Zoomerang which provided anonymity and ease of response resulting in 85% of the staff completing the survey. The use of the surveys at different points in the research process provided an opportunity to compare and contrast data and note evidence of saturation that ultimately assisted in refining the explanatory model of teachers' learning at Fulton. The surveys were an efficient way to gather data and

provide evidence of paradigm shifts and changes in beliefs, values, practice and sense of professional identity from subtle to significant.

Table 6.1 Use and timing of surveys in the research process

Title of survey	Timing	Number of respondents
Mason's (1999) Self Inventory <i>Sample questions: I see myself primarily as.... Where as I used to....I have recently begun to.....</i>	January 2003 November 2005	15 12
Initial survey on processes and outcomes of teachers' learning <i>Sample questions: see Table 6.2 below</i>	November 2004	24
Follow up survey on processes and outcomes of teachers' learning <i>Sample questions: During my time at Fulton, the most significant learning for me has been..... This learning has influenced my beliefs and practices in the following ways</i>	August 2007	25

6.2 Teacher-level outcomes

'From teacher with a science background.....to a teacher, learner, team member'

'From teacher of visual literacy.....to a supporter of innovations in science and mathematics teaching'

'What I look for in PD now is peers examining the work we've done in curriculum and ICT to improve my practice'

'Whereas I used to summarise and then allow activities now I engage students in activities and then we summarise'

These responses from teachers were elicited from Mason's (1999) Self Inventory and provided evidence of changes in teachers' perception of their professional role and changes in practices and expectations for their own learning. Given the teachers were working in a school that was very different from their previous experience of teaching, such outcomes were not surprising. However, Elmore (1996, p.2) contended that school reform does not change teachers' core educational practices and beliefs about 'the nature of knowledge and students' role in learning' and therefore I was interested to determine whether an outcomes of teachers' learning at Fulton was changes in teachers' core educational practices and beliefs not just about the nature of knowledge and students' role in learning but any aspect of their understanding of teaching and learning. The teachers had all self selected to teach at Fulton, being aware of the vision and expectation for teachers and students to work in different ways and it was expected that many teachers' 'core educational beliefs' would not change as they had specifically sought out a school that might match their existing beliefs. To determine teachers' beliefs and practices about such core issues about learning and processes that support learning and whether these had

changed due to their time and learning at Fulton, a series of questions was developed for the initial survey.

The survey was conducted towards the end of the second year of the school in operation to ensure the teachers had much experience of professional learning to draw on. The survey questions are presented in Table 6.2. The initial questions in the survey did not focus on outcomes of teachers' learning but were asked to determine teachers' perceptions of deep learning, a term commonly used in the school. Cohen and Ball (1990) said if surveys were to be used to determine the outcomes of teachers' professional development they must consider teachers' beliefs and knowledge as a context for understanding their responses. My interests in teachers' perceptions on deep learning were twofold; to determine if the language used in the school to describe deep learning was reflected in teachers' responses and, secondly to determine if teachers' connected deep learning with their own experiences of learning at Fulton. Teachers' responses to the first three questions will be reported and discussed following consideration of teachers' responses to questions four to eight which focused on outcomes of teachers' learning and perceived changes in beliefs and practices.

6.2.1 The outcomes of teachers' perceptions of their most significant learning about teaching and learning

The focus of survey questions four and five was on determining what teachers' valued and identified as significant learning and how this learning had occurred. Their responses, in particular to question four, provided data to determine outcomes of their learning.

Table 6.2 Initial survey questions on teachers' perceptions of learning, processes that supported learning, and perceived changes as a result of working and learning at Fulton.

Initial survey questions
<p>Beliefs about deep learning and teaching that supported deep learning.</p> <ol style="list-style-type: none"> 1. What do you believe are the characteristics of deep learning? 2. What do you believe are the processes that learners use to arrive at a deep understanding? 3. What do you believe schools and teachers can do to foster deep understanding in their students?
<p>Outcome of teachers' learning and processes that supported the learning</p> <ol style="list-style-type: none"> 4. What are the most important things that you have learned about teaching and learning since being at [Fulton]? 5. In what ways has this learning occurred?
<p>Changes in teachers' beliefs and practices and sources that supported the change</p> <ol style="list-style-type: none"> 6. What have been major changes in your beliefs about teaching and learning since commencing at [Fulton]? 7. What have been major changes in your teaching practices since commencing at [Fulton]? 8. What have been the major contributors to these changes in beliefs and practices?

Teachers took the opportunity to respond to the survey questions four and five from a number of different perspectives. Responses from teachers varied as to the most important things they had learned about teaching and learning, but included the following themes:

- Everyone learns differently
- Relevance is critical
- Choice is most important
- Collaboration with others is powerful
- Quality curriculum makes a difference but it is not enough
- Positive relationships make a difference
- Teachers are facilitator of learning – they cannot make students learn but they can help to motivate them to learn and consider new possibilities
- Belief in one's capabilities is vital
- High quality resources make a difference

These themes matched well with Brandt's (1998) criteria for powerful learning (see page 145 Chapter 4) and included reference to the role played by students and teachers in learning outcomes. Awareness of students' and teachers' roles in learning was a desired outcome of the school's professional learning strategy with a specific focus on students developing as independent learners responsible for shaping their learning outcomes. Teachers' responses reflected such beliefs.

Teachers' responses to the question of how significant learning had occurred proved to be valuable data for identifying the many affordances for learning at Fulton that were reported at length in Chapter 4. However, for the purposes of responding to the research questions on outcomes of teachers' learning I was more interested in responses that could be linked to evidence of increased knowledge, changed perceptions of students, schooling or teachers' role. For example, several responses focused on the changing role of teachers at Fulton and the emotional and intellectual work this demanded (Hargreaves et al, 2001). A graduate teacher responded:

I haven't taught very much at high school before so dealing with this age group has been a learning experience for me. It has reinforced a personal belief that teachers cannot really force students to learn and at best can only persuade the more reluctant learners to do so. In some cases students have a thirst for learning that a teacher has a struggle to keep up with in supplying enough challenging material.

This teacher's response indicated a belief in a role focused on facilitation of student learning while maintaining a strong sense of responsibility for providing (and keeping up with) new content. In responding to the question on most significant learning the graduate teacher had focused on his/her professional role.

A more experienced teacher also focused on his/her role and responded:

I am developing a better understanding of how people learn and the environment needed to support the learning at a deeper level. I have more insight into the role of

the teacher as a facilitator, one which I have used for some time but not as well as I am now able to. By that, I mean I am now in a position where I feel comfortable in handing more of the learning over to students, in the past I have felt a need to keep a very tight handle on the progress, now I feel I am able to manage that a lot better with some positive outcomes for students, ie not setting them up for failure by not being able to provide the framework needed for them to achieve their learning goals. Reaffirmation that relationships are key to the learning environment.

The teacher felt more confident about 'letting go' of control in the teaching –learning process and noted the positive outcomes for students. The shift in perception of roles was well supported by working in the Fulton environment that consistently focused on engaging students as self-directed learner through inquiry-based approaches to learning. Having a belief in the value of this concept the teacher was able to modify his/her practices and play a role in supporting some positive outcomes for students. This process reflected Guskey's (2000) proposed order of change but the teacher also acknowledged the importance of relationships in the learning environment. Hargreaves et al. (2001) claimed, "Meaning, motivation and relationships are at the heart of the change process, by either design or default" (p. 118-119). For this teacher, meaning, motivation and positive relationships were all evident and supported by working in an environment that was specifically designed for teachers' learning.

One teacher responded from a more political perspective, indicating that his/her most significant learning was also linked to professional role but from a critical view on the lack of system-level recognition. It appeared the survey was an opportunity for this teacher to share his/her frustration at the significant amount of work and change that was required to work at Fulton.

It is difficult to work within different frameworks to those that have been historically established. This difficulty in developing different curriculum and ways of delivering it is not truly valued in the sense that it is very undervalued and under resourced in human terms. The cost to individuals is difficult to quantify and it is not taken into account at the highest levels of planning (beyond the school!).

All responses reported to date in this section linked teachers' learning about teaching and learning at Fulton to their professional role and this appeared to be an important outcome. These teachers connected their most significant learning to aspects of their role, which is not surprising given their roles were changed through working at Fulton. Teachers were curriculum developers and leaders of professional learning for others beyond the school yet they still maintained the role of secondary school teacher. The experience of learning and working in a school that had redesigned the way teachers worked engaged teachers in reconceptualising their professional roles. Whether through the experience of working in different ways or an opportunity to enact preexisting beliefs many teachers reported a shift in perceptions of their

professional roles and identified this as a significant learning outcome about teaching and learning.

The school's focus on distributed leadership, the trust and respect that was placed in teachers, and the opportunity and time to create innovative curriculum, all reported by teachers as affordances for their learning, provided teachers with a greater sense of discretion in their work which in turn provided greater opportunities to 'explore new intellectual territory' (Hargreaves et al, 2001, p. 175). The shift in professional roles was well supported by the leadership team at Fulton and appeared to support a shift in teachers' sense of professional identity as well. Recognition from professional partners and joint presentations with academics at international conferences engaged teachers in a world well beyond the four walls of traditional science and mathematics classrooms. The emergence of a new sense of professional identity as an outcome of teachers' learning and experiences at Fulton was significant for teachers but also for the school in achieving its vision and developing as a learning organisation (see further discussion on these points in the forthcoming sections).

Further evidence of reconceptualisation of professional roles and identity is captured in another teacher's response which also identified the affordances that facilitated these changes.

We have been encouraged to explore how different forms of curriculum delivery can enhance learning. This includes delivering learning experiences, providing resources for students, using digital communication to build a learning community and in exploring new ways students can demonstrate their learning. I have pursued these matters by attending a small number of conferences, using web searches and reading research based publications. There has also been a significant peer to peer learning where we have shared ideas. Presenting at conferences and to visitors to [Fulton] has forced me to reflect, clarify and document my learning. It's taken me to a different level in my work; I sense a purpose well beyond the role of a traditional teacher.

Teachers' responses to the survey questions on most significant learning and the processes that supported their learning provided evidence that their learning influenced the way they perceived and enacted their role. The shift in teachers' perceptions of their role was supported through their daily work but also through their learning. Such an outcome was fundamental to achieving the educational transformation the school had envisioned. As Fullan (1991, p 117) stated, "Educational change depends on what teachers do and think. It's as simple and complex as that," and the outcomes of teachers' learning at Fulton added support to Fullan's findings.

6.2.2 Changes in teachers' beliefs as an outcome of teachers' learning

The following section reports teachers' responses to survey question six that focused specifically on changes in teachers' beliefs. Changes in practices (see following section) were more easily identified by teachers than changes in beliefs. The use of the word 'major' in the

question possibly resulted in teachers responding that beliefs had been reaffirmed as opposed to undergoing major changes. Teachers articulated how beliefs had been influenced through working at Fulton but some teachers did not consider their beliefs had changed. This was of interest given that they had reported changes in their professional roles. Guskey (2000) contended that efforts to change teachers' beliefs and attitudes were often futile if evidence of improvements in students' learning as a result of changes in teaching practices was not forthcoming. At Fulton teachers had made changes to their practice and reported positive outcomes for student learning. However, some teachers did not report any sense of significant change.

No major changes in my beliefs. I am pleased to say an affirmation of my beliefs.

I can't identify any changes at this point.

Teaching is a life long learning experience. Work at the Fulton has been a part of this and, as such, has served to confirm or re-prioritise beliefs rather than changing them. It has been possible to employ some approaches and strategies that would have been more difficult in other environments.

I do not think it has changed direction but I have been more convinced that the type of approach i.e. interdisciplinary, technology based learning is powerful. Teaching at [Fulton] has further convinced me that major change to the system of schooling and tertiary selection needs to be made.

I don't think there have been major changes more of revisions and enhancements. It always surprises me how much young people can achieve at times. Even though I've been a believer of problem based learning - this has been cemented even more during my time here.

The responses suggested that teachers reflected on their existing beliefs as being reaffirmed rather than changed but connections between beliefs and new practices were evident. For example, one teacher said he/she was 'more convinced' that technology and interdisciplinary curriculum should underpin other educational reforms. There was a sense that teachers' experiences of changes in practice were of greater influence to reaffirming rather than changing beliefs. To fit with Guskey's model this would suggest teachers held existing beliefs that matched the models of transformation generated by Fulton. Indeed many teachers chose to teach at Fulton as they believed education in the senior secondary years, particularly in mathematics and science, needed to change. The Fulton environment provided an opportunity to put their beliefs into practice and the outcomes served to reinforce their beliefs. One teacher captured this concept in his/her response:

I am not sure there have been any major changes as I strongly believe and support the underlying principles of [Fulton] and have been working towards these for some time now as a professional. Maybe I have more insight into frameworks to support teachers in their professional learning something I have not given much thought to before.

In this response, as with those cited previously the connection to 'possible' shifts in beliefs are all associated with engaging in new practices building the case for the strong connections between beliefs, practices and perceived student learning needs and outcomes. The following responses provided evidence of how beliefs and practices were interwoven and were also influenced by perceived students' learning needs.

In some respects it has reinforced the beliefs that I already had. The necessity to provide context and to allow students to pursue areas of interest have been strengthened. I have become even more aware of providing for different learning styles within a group and ensuring that they are catered for. I have become less convinced of the need for extended "drill and practice" type activities although there is still a place for this in some cases where "more of the same" can help to reinforce an idea.

Reinforced my belief that interdisciplinary learning and teaching have far greater value than reductionist teaching practices for both teacher & learner -reinforced my belief that the infrastructure of teaching e.g., data show projectors, video and DVD displays, ease of publication of materials, access to IT and internet are powerful tools to engage the learners with the curriculum

Guskey's (2000) Model of Teacher change, presented in Figure 6.1, was of interest in determining whether his proposed order of change was reflected in Fulton's teachers. Although the model is presented in a linear mode Guskey stated that the "process of teacher change is probably more cyclical than linear. In other words, change in attitudes and beliefs are likely to spur additional changes in practices that bring further change in student learning, and so on" (p.140). However, he also said that the model "oversimplifies a highly complex process, and exceptions to the model certainly exist...Still, under most conditions the order of change events described in the model holds true" (p.140). At Fulton many teachers appeared to be influenced by the successful outcomes of changed practices and reflection on student learning, providing support for Guskey's model. However, although changes in practice were easily identifies (see following section) teachers viewed these as reinforcing rather than changing their beliefs, suggesting that their beliefs shaped their practices.

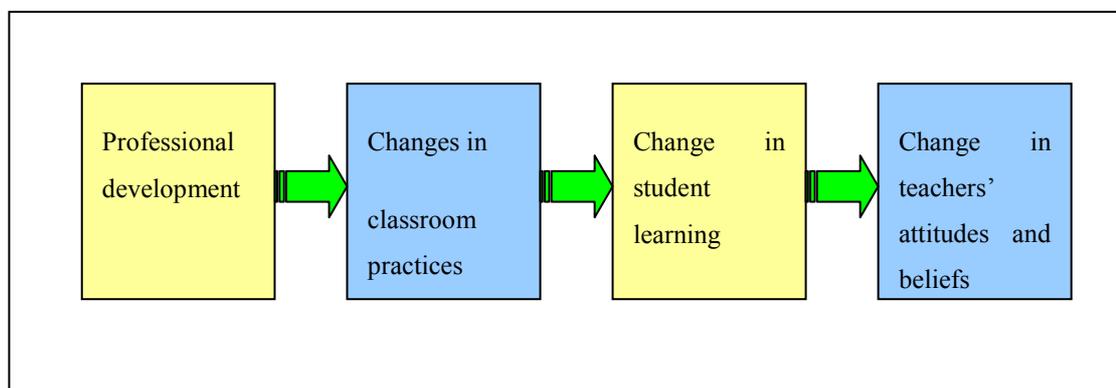


Figure 6.1 Guskey's Model of Teacher Change (2000, p. 139)

Desimone (2009) in her research on evaluating the effects of professional development on teachers and students proposed a different change model to Guskey's. Her model, presented in Figure 6.2, contended that teachers who experience high quality professional learning will increase their knowledge and skills and change their attitudes and beliefs. As a result they will change their instructional practices and improved student learning will result. Although Guskey and Desimone both agreed on the importance of teachers engaging in high quality professional learning prior to changes in beliefs and/or practices emerging they differed on the influence of student learning on teachers' attitudes and beliefs. Guskey's model viewed change in students' learning as a prerequisite to change in teachers' beliefs and attitudes while Desimone's model proposed that changes in teachers' attitudes and beliefs preceded change in practice and improved student learning outcomes, although her arrows suggest an interactive effect of one factor on another. Desimone acknowledged that her model contrasted to those of other researchers including Guskey, (2000), Clarke and Hollingsworth, (2002) and Borko (2004) (cited in Desimone, 2009), and stated:

My notion of nonrecursive, interactive pathways does not prevent differential emphases on either the basic components (professional development, knowledge, practice, and student achievement) or the addition of moderating and mediating elements such as teacher identity, beliefs, and perceptions (p. 185).

Indeed her acknowledgement of moderating and mediating elements is included in the model as underlying the change process. However, she pays limited attention to these elements suggesting empirical studies that "include all elements are rare" (p.185). Further discussion on the role this thesis played in illuminating many of the moderating and mediating effects is taken up in Chapter Seven but for now the focus remains on ascertaining whether the experiences of teachers at Fulton replicated either Guskey's or Desimone's models or both.

Desimone model proposed that the order of change, although generally occurring in the order presented in Figure 6.2, is subject to change depending on where emphases are placed. At Fulton emphases were placed on creating an innovative model of schooling, changing teachers' traditional ways of working in senior secondary school and recreating the traditional discrete subjects model of curriculum in favour of interdisciplinary curriculum. These emphases featured in some teachers' responses to survey question six on changes in beliefs

Previously I believed that an interdisciplinary curriculum was OK for primary schools, interdisciplinary science was OK for middle schools but teaching within the disciplines was best for senior school. I can now see the power of interdisciplinary learning at senior secondary level. I believed it was very difficult to bring about total change that I could only make small changes around the outside of accepted practice. At [Fulton] we have made incredible changes to the way we deliver, assess, report etc. We have made enormous changes to curriculum and curriculum design.

I have made an escape from a raft of traditional paradigms about schooling as a process. I have been liberated from the school: classroom: teacher: class: subject: grades: reports constructs. I don't see schooling anymore defined by these confining delineations.

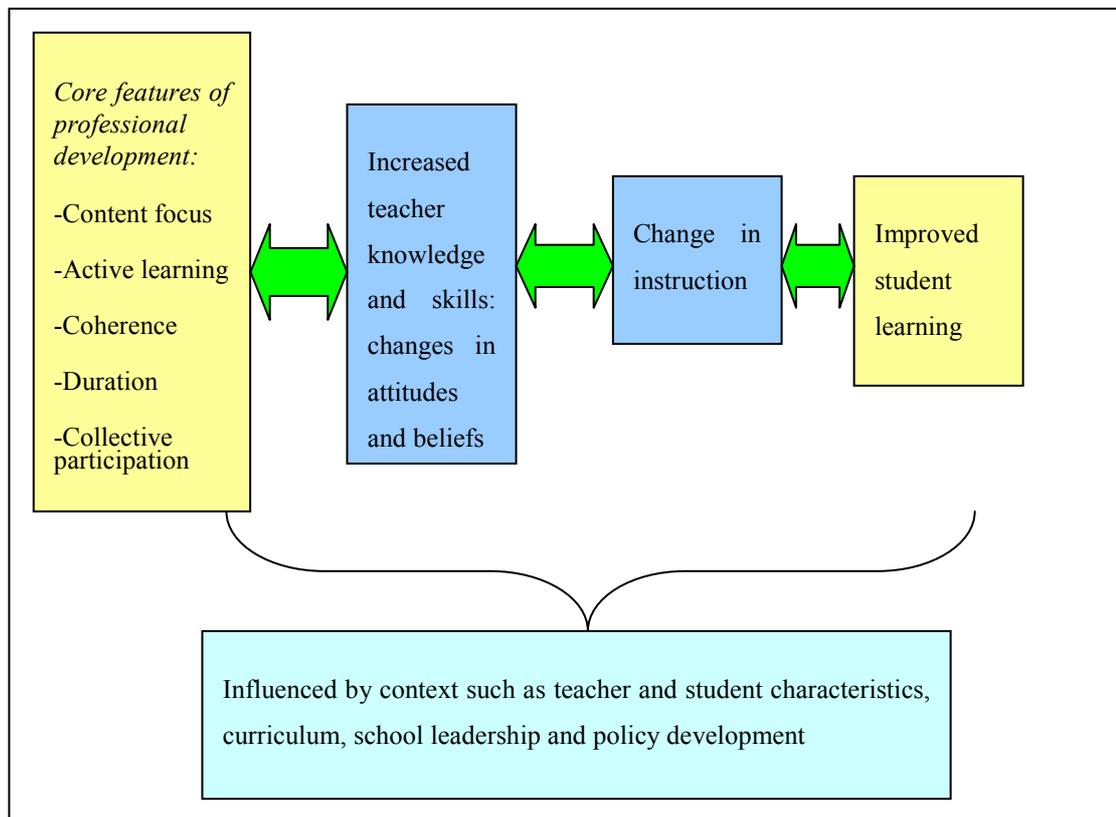


Figure 6.2 Desimone's (2009, p.185) conceptual framework for studying the effects of professional development on teachers and students.

Clearly these teachers were both influenced by Desimone's notion of 'policy development' as a mediating factor in their beliefs and practices. However, the first response clearly suggested that a shift in beliefs was only possible once the success of interdisciplinary curriculum was evident. The teachers' response did not include his/her criteria for success, for example, student learning outcomes, but considered that the outcomes were powerful enough to recognise that significant change in practices had occurred and this had supported a shift in beliefs about what was possible for senior secondary schools.

In essence teachers' responses to changes in beliefs served to support Guskey's proposed order of change over that of Desimone's. However, Fulton was unique in that changes to traditional ways of working and organising the school did not occur as a gradual process but were enacted from the opening day and as such skills and knowledge to work in new ways

developed through practices rather than prior to it as suggested in Desimone's and Guskey's model. This concept is considered in more detail in the summary discussion in Chapter Seven.

Desimone's notion of moderating and mediating elements was of more interest in considering changes in beliefs for teachers at Fulton, rather than defining an order of change. Teachers' reported few significant changes in beliefs rather, their preexisting beliefs were reaffirmed and this was based on the mediating elements of the school's policy for innovation, and the moderating effects of the students' levels of engagement and teachers' own sense of efficacy within the school as a learning organisation. The mediating and moderating elements Desimone referred to are identified in this thesis as affordances for learning and, as documented in previous chapters, each had an influence on teachers' learning. The research process did not seek to determine which affordances resulted in more significant change to teachers' learning and beliefs as it was clear there were many diverse factors that influenced teachers' learning. However, one affordance seemed fundamental to the opportunity for change to occur and that was teachers 'being open' to new ways of doing things and engaging in learning. It would appear such teacher characteristics should feature in any model of teacher change, particularly when the changes in beliefs were seen to support improved student learning outcomes.

Teachers' own characteristics and levels of interest and engagement with the different innovations at Fulton and the alignment these had with their preexisting beliefs influenced their choices in learning and as such the outcomes of their learning. The school as a learning organisation provided teachers with many options to engage at different levels in learning and beyond the need for all teachers to work with an interdisciplinary curriculum and in teams in an open space environment teachers were often free to pursue their own interests in learning. While this proved positive from the perspective of high levels of teacher engagement in learning it could be one reason for teachers' reporting limited changes in beliefs. The outcome of teachers pursuing areas of personal interest was reinforcement of their preexisting beliefs rather than significant change in beliefs. However, another outcome was the development of teacher expertise in specific areas of innovative practices and this served students and the school as a learning organisation well. Therefore significant changes in belief were not a prerequisite to teachers at Fulton improving knowledge and skills that resulted in improved outcomes. However, the fact that teachers' perceived there were few significant changes in their beliefs interested me and the outcome is explored in more detail following a discussion on teachers' perceptions of changes in their practice.

6.2.3 Changes in teachers' practices as an outcome of teachers' learning

All teachers reported changes in their practices in their responses to survey question seven. Responses from the teacher interviews also confirmed significant changes in practices. Changes were linked to interacting with colleagues with different discipline expertise, interdisciplinary curriculum, the availability of more extensive resources and as a contrast to previous ways of working. The majority of teachers had come from traditional secondary schools where each teacher was responsible for a range of classes and year levels and taught one or two subjects independently; therefore the experience of Fulton demanded changes in practice. Teachers' responses to the question on major changes in practice included:

Collaborative learning and teaching. I can learn from the wisdom of others with different expertise to mine.

Interdisciplinary teaching - I would have never thought that I would be involved in teaching English or Philosophy! I use collaborative learning and group work a lot more. I am much more explicit about how I assess.

I have had more professional interaction with science teachers; something I did little of in my previous school. I have had to spend an immense amount of time planning teaching sessions, more time developing resources online and taking more risks in curriculum delivery. The assessment of tasks has changed through the greater use of rubrics. Teaching science content and concepts has been a huge change. Being on display, to [Fulton] teachers and the stream of visitors.

One major change has been accommodating the interdisciplinary curriculum at Year 10/11 level. This has demanded a great deal of time on research and the development of suitable teaching materials/resources. The policy of no textbook (or limited access to texts) has required adjustment. The development of teaching practices that engage ICT options has been facilitated at [Fulton]. Few other schools have the ready access to computers and the net that exists here. It is desirable to take maximum advantage of this - but without losing the benefit of more conventional approaches.

The following response was of interest as it provided a further example of changing practice as a result of working in a school that demanded teachers interact and justify their planning and actions. The process of 'working' in a school successfully enacting a vision for innovation, as opposed to specific 'professional development' resulted in the teacher becoming more reflective of her/his own practice. The teacher also recognised the active role played by students in guiding his/her teaching, something that appeared to have changed to be reported in this way. Such an outcome reinforces Eraut's (2007) model of workplace learning with the teacher reporting that their 'work' as opposed to their 'learning' had influenced changes in practice.

I think I have become more reflective of my own practice. I have not always analysed what I have done in the past. Here it is necessary to be prepared to justify what you are doing and why and where it fits in the “big picture”. I have tried to be more creative in what I do and presenting things in a variety of different ways. I have relied on the students to indicate what they need to focus on to improve their understanding and to be guided by them to a certain extent in what is covered. I have been more conscious of trying to link ideas to topics and contexts that they are covering in other areas. The collaborative nature of the teaching environment means that it is fairly easy to do this.

The response highlighted affordances for learning including reflective practice, collaboration, students and the environment. However, the teacher described changes in practice as being linked to demands for new ways of working. Several of the changes reported by the teacher were connected to his/her professional role, for example, being more accountable, working in collaboration and being guided by students. This tended to suggest that the process for change in practices was initially based on the vision and policies of the school but through the teacher being open to working in new ways he/she noted that new practices led to a perception that he/she was a more reflective, creative teacher. The teacher also reported a new sense of professional role in supporting students' learning as well.

Other teachers also commented on spending much greater time in planning and one teacher responded:

Attention to detail in preparing curriculum materials. I used to rely on my knowledge and relationships rather than any given material.

The demand to work in new ways appeared to engage all teachers in thinking more deeply about the content they were teaching and how they would teach it. There was sense of accountability to colleagues in addition to accountability to students, and this was a shift in role from previous schools. Developing innovative curriculum was a major change in teachers' practice but it also appeared to act as a catalyst for other changes in teachers' sense of professional role and identity.

Designing innovative curriculum was often challenging work and teachers occasionally vented their frustration, as stated previously in this thesis. The frustration was directed at the system's lack of recognition for the changing nature of teachers' work at Fulton, rather than at Fulton itself. The need to engage in interdisciplinary curriculum writing was a new role for teachers and led to teachers redefining their practices and sense of professional roles. Although the work of designing and developing innovative curriculum was complex and challenging, teachers found this aspect of their work rewarding and embraced the opportunity to work in new ways. The engagement in and outcomes from working in curriculum writing team again reflected Eraut's (2007) model of workplace learning with teachers' learning and shifts in practice and sense of professional roles and identity being embedded in their daily work

challenges. Eraut proposed that confidence results from successfully meeting workplace challenges. It was evident that many of the teachers at Fulton developed confidence in their abilities as curriculum designers and leaders of professional learning for others. The confidence coupled with support from colleagues and the leadership team resulted in high levels of teacher commitment. One teacher reflected:

Perhaps the self-confidence I alluded to earlier is most relevant to talk about here. Perhaps it is just repetition, but collegial support, the feeling of being part of a dynamic developing place that gives me the opportunity to try new things and values my efforts has been significant and leads to greater commitment.

Whether this reflection was connected to changes in previous practices and beliefs or not, it does suggest that an outcome of working and learning at Fulton was enhanced teacher confidence and commitment.

Teacher confidence and commitment emerged from the success of the Fulton model and an outcome was a shift in teachers' perceptions about what was possible in senior secondary schooling. Possibilities for schooling and teachers' professional roles and identity were based on observing outcomes for students and for the teachers' own sense of personal agency. Links with the model of teacher change proposed by Guskey (2000) and Desimone (2009) were evident. However, their models were focused on teacher learning that enhanced student learning outcomes whereas Flores and Day (2002) proposed that changes in teachers' sense of professional identity needed acknowledging as a valued outcome of teachers' learning and work.

Day (2009) stressed that for teachers to change their sense of identity, the "modification or transformation of values, attitudes, emotions and perceptions which informs practice: is required" (p. 98) Teachers reported that changes in professional role and identity were linked to opportunities for leadership and working in new ways rather than being driven by shifts in values and attitudes. Changes in practice and roles were easy to identify in the innovative environment of Fulton. Changes in beliefs and values were harder to determine particularly if the outcomes of changes in practice matched teachers' aspirations for desired ways of working as well. It could be that teachers' values, attitudes and beliefs had shifted through their experience of working at Fulton but most teachers' did not report these as significant shifts. The focus on teachers' ability to connect their learning and changes in beliefs and practice is addressed again in the section to follow on teachers' perceptions of their most important learning at Fulton.

Teachers' responses to changes in practice at Fulton provided a basis for reconsidering existing models for teacher change (Guskey, 2000, Desimone, 2009). Responses to the survey

questions on change indicated that the scope of 'professional development' as a prerequisite for changes in teachers' practices and/or beliefs and attitudes at Fulton was much broader than the traditional notions of 'professional development' and even that of the professional learning strategy of the school itself. The explanatory model of teachers' learning developed in this thesis is a more expansive model for understanding the many processes that supported change and that many of these processes were embedded in teachers' everyday work. The vision of the school's founders to re-conceptualise senior secondary schooling and teachers' roles within the new model resulted in teachers' work becoming their learning – a vision also supported by Fullan (2008) as a feature of achieving positive change in organisations. Eraut (2007) also supported such a model as do the principles of effective professional learning identified by Hawley and Valli (1999) but they provide limited evidence as to the degree to which 'work as learning' supports change. The stories from the teachers at Fulton supported the paradigm that reconceptualising teachers' work in a purpose built environment, and linking this with opportunities to learn, proved a powerful catalyst to change. Given there is limited evidence in the literature of schools reconceptualising teachers' work as their learning to the degree found at Fulton this is an area worthy of additional research.

6.2.4 Teachers' understanding of learning and teaching and its influence on changes in beliefs and practices

The professional learning strategy at Fulton had an explicit focus on teachers developing clarity of understanding of the concept of deep learning and pedagogy that would support such learning and the initial three survey questions sought to determine whether teachers' responses reflected the learning they had engaged in as part of the school's professional learning strategy. The purpose of asking these questions in relation to the overall research aims was to determine if such an explicit focus on deep learning and pedagogy supported teachers in making changes to their beliefs and practices. Darling-Hammond and Richardson (2009, p.42) found that, 'Ensuring student success requires a new kind of teaching, conducted by teachers who understand learning and pedagogy'. The link between teachers' knowledge of learning and teaching, and improved outcomes for students, was addressed by other researchers as well, including Fullan, (2007), Sergiovanni, (2007) and Timperley et al. (2007). Although it was not possible in my research to directly link enhanced teachers' knowledge of teaching and learning to improved outcomes for students it was considered foundational to the ability to describe how students best learn and subsequently engage in teaching to support such outcomes. Johann's story provided an excellent example of one teacher's knowledge of teaching and learning and the importance of this knowledge in transforming his practices.

The term deep learning was used in the survey as this was the language teachers had been exposed to as part of the school's professional learning strategy and teachers were using as a desired outcome for student learning. The responses to the first question on deep learning could be read as the type of learning and behaviours that teachers desired as outcomes for students at Fulton. Responses from teachers included:

Deep understanding of ideas, disciplines or concepts includes: the ability to construct relevant questions - the ability to identify how ideas or theories apply to real world phenomena - the ability to readily make links between different aspects or areas - being able to appreciate why problems are approached in a particular manner - being able to make correct decisions on when to be flexible and when to be rigorous or consistent in a particular approach to learning or problem solving - the ability to illustrate, amplify or summarise ideas using examples, models or links to other areas

Firstly, 'deep' implies considerably more than superficial; secondly, 'understanding' implies that something is understood at a conceptual as well as a factual level. If we combine the two we get something that is understood at a deep conceptual level enabling the person to manipulate information and purposefully use the information to create new information or ideas.

Being able to fluently discuss a concept: to move from one type of audience to another and be able to communicate understandings using language which is appropriate to the audience. This includes communication in written, graphic or performance modes. Deep understanding also includes understanding the relationship between knowledge in one area and another. How the knowledge in one area influences understandings of another.

The teachers used a range of words to link learning with understanding and in effect captured many of the facets of understanding proposed by Wiggins and McTighe (1998) including the ability to explain, interpret, apply and take varied perspectives. Such descriptions were reflective of content covered in the school's professional learning strategy sessions although it is not possible to tell whether responses were generated from these sessions or other sources.

In general, teachers responded to the question on deep learning with students' learning in mind and this was not unusual given teachers' identities are grounded in a responsibility for student learning (Hargeaves et al, 2001). Even though many teachers reported changes in the way they worked with students they still felt accountable for supporting students to develop deep understanding and it was not surprising to find that most teachers failed to connect their own experiences of learning at the school to their description of deep learning.

Only one teacher in their response to survey question two, "What do you believe are the characteristics of deep understanding?", reflected that deep learning manifested an "ability to

change the way I view and do things based on validated evidence” suggesting a link with knowledge of self as a learner. As the school’s vision was for all teachers to view themselves as learners it was interesting to note that only one teacher had made a connection between his/her learning and the concept of deep learning. The teacher’s use of the term ‘validated evidence’ was of interest too, as it reflected the notion that deep learning was connected to a positivist perspective. Such a notion is reflected in much mathematics and science yet the school’s professional development strategy sought to ensure that teachers promoted the perspective that there was more than one way to do something and there is often more than one answer to a problem. Even though teachers provided some sound responses to the question of deep learning several responses failed to make connections between self as learner and descriptions of deep learning. In addition, there was limited connection to understanding related to knowledge of self as a learner (Wiggins and McTighe, 1998) although this had also been a priority in the professional learning strategy.

The second question in the survey engaged teachers in thinking about processes that best support deep learning, and the responses this time focused on both student and personal learning. Responses included reference to motivation, self reflection, time, opportunity, perseverance and processes of reading, questioning and analysing information, writing, reporting and so forth. Individual responses from teachers also recognised that processes varied based on individual preferences. Many responses indicated that deep learning was evident when the person could explain or teach the concept to another person. Many of the connections made between processes that supported deep learning and subsequent evidence of deep learning were possibly linked to teachers’ reflecting on their expectations of students when displaying evidence of deep learning. The following reflection identifies the importance of explaining learning to others but it also highlighted that achieving deep learning was a cyclic process and not knowing appeared to be an important aspect of the process. The following reflection provided a sense that the teacher had been engaged in exactly this process while working at Fulton.

Initially it's collecting, reading or listening to the information. Then the questions start to arise about the information or about how the information is related. It's finding the answers to those questions that are posed by the learner or by teachers or others that results in deep learning. Deep learning has occurred when the learner can explain the interconnections between the information to others. Even deeper learning is when exceptions are found that challenge the accepted connections or interpretation. That's when the real research starts. So in reality it's cyclic - gaining knowledge, using knowledge, developing connections then realising that you in fact know very little about the really interesting parts of that knowledge collection!!

Processes that supported deep learning appeared linked to a very personal and individual experiences but that were well supported by teachers' understanding of engaging students in learning, be it at Fulton or through prior experiences. The following response provided a strong sense of the pedagogical practices the teacher would use to support student learning.

Opportunities to make mistakes in a supportive environment, identify current knowledge and skills, and move to new understandings from this base, to work in a range of pathways to acquire knowledge and skills via visual, aural, and kinesthetic modes.

Most responses about processes that supported deep learning made limited references to learning in collaboration and yet this was consistently reported as an affordance for teachers' learning. This gap was of interest as it appeared that teachers were failing to draw on personal experiences that supported their own enhanced understanding. Rather, they appeared to respond to the question based on thinking about how to support learners in a system based on assessing students as individuals. Elmore (1996) contended that in the "vortex of change...basic conceptions of knowledge, of the teacher's and the student's role in constructing knowledge and the role of classroom-and-school level structures in enabling student learning remain relatively static" (p. 4). Although Fulton represented a significant shift away from traditional models of schooling and engaged students and teachers in working in new ways, including in collaboration, teachers' responses to processes that supported deep learning reflected a notion of learners as individuals. A perspective possibly perpetuated by the high stakes final year exams.

The following response provided another example of a teacher having a sound understanding of processes that support deep learning. He/she concluded the response by acknowledging the importance of interaction with "rich and diverse sources" but does not indicate this required collaboration with others.

Multi-analysis! Learners working towards deep understanding are engaged in a complex interactive sifting / reflection processes that allows them to use an array of processes to experience, understand, evaluate, interpret, review etc. The brain needs to argue, analyse, debate and muse with itself. Significant in the process is the interaction with rich and diverse sources of knowledge, ideas and experience

One teacher's mentioned the value of working with others to support deep learning. This was embedded in a detailed response that identified many elements that appeared to link with the culture of Fulton including daring and courage, patience and feedback and not always being able to see the big picture while on the journey.

First and foremost engagement and daring. There needs to be a sense of patience - something that is understood in the first few minutes may not be a very challenging or fruitful area for future study. Developing deep understanding involves a journey with many small stages and the whole destination or scenery may not be evident until you reach the top of the mountain and look around. Learners learn by questioning and answering, by testing their ideas, by engaging with the process

honestly, by working with other learners, by reading and listening and talking, by planning, by sitting on hilltops thinking, by sleeping and eating and exercising in a balanced manner and by accepting advice while having the courage to test it.

It was difficult to determine whether the teachers' responses to the survey were generated specifically by their experiences at Fulton but given Elmore's (1996) contention that most school reforms do not result in significant change to teachers' core beliefs and practices it is likely that the responses to the first two survey questions were based on existing beliefs about learning, rather than solely on their learning at Fulton. This provided some sense of the challenge in changing teachers' existing beliefs even when they experience high quality professional learning. It also challenged the notion that models of teacher change rely on changes in beliefs before changes in instruction may occur (Desimone, 2009).

Teachers at Fulton experienced a model of professional learning that reflected the research on best practice (Darling-Hammond et al, 2009, Desimone, 2009, Hawley and Valli, 2000, Timperley et al, 2007). The opportunity to focus on and experience deep learning reinforced Hargreaves' et al., (2001) belief that teachers need to see exemplars of theoretical perspectives in action to reinforce or change their beliefs and practices. At Fulton many exemplars of deep learning were available and personally experienced by teachers and as such the majority responded to questions on deep learning in comprehensive ways. Such an outcome may have been based on existing beliefs but the opportunity to explore these beliefs in more depth with colleagues, and observe and engage in such learning at Fulton achieved one of the goals of the professional learning strategy and in turn contributed to building a rich and dynamic learning organisation based on well informed teachers. However, there was little evidence that the teachers drew on their own experiences to describe deep learning and the processes that support deep learning. Further consideration of why this proved to be the case is discussed following an analysis of teachers' responses to the third survey question.

The third question in the initial survey focused on teachers' beliefs about what schools should do to foster deep understanding in students and provided an opportunity for teachers to shift their thinking beyond Fulton. However, responses indicated that the teachers' experiences of working and learning at Fulton were influential. Language such as 'making connections between understandings', 'immersion activities', 'public displays of knowledge', 'place of learning', 'judges of learning' and to move beyond 'learning outcomes being predetermined' could all be directly linked to specific practices and foci of professional learning sessions and experiences of working at Fulton. The responses suggested teachers' experiences of learning at Fulton influenced their ability to define models of schooling that foster deep learning for students.

Excite and motivate, provide an environment that stimulates the making of connections between understandings. Flexibility in accommodating the need for students to approach the understanding from different angles/views etc. Make the learning environment one in which exploration of the understandings is possible (or even expected).

Students need to be interested in the knowledge set that they are working with. That may be inherent interest or the interest needs to be fostered by novel situations, immersion activities, tasters etc. It depends on the individual how the initial knowledge is attained so different formats for presenting knowledge or searching for knowledge are needed. Continually challenging the students' understanding is of utmost importance. When the knowledge is sufficiently developed, set up situations where students publicly display their knowledge. Ask students to teach each other and other people.

Schools must provide the time and the exposure to a variety of situations to inspire students to delve deeper into a particular aspect or idea under discussion. The student must be given the chance to explore a concept and to be comfortable to report back what he or she has discovered. He or she must be shown that it is OK to "fail" i.e. that a particular avenue of investigation has not led anywhere. This is a learning experience in itself. The main problem with this approach in schools today is that they lack the time to allow students the luxury to explore where they will.

We need to challenge students. There must be an attempt to find a happy balance between guidance, direction and freedom - all of them have their place in different circumstances. We need to develop trusting relationships without losing sight of the fact that we have different roles as students and teachers with each having different rights and responsibilities because of this. We need to try to establish what it means to be an emerging young adult today and agree on how this affects personal freedoms and obligations.

Collaborate, challenge thinking, and focus on learning as an indefinite continuum. Understand learning to be a personal experience in the first instance...something that is valued and not finite. Schools need move on from adopting the paradigm that learning outcomes are predefined by teachers or communities that know what has to be learned. That paradigm is limiting. School needs to be redefined from 'place of learning' and 'judge of learning' to 'facilitator of learning' Teachers in places that facilitate learning are then more cast as motivators, encouragers, coaches, investigators, supporters, provocateurs, challengers, inquisitors etc.

Although teachers also brought many beliefs about learning and pedagogy to their positions at Fulton many responses could be directly linked to the experiences of learning and working at the school. The fact that the final three responses challenged existing model of schooling by calling for different roles for teachers and great recognition of students' capabilities was on outcomes of their experiences at Fulton. Although the responses did not provide evidence that teachers' changed their core educational beliefs, there was a sense that beliefs were enriched and articulated through the experience of working at Fulton. Once again,

this served to strengthen the school as a learning organisation as leaders were confident in teachers' abilities to share and enact the vision of the school with students, parents and visitors.

The responses to the initial three questions of the survey provided insight into the teachers' beliefs about learning and processes they believed best supported deep learning. The language used in the third question provided explicit connections between teachers' beliefs and the practices and the culture of Fulton. The responses displayed evidence of teachers' engagement in a school culture and philosophy (SCP) that provided a specific focus on being a learner and a professional learning strategy (PLS) that consistently engaged teachers in understanding and questioning processes that fostered deep learning for students and themselves.

Teachers certainly used the language and concepts proposed by other researchers about deep learning, particularly those prioritised within the school's professional learning strategy (Atkinson and Claxton, 2000, Biggs 1999, Bransford et al, 1998, Moon, 1999, Stoll et al, 2003, Wiggins and McTighe, 1998). However, there was limited recognition of aspects that teachers reported through interviews and journals as affordances to their own learning, for example, learning in collaboration with colleagues, access to expertise, physical proximity and so forth. The gap between describing learning processes for others and drawing on their own experiences as a learner was surprising especially given the explicit and sustained focus on everyone in the school being a learner. Again, this gap appeared connected to teachers' sense of identity and professional responsibilities for students' learning over an above their own learning. Teachers applied to teach at Fulton not because they wanted to become learners themselves but because they wanted to improve students' experiences of senior secondary mathematics and science education. This was their primary mission and such a core belief was reinforced by outside expectations that students would be successful and ultimately achieve well in the final Year 12 exams. These were familiar social and political pressures experienced in previous schools but given the sharp focus on Fulton as an innovative school the pressure to support students to achieve successful learning outcomes seemed more pressing and possibly acted as a roadblock to teachers making more specific connections with their own experiences of learning and those of their students.

The failure of teachers to connect their own affordances for learning to their descriptions of processes that support deep learning for students may also reflect an understanding of the contextual differences between students and adult learning. In general, adult learners make their own choices about engaging in learning and many of their professional learning experiences occur in collaboration with other teachers without the pressure of time limits and high-stakes testing (Cuban, 1995, Foley, 2004). Students on the other hand are rarely provided with the

same conditions and the teachers at Fulton in their responses may have reflected this understanding. However, Fulton aimed to replicate many of the conditions enjoyed by adult learners for students, including choice, learning in collaboration and extended time for learning and therefore connections to the affordances teachers experienced for learning may have been expected in teachers' responses. Further investigation as to the reasons for this gap between teachers' experiences of learning and their descriptions of supporting deep learning for students would be worthy of additional research.

6.2.5 Reflecting on the outcomes of teachers' responses to the initial survey

The survey responses provided evidence that teachers' learning (and work) at Fulton influenced, though not always changed, their beliefs. Teachers identified changes in practices and reported that changes in practices were a result of the requirement to work in new ways but also the opportunities provided for learning generated by contextual conditions, organisational elements and relationships factors at Fulton. Some outcomes of teachers' learning warranted closer consideration including whether the change processes as reported in the literature by researchers such as Fullan, (2001, 2002, 2003), Guskey, (2000), Hall and Hord, (2001) and Desimone (2009) were reflected in the learning of teachers at Fulton and why a gap appeared to exist between teachers' learning experiences and their description of learning processes to foster deep understanding in students. The following section reflects on both of these issues.

In reviewing teachers' overall responses to the survey questions a pattern of failing to make explicit connection between teachers' own learning experiences and supporting learning for students was evident. The following responses from one teacher to questions in the survey provided an example of this:

What do you believe schools and teachers can do to foster deep understanding in their students?

Schools must provide the time and the exposure to a variety of situations to inspire students to delve deeper into a particular aspect of idea under discussion. The student must be given the chance to explore a concept and to be comfortable to report back what he or she has discovered. He or she must be shown that is it OK to "fail" i.e. that a particular avenue of investigation has not led anywhere. This is a learning experience in itself. The main problem with this approach in schools today is that they lack the time to allow student the luxury to explore where they will.

What are the most important things you have learned about teaching and learning since being at Fulton?

The importance of collaboration is evident. There is a high level of collegiate support and dedication. I have been able to re-evaluate what I think of as good teaching practice and have tried to be more creative in how I introduce a concept.

What have been major changes in your beliefs about teaching and learning since commencing at Fulton?

In some respects, it has reinforced the beliefs I already had. The necessity to provide context and to allow students to pursue area of interest have been strengthened.

What have been major changes in your practices since commencing at Fulton?

The amount of team teaching I am now engaged in. The close collaboration across the disciplines has meant less skepticism about team teaching.

The four responses from the teacher captured the shift between thinking about students as learners and thinking about self as learner. There was recognition that students should be provided with opportunities to pursue their own interests in supported ways, particularly through allocation of more time. This teacher went on to make a direct reference to the role of collaboration in supporting changes in his/her practice and belief but such processes to support student learning was not mentioned. There was much evidence that teachers at the school did encourage collaborative learning and many internal assessments were completed in groups yet collaborative learning failed to be acknowledged by teachers as an important support to foster deep learning. As stated previously, this may have more to do with the boundaries placed on teachers by external bodies and the nature of schools but Fulton was striving to break down these barriers and indeed had achieved many successful changes. Therefore, it would seem desirable that teachers made more explicit connections between their own processes of learning and those provided for students.

A further point of interest in the teacher's overall responses to the survey questions was evidence of a shift in belief about the benefits of team teaching yet this was not reported as a change in belief in the previous question. Such a response highlights the challenge teacher may experience in separating practice and beliefs and the subsequent difficulty for researchers in understanding which drives which in the change process. The response to the question on important learning indicated that the opportunity to re-evaluate beliefs preceded intent to engage in more creative teaching practices. This supports the position of changes in beliefs driving changes in practices, a contrast to Guskey's (2000) model. However, the teacher has not recognised this order of change in his/her responses either. This may support Scharmer's (2009) contention that it is often difficult to determine the "source" from which one operates.

The difficulty in determining which drives which in the change process may connect with the implicit nature of beliefs and the explicit nature of teaching practices. If teachers explicitly explored in more detail how their beliefs influenced practice or their practices influenced beliefs the transfer of this knowledge to foster deep learning in students may be more

evident. Even with the intensive focus on self as learner at Fulton Johann was one of the few teachers to focus on the connections between his beliefs and actual practices. His learning generated well justified links between research on learning processes and his own experience of successful learning on which to base his changes in practices (again an order that contrasts to Guskey's but supports that of Desimone's (2009)). He made changes in practice prior to having evidence of student learning outcomes, as many teachers at Fulton were required to do as well. However, Johann's changes were explicitly linked to his beliefs about effective learning and teaching. An outcome in Johann's story was resistance to his changed pedagogical practices, mostly from Year 12 students who preferred a more traditional model of teaching that they believed would result in the best learning outcomes in their final exams. But Johann's sustained reflection on his beliefs provided confidence to maintain a commitment to his pedagogical changes with the belief that they would ultimately support improved outcomes for students.

Support for Guskey's proposed order of change was provided by the following teacher's response about changes in beliefs. Although the focus was on a change in belief the evidence for the change was provided by the experience of seeing students at Fulton taking control of their own learning.

Students as owners of their learning. This is actually a wonderfully liberating concept for teachers.

The teacher's response generated a sense that he/she had experienced students taking control of their learning successfully and that had 'liberated' his/her perspective of the role of teachers. In this sense, student performance was the catalyst to the change in a teacher's beliefs and subsequent practices. Yet it required a school and teachers to provide such opportunities for student self-directed learning, and the students to achieve successful outcomes through this process, before a shift in the paradigm of the role of the teachers was possible.

From my research at Fulton it appeared that the change process was not easily defined or linear in process, rather it resulted from a number of affordances coming together to generate learning opportunities and new experiences, plus different outcomes, and from these change occurred. It was not always easy for teachers to identify significant changes in beliefs but they were able to identify changes in practice. Teachers were not easily able to articulate the connection between their own learning experiences with processes that would support deep learning for students and yet their practices provided many opportunities to support student learning that mirrored their own learning experiences. The challenge of exploring that lack of connection between personal learning experiences and their articulation of beliefs for supporting student learning is worthy of further investigation with teachers at Fulton.

6.2.6 Findings from the follow-up teacher survey

The second 'follow-up' teacher survey was completed by ninety percent of teachers as a process for triangulating data and checking on the soundness of the explanatory model of teachers' learning that was emerging at that point of the research process. In addition, approximately thirty percent of staff at the time of the follow-up survey were new to the school and I was interested in whether their responses would indicate that the learning processes and outcomes reported by the school's foundation staff were sustainable several years into the school in operation. Three open-ended questions were asked in the 'Zoomerang' survey. Teachers were asked what their most significant learning had been, how this had changed their beliefs and/or practices and how their learning was best supported.

The use of overall responses provides evidence of processes that supported and sustained teachers' learning but of more relevance to this chapter, the outcomes of teachers' learning. Teachers new to the school, some graduates and some highly experienced teachers' responses have been included to provide for diversity in teacher characteristics, capacities and sense of personal agency. The responses substantiated the data gathered in the initial teacher survey and through other data gathering methods.

The most significant learning has occurred in a triumvirate manner firstly, that based upon the collegial atmosphere of the school, the ability to learn from colleagues both in a semi-formal and informal manner; secondly, the committed stance made by the leadership of the school towards professional development and the third aspect being as a graduate teacher the ability to plan, programme, teach and evaluate. I feel that I have become both a more knowledgeable and effective teacher and this has been supported by everything that happens in this school!

Everything, starting as a graduate I had limited experience. Working with people who care about education is great. I have built confidence in teaching and also in my leadership. The PD opportunities have allowed me to explore areas of teaching and learning that I would never have had the opportunity to explore in other school settings. The flexibility of leadership and encouragement of my line manager has helped me feel confident in developing my own interests and skills. My eyes have been opened and my personal beliefs about teaching and learning have been reinforced. Working with like minded educators and mentors has been very beneficial. Working with Industry as part of the Premier's Award helped me appreciate what science is like in the real world. In my first few years I got involved in everything I could, but I started to feel burnt out. The ability to adjust and personalise my PD really helped. Supportive and open minded leadership are also very helpful. I really love the learning opportunities I have as a staff member at the [Fulton].

The adaptation to a drastically different pedagogical approach. Student directed learning and the preparation for life long learning at university and beyond. Giving students the opportunity to develop their own knowledge, and develop their own personalised learning strategies does have a dramatic effect on the productivity,

quality, efficiency and confidence of the student and their work. Students respond well to a mutual respect. If a student feels that their opinions are valued, and that they are respected as a person (not a child) then they will more often than not reciprocate that respect. Although I already felt strongly that this was the case, [Fulton] has provided me with an opportunity to flesh out and test this. Highly collaborative activity. Professional dialogue, debate, ideas generation processes, risk taking and knowing that there is permission to stretch out and try. There is an important culture at [Fulton]...Learning is an expectation. That, in itself, is fundamental because what it does is to provide opportunity to search for new ideas and not be constrained by seeing the world as being known or as 'black and white'.

Each of the teachers' brief stories identified many of the affordances for learning cited by the case study teachers and responses to the initial survey and they continued to feature the affordances identified in the explanatory model. Teachers were not asked a specific question about how to foster deep learning for students, in fact there was no specific reference made to students in the open-ended questions; the focus was on the teachers' learning so there was every reason to suspect connections to student learning may be minimal. However, in the final response, from the more experienced, but new to Fulton teacher, there was specific acknowledgement of students influencing the teachers' beliefs and practice. The teacher suggested that many of their pre-existing beliefs about student learning were 'tested' in the Fulton environment once again providing evidence of practice and student learning outcomes reinforcing, challenging or changing beliefs (Guskey, 2000).

In the first response the teacher was unable to specify any specific outcomes of learning other than she/he felt they were a more knowledgeable and effective teacher. The final words in the response that learning was supported from 'everything that happens in this school' suggested a sense of feeling overwhelmed by the scope of what could be talked about in relation to learning. The response from the graduate teacher that followed also provided a sense of the many and varied affordances for learning but he/she was also unable to specify learning outcomes other than reinforcement of existing beliefs and practices. The teacher highlighted that getting involved in everything she/he could led to feeling overwhelmed. Many teachers commented on feeling overwhelmed as times and this appeared to be linked to the expectations of teachers to engage in teaching, curriculum development, and pastoral care of students, professional learning and often also the learning of educators from beyond the school. While this presented as a wonderful opportunity for learning there was a fine line between positive and negative outcomes and the emotional dimension of learning. Eraut (2007) and Hargeaves et al (2001) both noted the importance of acknowledging the influence of the emotional dimension on the quality of outcomes for professional learning with Eraut stating:

The emotion dimension of working life requires ongoing attention, which goes well beyond supportive relationships to include a sense of being a valued

professional whose progress meets expectations and who continues to construct a professional identity that is personally and socially valued. (2007, p. 420).

The final story that follows certainly captured a wide range of affordances that supported learning at Fulton and the influence of the teacher's own capacities and sense of personal agency as a vital affordance in learning. However, embedded in the reflection are a number of important outcomes of the teacher's learning with recognition that these were influenced by prior experiences together with those provided by working at Fulton.

My direct involvement in meeting new, enjoyable and refreshing challenges, and the development of a broader, more holistic perspective on the education of young people. It has been interesting to carry into [Fulton] my prior teaching experiences, and to see how well they can integrate with the innovative teaching and learning philosophies of the school. I believe that I have developed a preparedness to be more cavalier, more adaptable and more imaginative/creative in my approach to the teaching profession. I have learned to recognise, accommodate, and implement (ie. experience) alternative approaches to teaching, and alternative pedagogies that assist with the achievement of favourable learning outcomes for students. As with any school, [Fulton] has problems or issues that need to be addressed, but the manner of dealing with these issues has been, and continues to be, somewhat different here to elsewhere. Thus, I feel that I have gained considerable benefit from professional learning in that it has enhanced my inclination to think in a more open minded fashion and in a more informed manner, about the possible management of solutions to issues that may arise. I have a sense of feeling more authoritative in dealing with professional matters. Working at [Fulton] has lifted my confidence in meeting new challenges through some of the many opportunities presented to staff at the school. The most influential opportunities that I have experienced must include (in no particular order): Acting AP position (with associated responsibilities and interaction with staff in senior management positions); Study tour with students to South Korea; Working with university staff - University Studies, and other professional activities; Working with international students - both in my classes and through a variety of international forums; Attending PD conferences (some of which I found very stimulating); Assisting with construction, development and implementation of interdisciplinary curriculum for Central Studies; Using contemporary ICT in the delivery of programs; Adapting to working in a much smaller school than previously encountered; Interacting with "team" members, and entertaining their ideas. Clearly, this is not an exhaustive list, but it serves to identify some of the activities that have contributed to my professional learning during my tenure at [Fulton].

The teacher's story captured in the fifth year of the school in operation provided a sense of the school's sustained commitment to teacher's learning through affordances such as distributed leadership (including such opportunities for newcomers to the school), collaboration with university partners, working in interdisciplinary teams and where problems were viewed as opportunities for learning. These affordances for learning all featured in the explanatory model of professional learning. However, the teacher also reported other learning outcomes as a result of being at Fulton including being more creative, cavalier, adaptable and making use of approaches to teaching that he/she believed resulted in more favourable learning outcomes for students. There were no specific examples provided of the outcomes for students but it appeared

that the recognition of 'favourable learning outcomes for students' reinforced belief in his/her new practices. The teacher also commented that professional learning at Fulton had led to thinking in a more open-minded and informed manner and that this in turn led to working in a more authoritative and professional ways. Eighteen months following this statement the teacher won excellence in science teaching awards in his/her discipline at both the state and national level indicating that the teacher's self reported outcomes were also acknowledge by the wider profession. Personal achievement was certainly another outcome of this teacher's learning and experiences of working at Fulton and other teachers' personal and professional outcomes are reported in the section that follows.

Teachers' responses to the follow-up survey served to reinforce previous data that answered the research questions on what supported and sustained teachers' learning at Fulton and were reflected in the explanatory model of teachers' professional learning at Fulton. The responses also added to, and reinforced the data on outcomes of teachers' learning and highlighted that many teachers understood a great deal about deep learning and pedagogy that supported such learning and aimed to reflect this in their practices. Other outcomes included increased content knowledge, greater confidence and creativity in planning and pedagogical approaches. In addition, many teachers' reported a change in their sense of professional identity and role as a result of their learning and work at Fulton. However, outcomes also highlighted that teachers reported few changes but much reinforcement of preexisting beliefs. Teachers more easily identified changes in practice and such an outcome generates additional questions on how, and whether, teachers made explicit connections between their beliefs and practices. The outcomes of teachers' learning appeared to generate ongoing energy and motivation for learning which in turn were pivotal in sustaining the school as a generative learning community.

6.2.7 Diverse personal and professional outcomes for teachers generated by their learning

Many teachers through the partnership with the university complete post graduate study from Graduate Certificates to Master of Education. Ten teachers went on to enrol in a Doctorate of Education, indicating their commitment to the highest levels of learning. Through these scholarly activities, the teachers came to view themselves as equal partners in learning with their university colleagues and some were offered adjunct status at the university based on their work and commitment to sharing their expertise with university students as well. The increasingly qualified teachers applied for and won leadership positions within the school which brought with it financial rewards and increased confidence in their abilities.

Teachers spoke constantly of growth in confidence and the growth in confidence generated greater commitment and willingness to take on new challenges. The desire to take on

new challenges saw some teachers depart the school for leadership positions elsewhere. Teachers moved into principal and deputy principal positions, another teacher moved to New York to offer school-based professional development in mathematics. He went on to write a book about innovative teaching of mathematics in senior secondary schools following encouragement from publishers in Australia and the United States of America. Two teachers were selected to work on a national curriculum writing project and were often flying interstate to engage in this work. Teachers consistently presented at conferences at local, national and international levels and published papers in online teacher and scholarly journals. Teachers at the school combined teaching school students with mentoring teachers from other schools in their transformation of curriculum offerings. Some teachers were engaged to teach university courses in both science and education studies. Such diverse opportunities resulted in exceptional low teacher absenteeism and greater scope for the school to use teachers in different ways. However, such outcomes for teachers led to outcomes for others beyond the school as well and this is considered in more detail in a section that follows.

A challenge for the leadership team was to ensure that teachers were supported to take on new opportunities while at the same time maintaining a highly capable and consistent teaching team to support student learning at the school. The flexibility and foresight of the leadership team ensured a balance for teachers between new professional roles and their core business of teaching students. Discussion was often heard as to the best approach to manage this and at one stage teachers were completely released from teaching school students to focus on the professional development programs offered to other schools. However, teachers indicated they preferred a combination of working with students and in other professional roles. They believed continuing to work with students in new ways enhanced their abilities to be more authentic in the work they did with other schools and teachers. The leadership team listened closely to teachers and valued and respected their 'practical wisdom' in shaping their roles. Teachers in turn valued and respected the leadership team's decision making and were more open to suggestions from them as to directions they might consider taking. Such a scenario reflected Day's (1999) belief, that, "Support for their [teachers] well-being and professional development is an integral and essential part of efforts to raise standards of teaching, learning and achievements" (p.2). The leadership team at Fulton paid particular attention to teachers' specific skills and personal characteristics and valued these in developing Fulton as a learning organisation. Korthagen (2001) said it is "not common to pay attention to personal qualities and strength' suggesting that "educational change generally focuses on what should be altered" (p.268). At Fulton, the affordance of trust and respect resulted in support and recognition of teachers rather than a desire to change them and these outcomes were relevant when reflecting on the outcomes of teachers' learning for students, as reported in the following section.

6.3 *Outcomes of teachers' learning for students*

The present thesis did not aim to determine the influence of teachers' learning on outcomes for students' learning. However, through opportunities to talk with teachers and students about student learning and access to data about student's levels of satisfaction with their schooling experience it was possible to consider connections between teachers' learning and students' experience of schooling and their learning outcomes. Students' academic results have not been considered in this section as the variables associated with linking teachers' learning to improved learning outcomes are complex and beyond the scope of the research. However, with a growing body of data about students' level of academic achievements and post-schooling outcomes connections between their schooling experiences, of which teachers' learning played a role, would be a valuable focus for future research.

An initial connection between teachers' learning and outcomes for student was the opportunity for students to engage with new and innovative curriculum. Tytler (2007) stated: "there is clear evidence that the curriculum and classroom practice is failing to excite the interest of many if not most young people at a time when science is the driving force behind so many developments and issues in contemporary society" (p.15). However, at Fulton because of teachers learning about nanotechnology and neuroscience and working in interdisciplinary curriculum writing teams, students had the opportunity to design nano-products and investigate the effects of drugs on the communication receptors. Teachers' learning associated with inquiry and problem based learning and the notion of 'fertile questions' (Harpaz, 2005) also resulted in students learning in collaboration with peers and other community and university members and through identifying their own areas of interest for inquiry. Students were required to teach others about their learning rather than being taught solely by one teacher for one discipline area. The shift in pedagogical approaches resulted in student having more autonomy over their learning yet recognising help and support were close at hand. It may be considered that these outcomes were a result of the organisational elements of Fulton rather than teachers' learning. However, unless teachers engaged in sustained dialogue with colleagues about best practices for working in such innovative ways learning opportunities for students may have been more traditional in nature.

Teachers' focus on deep learning through the professional learning strategy (PLS) resulted in them consistently providing detailed feedback to students about the quality of their learning. Many teachers were enthused by the quality of students' learning and ensured they shared this feedback with them. Some students shared with me that teachers' positive feedback encouraged them to spend more time on their inquiry projects and think more creatively about directions to pursue.

The model of Tutor Group also provided opportunities for teachers and students to develop close relationships, and although this was once again an organisational element of the school, my research provided evidence of the learning outcomes for teachers generated by the Tutor Group model. Teachers needed to develop deep understanding of the purpose of Tutor Group and the role they played in it. Through this learning teachers provided students with individualised support that served to support students' learning and experiences of school.

The completion of an Honours' research project (Roberts, 2009) towards the end of my research provided an opportunity to consider additional students' comments about their experiences of Tutor Group in particular. The outcomes of the project served to reinforce many of the observations and anecdotal comments I had gathered in my research. However, it was of value to include some students' comments elicited from the Honours' project here as evidence of outcomes of teachers' learning for students. Although the student comments do not relate directly to the teachers learning there are certainly links between the focus of the professional learning strategy sessions on teacher – learner relationships and understanding and enacting the vision of Tutor Group. The initial students' comments highlight the value students placed on quality relationships with teachers and the small variations in traditional schooling models that made a difference. The Year level of each student respondent is identified in brackets.

Yeah, like, calling them by their first name makes a huge difference... you can have a better relationship with them right away. (Year 12) I know... I reckon it's heaps better calling them by their first name, its like we're all on the same level, you know. (Year 11)

...it makes you respect them more too cos they're not having a power trip over it. (Year 11)

...they're like a colleague, you can talk to them about stuff. (Year 12)

It's not like 'them' and 'us', it's more like we're mates... (Year 11)

A teacher reinforced the sentiment of the last student comment when he/she stated Tutor Group is designed to, "break down the 'us versus them' mentality and replaces it with 'we're all in this together'" (Roberts, 2009). Such teacher attitudes and beliefs may have been in existence when the teacher arrived at the school but they were clearly reinforced by the constant dialogue among teachers about the importance of working with not against students.

The following students' comments highlight the goals teachers defined through their extended focus on tutor group and processes to support deep learning worked for some students but not others:

I like Tutor Group because it's like that time you get in the day where you don't have to go straight to another lesson. You can think, organise yourself, get your books ready and make sure your homework is done and that. (Year 11)

I'd like more control over the Tutor Group time... Sometimes I'd socialize and that, but mostly I'd do work, especially when there is heaps to do. (Year 11)

It's annoying when you've got assignments and tests and stuff coming up really soon and you can't do anything about it. You're, like, wasting your time doing things that aren't as important. (Year 12)

I'd like there to be less work to do in Tutor Group... cos there is heaps of work to do at this school and it would be good to do, like, some of that in Tutor Group...you know, cos it's actually for marks. (Year 10)

The comments are of interest from the perspective that not all students perceived their needs were well met but the Tutor Group program but what I found of interest was their level of reflection. These students seemed aware of worked for them and what didn't and what was important and what was less so. The Year 10 student who was relatively new to the school obviously noted a difference the amount of work that was expected and as such was focused on using time for the work that was marked. This reflected that students were aware that Tutor Group was not just for finishing work but a time to reflect more deeply on a range of issues but in particular to develop a range of generic learning skills (see discussion on Graduate Qualities below). This indicated that the teachers' focus on and learning about Tutor Group resulted in implementation of a program that some students could note initially see the benefits in but the teachers believed would ultimately serve a valuable purpose for all students. The Honours' research project provides a more detailed discussion of the value of the Tutor Group from student and teacher perspectives (see Roberts, 2009). However, for the scope of my research I was more interested in how teachers' learning was linked to students' experiences of school and subsequent learning outcomes and I believe many additional connections could be made from a closer analysis of the outcomes of the Honours' project. This presents as a valuable opportunity following the completion of my current research.

Students were influenced by teachers' learning in the ways described in previous paragraphs and reported high levels of satisfaction with their schooling experience. Each year the school commissioned the Australian Council of Educational Research to conduct a survey on levels of student satisfaction. From the inception of the survey in 2004 students reported sustained high levels of satisfaction with the Fulton schooling experience. Table 6.1 provides the results of the student survey conducted in 2005, the third year of the school in operation.

The students responded to a Likert survey and responses were aggregated to provide a percentage score of agreement or disagreement on a range of items including satisfaction with teachers.

The results of the 2005 survey are of interest from a number of perspectives. Students rated teacher items highly across all areas and only second to satisfaction with social integration items. This indicated students felt accepted and treated well by both peers and teachers, a vital factor for successful learning outcomes. It was interesting to note that students rated the relevance of their learning in Year 10 and 11, which was based on the innovative Central Study model, more highly than their learning in Year 12 where teachers were required to use the existing state-based curriculum due to requirements of the final external examinations. Year 10 and 11 students also reported higher expectations of success than Year 12 students and this was possibly related to a lack of control over content that would be included in the final examinations as opposed to the variety of choice that was provided in the Central Studies

Table 6.3 Student opinion of satisfaction with school (ACER, 2005)

Items	Year 10	Year 11	Year 12	All
General satisfaction (eg I really like to go to school)	71.20	80.48	67.70	73.13
Teacher items (eg Teachers treat me fairly in class)	86.57	83.32	85.47	85.12
Relevance items (eg The things I learn are important to me)	86.00	84.12	75.33	81.82
Success items (eg I know I can do well enough to be successful)	81.42	86.12	68.35	78.63
Status items (eg People care about what I think)	68.52	72.87	71.42	70.93
Social Integration (eg Other students accept me as I am)	88.50	88.23	90.68	89.14
Negative affect items (eg I feel worried, I get upset)	17.94	19.08	32.76	23.26

Although the Year 12 cohort reported lower levels of satisfaction with school, particularly in relation to their increasing level of anxiety (negative affect items) they rated teachers highly, suggesting that the teachers were supportive of their learning. Such information provided a provocation for the leadership and teachers at the school and in essence reinforced the value of the work they were doing to change the nature of schooling. However, this did not absolve them from considering how they could improve the support for Year 12 students. Through teacher dialogue and action research on teachers' roles in Tutor Groups a school-wide

decision was made to implement Graduate Capabilities. The Graduate Capabilities Certificate was designed to provide evidence of students' capabilities in the following areas:

- Operates scientifically
- Operates mathematically
- Can communicate effectively
- Can work both autonomously and collaboratively
- Can demonstrate both personal and social enterprise
- Can demonstrate critical literacy

Each Graduate Capability became a focus on teachers' learning in the school's weekly professional learning sessions. Teachers were committed to providing students with opportunities to develop a set of generic skills and abilities that promoted higher order thinking and learning beyond specific discipline knowledge and a Tertiary Entrance Score. Teaching and learning on this project provided deeper understanding of the skills and knowledge students needed to be successful in the 21st century and as a result students graduated with evidence of their abilities in these areas to share with prospective employers.

Many outcomes for students were underpinned by the learning culture of the school and that learning culture was certainly driven by the school's explicit focus on teachers' learning. The principal of the school commented that, "The learning environment of students is derived from, and a reflection of, the learning environment of teachers." Given the teachers were provided with such a rich learning environment students were also afforded vastly different opportunities for learning than they had experienced in their previous schools. As one student succinctly reflected, 'There's no boundaries here – in the building or to our learning' (ACER HEIP Report, 2005).

6.4 Outcomes of teachers' learning for the school as a learning organisation

Much has been written about learning organisations and Fulton provided an excellent example of the potential to create a dynamic learning organisation where specific affordances are available. There is no doubt that a combination of the vision of the school, the leadership team's qualities and capacities, the physical environment and interaction with professional partners were critical to creating a powerful learning organisation. Everyone was provided with an opportunity to learn and as Hargreaves (2003) said:

People who cannot learn, who are prevented from learning, are a loss to their organisations, and to their organisation's capacity to improve over time...Deep professional learning involves more than workshops of in-service training in government priorities. At the very least, implementing change requires time to understand, learn about and reflect on what change involves and requires. (p.83)

Teachers at the school were provided with time and support for learning and the outcomes were significant for the school. Teachers were at the heart of the action and responsible for students' welfare and learning. They were also responsible for sharing their learning with other professionals. They did this through a number of forums locally, nationally and internationally and the school became recognised on a world level for its innovative practices and transformation of senior secondary schooling, particular in the discipline of mathematics and science. What appeared to sustain the school as a dynamic learning organisation was the level of reflective practice teacher engaged in on a daily basis. Schall (1995) stated, "Reflective organisations are places where people can bring themselves fully to work. Being fully present at work is a remarkable and powerful experience, all the more so if one contrasts it experientially with its opposite, disconnection or alienation" (p. 207). Teachers were fully present at Fulton and their level of commitment and energy for the school was central to success of the school as a generative learning organisation.

Perhaps the self-confidence I alluded to earlier is most relevant to talk about here. Perhaps it is just repetition, but collegial support, the feeling of being part of a dynamic developing place that gives me the opportunity to try new things and values my efforts has been significant.

The teacher's comment linked to affordances identified in the explanatory model of teachers' learning but also made reference to enhanced confidence levels and greater commitment which I assumed to be to the school. The principal of the school made reference to the low level of teacher absenteeism at Fulton and connected this to teachers' commitment to the school. He commented:

A great positive about leading in this place is people's level of commitment; a real obvious example is that teachers are hardly ever away...it's the lowest level of teacher absenteeism I have experienced in any school...

Although the research process did not seek to determine whether the teachers at the school reported lower level of absenteeism at Fulton than at previous schools and improved attendance could not be directly related to teachers' learning teachers experiences of working in the school, being involved in challenging yet stimulating work and being respected and valued to use personal discretion in teaching and learning all appeared to support enhanced levels of commitment to the school.

An ethos permeated the school whereby teachers were constantly asking questions of themselves about how to improve students' learning and create and refine curriculum offerings. The trust and respect that had developed between teachers and the teachers and leadership team resulted in knowledge (and power) being proactively shared. While teachers were provided with many affordances for learning they were ultimately in control of how they engaged and contributed back to the school. They operated from their "source" (Scharmer, 2009) and the

connection between understanding their role and identity and its influence on outcomes for the school generated a commitment and passion beyond turning up for work each day. Pace Marshall (2006) captured the essence of outcomes of the teachers' learning for the school as a learning organisation when she stated, "Clarity at the core is both the ground and the fire that will sustain the new learning story and light the path" (p.199). The teachers' learning sustained the school as a learning organisation and were the invisible, though recognisable, source of energy and power. Pace Marshall (2006) added that:

Meaningful information that continuously deepens the system's capacity to achieve its essential learning purpose is the sustaining energy in generative systems of learning and schooling. Abundant, freely flowing, and shared information about students and system learning enable it to sustain its vibrancy and capacity for continuous learning. (p.200)

Teachers' learning was often the conduit to 'abundant and freely flowing' information that was valued by and influenced the school as a learning organisation. At the end of the sixth year of the school in operation Fulton won the highest award for contribution to Education in the state of South Australia. Such an accolade provided strong evidence of its success as a learning organisation, of which teachers and their learning were a pivotal part. It also strongly supported the claim that the school and its teachers influenced learning for others beyond the school.

6.5 Outcomes of teachers' learning for schooling in general

Thousands of visitors have spent time at Fulton; they included school students, teachers, members of governments and world renowned researchers. They have participated in visits lasting a few hours to a few months. Feedback from the visitors provided a sense of awe and wonder at the many facets of the school. However, many visitors believed the outcomes achieved by Fulton were only possible if all the elements were in place including the building, the funding, the innovative curriculum, the same leadership team and teachers and so forth. While resources and social capital made a significant difference to successful outcomes at Fulton there were underlying tenets about education that were generalisable to other educational settings and for educational policy. Two innovative directions developed at the school included the concept of personal learning plans for all students and the completion of an independent and integrated study as a Year 12 subject. Much of this work was generated through teachers' learning in the early years of the school in operation. The work influenced the state-based assessment authority's policy development and in their review of assessment options for the final years of schooling the concept of personal learning plans and integrated studies were adopted for all students in the state.

The leadership team at Fulton prioritised its connections with other schools locally and internationally and stated:

The school actively fostered collaboration, flexibility, respect and interconnectedness with others as a means of capturing the power that evolves through operating within a community. Perspectives gained through inter-cultural and international communications strengthens understanding and ability to operate within a global context.

Teachers were often at the forefront of these connections learning from and also sharing their knowledge with others. Fullan (2007) said, "As teachers work more and more with people beyond their own schools, a whole gamut of new skills, relationships and orientations will fundamental change the essence of their profession" (p.297). There was much evidence the teachers' perspective of their professional and professional identity changed as a result of their learning and work at Fulton and they acted in new and more confident ways with the many people that visited the school.

Teachers at Fulton acted as mentors to numerous teachers and schools who desired to change their own practices and curriculum offerings. Many schools across the state now employ inquiry-based learning in senior science and mathematics classes. Teachers have published papers for international online teacher forums, delivered professional learning in a range of international schools and worked on national projects. Teachers who have worked at the school and left have also taken aspects of the Fulton model with them and together with the world wide interest in designing new environments for learning have had the opportunity to influence new building design, organisation of schools and promote teachers' learning. The ripples of influence of teachers' learning are difficult to measure and certainly beyond the scope of my research but there is evidence that the processes and outcomes of teachers' learning at Fulton provided much 'food for thought' for those who spent time at the school.

6.6 Outcomes of teachers' learning for professional partners

A final outcome of teachers' learning was its influence on the learning of professional partners, in particular university colleagues. The thesis speaks for itself as a testament to my own learning but many other university colleagues also learned a great deal by their involvement with teachers and their learning. One academic commented, "Initially, I saw myself as the expert teaching the teachers but this has certainly changed over time and I realised there was much I could learn from the teaching approaches used by the teachers...the use of fertile questions really struck me as valuable for uni students too". Although there was much anecdotal evidence of learning for academics associated with the school an evaluation conducted by the Australian Council of Education Research on of the Higher Education

Innovation Programme²⁴ (ACER, 2005) provided valuable evidence of academics' perspectives of their interactions and subsequent learning through engaging with the teachers at Fulton. The evaluation highlighted an academic's reflection of his/her involvement with teachers in developing curriculum:

... it has been interesting to watch the relationships develop ... initially, the completely different languages we dealt in ... we were talking about different things when we thought we were talking about the same things. As a scientist, I now have a much better appreciation of what happens in high schools, and how curriculum is developed, and the basic educational issues beyond the approach and delivery of curriculum ... this has been a good thing.

Although there is no direct reference to teachers' learning, the engagement with the school and the teachers and the need to think about language and shared understandings clearly influenced the academic's knowledge. The opportunity to engage with teachers was a fundamental innovation driven by the vision for the school. However, the ability for academics to learn from their involvement with the school was associated with the development of relationships with teachers and the teachers' desire to engage with and learn from the academics. Mutual engagement became an affordance that generated mutual learning as well. Although it was not feasible in the scope of this research to gather data on specific outcomes for academics it was anticipated that the academic's deeper understanding of high school students would result in better support of first year students in science-based degrees as this was one of the broader outcome desired by the founders of Fulton. Research on such outcomes has become the focus of one of the leadership team's doctoral studies.

6.7 Summary

".....it's a combination of the environment and the vision of the leaders which has been adopted and re-created by the teachers so that Fulton emerged as a cultural environment...where everyone leads learning" Fulton teacher

"At my old school I had some really bad teachers who I just didn't want to learn from, like, I wasn't interested in what they had to say. But here, like, you notice that a lot of the teachers have stuff that is worthwhile to teach". Year 11 Fulton student

This teacher's reflection ascertained that the vision of the school was adopted and re-created by teachers which resulted in a generative learning organisation that represented much of what has been called for in the research literature (Caldwell, 2008, Darling-Hammond & Richardson, 2009, Fullan, 2001, 2007, Hargreaves, 2003, Pace Marshall, 2006). How this occurred was the focus of Chapters 4 and 5, and the answer to research question on how teachers' learning was supported and sustained in an innovative context. However, the teacher's

²⁴ The Higher Education Innovation Programme was a government grant designed to promote innovation in higher education practices. The grant provided funding to release university academics to work with teachers at Fulton.

reflection captures an overall answer to the research questions on what were the outcomes of teachers' learning for teachers, the school and the students. The teacher affirmed that a major outcome was that everyone at Fulton "leads learning". Such an outcome supported the achievement of an educational transformation envisioned by a group of people committed to disrupting traditional paradigms of secondary science and mathematics education. Teachers' learning was pivotal to achieving such outcomes as the outcomes of their learning, as described in this chapter, were the foundation on which much the school operated.

The development of innovative curriculum was a major source and outcome of teachers' learning and the student's quote (Roberts. 2009) that opens this summary provided evidence that the innovative curriculum on offer was more engaging, at least to this student. It was of interest to note that student also used the word 'notice' in his/her response and this possibly reflected an outcome where not only was everyone viewed as leading learning, the learning was shared between all as well.

Pascale, Millemann & Goja, (2000, cited in Fullan 2001) stated, "what is gained as a group must be shared as a group" (p.264), and this was central to the success of Fulton as a learning organisation. Teachers were recognised and valued for their contributions to the school and the concept of distributed leadership promoted commitment, reciprocity and mutual engagement. The processes for learning that were ultimately identified as affordances generated by the contextual condition, organisational elements, relationship factors and the teachers' characteristics, capabilities and sense of personal agency evolved and served to sustain teachers' capacities and the school as a learning organisation to "deepen its observations, interpretations, and understandings of itself" (Pace Marshall (2006, p.198) – from individual and collective perspectives.

The outcomes of teachers' learning as presented in this chapter were many and all looped back into the explanatory model of teachers' learning so that it was never possible to create a static model to explain the phenomena. The model evolved and will continue to evolve as new teachers, new students and new opportunities emerge or are created. Such an outcome fits well with teachers' dialogue about the challenges of sharing the school's curriculum in published form with other schools. Teachers' recognised that the power of the curriculum was in creating and recreating it, and the power of the explanatory model of teachers' learning at Fulton is in its scope for creating and recreating learning opportunities that are only restricted by teachers' imaginations and that serve to focus on transforming senior secondary students' experience of science and mathematics education and schooling in general.

The explanatory model and outcomes of teachers' learning were complex, rich and at times difficult to do justice to. However, the story is an important one to tell from many perspectives and these perspectives are addressed in the following and final chapter of the thesis.

Chapter 7 Conclusion: looking back and looking forward

'It will be a wise and courageous politician who declares that capacity building is more important than accountability (and it will take a wise and courageous teacher union leader to declare that professional learning communities take precedence over individual teacher autonomy.' Michael Fullan (2007, p.235)

'A business maxim holds that every organization is perfectly structured to achieve the results that it achieves. We could say the same of schools. And when outcomes are particularly problematic...attaining substantially different results for our schools will require more than just teachers "trying harder" with the traditional bureaucratic constraints. Such a shift typically requires new organizational structures.' Darling-Hammond and Friedlander (2008, 14)

7.1 Introduction

The process of engaging in longitudinal research at Fulton provided the opportunity to develop deep insight into the processes and outcomes of teachers' learning and the influence teachers' learning had on achieving the school's vision of being "*a quality school that provides leadership of innovation and reform of the teaching and learning of science and mathematics.*" (Vision Statement, 2004).

The research also provided an opportunity to consider whether the epistemological beliefs associated with the field of professional learning are a 'truth' for Fulton and its teachers. Certainly in reflecting on the opening quotes from Fullan and Darling-Hammond and Friedlander, it is clear that the outcomes of the thesis supported Fullan's call for communities of learners in preference to individual autonomy. The thesis also highlighted that new organisational structures, as called for by Darling-Hammond and Friedlander, proved significant to the processes and outcomes of teachers' learning at Fulton. The research process resulted in emerging principles and insights that represented a contribution to the field of professional learning, provided support for existing literature and revealed the importance and value of researching teachers' learning in context.

The research process enabled me to comprehensively respond to the aims of the thesis, these being to:

- provide a rich description and analysis of how teachers' learning was supported and sustained in an innovative school
- theorise about the processes of teachers' learning at Fulton which led to the construction of an explanatory model of professional learning
- explore the influence of teachers' learning on outcomes for teachers, students and the school as a 'learning organisation'
- add to the literature on professional learning.

This chapter discusses the outcomes of the research and in particular, the relevance of the explanatory model for Fulton as an organisation including its value and utility for ongoing use and the potential of the explanatory model to adequately capture all teachers' experiences and stories. The chapter also considers the outcomes of the research in light of the literature reviewed in Chapter 2 and more recent research on teacher's professional learning. Finally, the chapter reflects on the research process and makes recommendations for future research arising from this thesis.

7.2 Relevance of the explanatory model of teachers' learning for Fulton

The proposed explanatory model of professional learning at Fulton serves several purposes. In one sense it provides a historical account of the development of the school as a learning organisation that influences teachers' learning opportunities and outcomes and the achievement of school reform. Little (2008, cited in Crow, 2008) calls for more attention to be given to how effective learning organisations and communities develop. The thesis provided significant insight into the many conditions, elements and factors that interacted to support teachers' learning and for the school to emerge as a dynamic learning organisation. The identification of the conditions, elements and factors enabled the school to gain deeper insight into how they provided a context for and supported teachers' learning. The school's initial focus on providing for teachers' professional learning was through the appointment of an Assistant Principal (Professional Learning), and the development of a policy and protocols to shape professional learning in the school including the implementation of individual professional learning plans and a professional learning strategy. The professional learning strategy was conducted in normal school hours and provided teachers with a weekly time to engage in professional learning focused on the authentic needs of the teachers and students at the school. Such action fits well with the recent research outcomes of Darling-Hammond and Richardson (2009) who noted that effective professional learning is intensive and sustained over time, collaborative and collegial, part of a school reform effort that links curriculum, assessment and

standards to professional learning and involves acquiring, applying and reflecting on learning about new content and how students learn that content (p.49).

The explicit actions of Fulton's professional learning strategy to support teachers' learning were well supported by research but failed to acknowledge the many affordances ultimately identified by teachers as supporting their learning. In particular, the explanatory model provided explicit recognition of the value of intentional and incidental learning and names affordances for learning that were less visible including contested views, purposeful listening, and openness. It also highlighted the value placed by teachers on affordances such as use of a specific language, physical proximity and writing to learn on their learning. Such affordances are acknowledged separately in some of the literature on professional learning but rarely featured as significant (Darling-Hammond et al. (2009), Eraut, (2007), Ingvarson & Meiers, (2000), Timperley et al (2007). Therefore these research outcomes provide a valuable addition to the literature.

The explanatory model (see Figure 7.1) also identified that effective synchronisation between the four key domains of contextual conditions, organisational elements, relationship factors and teachers' characteristics and sense of personal agency supported powerful outcomes for teachers and the school as well.

The ability to identify specific features that supported and sustained teachers' learning set within a model that is generative in nature provides an opportunity for leaders and teachers at the school to consider which aspects of the model are of greater relevance to specific individuals and the school as a collective, and identify what gaps there may be in some teachers' professional learning opportunities. The model also provides the capacity to continue to identify new affordances as new partnerships and new initiatives are undertaken at the school. It may be that over time redundancy of some current processes for learning result in the deletion of some existing affordances as well. The explanatory model provides an opportunity to keep track of any shifts in affordances over time and how changes in specific organisational features or teachers' characteristics and capacities impact on current affordances for learning.

The explanatory model of teachers' learning is a valuable resource for Fulton's leaders and teachers to share with the many visitors to the school and for use in presentations to other professionals. This enables them to more thoroughly capture the richness and complexity of teachers' learning at the school. Each of the four domains and their underlying affordances provide scope for detailed discussion of how they emerged, what they looked like at Fulton and their relevance to outcomes for teachers, students and the school as a learning organisation. In essence the model provides the foundation for ongoing theorising about teachers' learning at Fulton and in other schools as well. However, it is important to recognise possible limitations of the model and in particular to discuss whether the model adequately explains all teachers'

stories, especially those teachers who were more resistant to change.



Figure 7.1 An explanatory model of teachers' learning at Fulton: dual layers of affordances

7.3 An explanatory model that explains and supports transformation for all?

There is no doubt that Fulton was a very unique senior secondary school. Its uniqueness presents a dilemma as to the value and utility of the outcomes for others beyond the school and this will be considered in more detail in later sections in this chapter. Certainly Fulton's unique features including its architectural design, interdisciplinary curriculum and the extent of explicit planning for teachers' learning are not experienced in many other secondary schools. However, as I analysed the culture and organisation much in common with the literature associated with high quality professional learning was found. There was a sense that Fulton mirrored Hargreaves's (2003, p.100) Blue Mountain, a school he described as the knowledge society school and 'an effective learning organisation'. He stated:

...as an effective learning organization is reflected in many different aspects of its creation, and its continuing operation; the nature and distribution of its leadership;

its goals and vision; the organization of curriculum and teaching; its innovative structures and process and the teachers' orientation to personal and professional learning.

Hargreaves's criteria match well the features of the explanatory model of professional learning that emerged in my research and its subsequent role in sustaining an effective learning organisation. High level synchronisation of the many aspects of the explanatory model of professional learning at Fulton resulted in powerful outcomes and many lessons in what it takes to transform secondary schooling. A major lesson is that it takes a great deal, including a new learning environment, complete restructuring of curriculum and how it is offered, reorganisation of student grouping, quarantined time for teacher learning, deep understanding of learning and the change process, financial and social capital, professional partnerships, recognition of the 'sources' (Scharmer, 2009) from which all community members operated and an abiding and collective commitment to the vision and a belief in achieving outcomes that will shape the future of education.

Fulton provided an example of what can be achieved with vision, resources and passion. However, high level synchronisation of all of the key aspects was not always possible and the aspect for which the school had least control was teachers' characteristics and sense of personal agency. As Wenger (1998) reminded us, '*Learning cannot be designed: it can only be designed for* – that is facilitated or frustrated' (p. 229). At Fulton, learning for teachers was clearly facilitated and that left the outcomes very much in the teachers' domain. Not all teachers engaged in learning that supported changes in beliefs and practices to the same degree. Some held tightly to their existing beliefs and perceptions of the roles of teachers and students even within the innovative environment offered by Fulton. Such teachers were very few in number over the time of the school in operation and they often stayed at the school for a limited tenure. However, it is important to consider why even one teacher would be unable, or choose not to shift paradigms given such supportive and rich conditions for learning. In reflecting on those teachers who did not shift their beliefs and practices I recognised that Fulton was not a school for all people; students and teachers alike. I acknowledge the value to the wider community of having a range of schooling options and teaching approaches and teachers that work well in different settings. However, as teachers had self-selected to teach at Fulton and were provided with substantial orientation to the school and its vision it was important to consider why the processes designed to support teachers' learning were less effective for some than others.

The work of Scharmer (2009) was helpful in understanding what the roadblocks to learning might be for such teachers. Scharmer proposed that to succeed in transforming existing beliefs and practices, individuals and organisations need an 'open mind – that is, the capacity to see with fresh eyes, to inquire and reflect, an open heart - the capacity for empathic listening,

for “exchanging places” with another person or system, and an open will – the capacity to let go of old identities and intentions to tune in to an emerging field of future possibilities’ (p.244). The school and the majority of its teachers reflected a sense of open mind, open heart and open will but at times all probably experienced what Scharmer described as the three enemies of transformation, the voice of judgment, the voice of cynicism and the voice of fear. In his description of these three voices recognition of patterns of thinking and feeling that prevent transformation of thinking and action are evident.

VOJ (Voice of Judgment): Old and limiting patterns of judgment and thought. Without the capacity to shift down or suspend the VOJ, we will make no progress toward accessing creative and new ways of perceiving.

VOC (Voice of Cynicism): Emotions of disconnection such as cynicism, arrogance and callousness that prevent us from diving into the fields around us.

VOF (Voice of Fear): Fear of letting go of the familiar self and world; fear of going forth; fear of surrendering into the space of nothingness. (Scharmer, 2009, p. 246)

The existence of the three voices may have been stronger in the teachers who found it more challenging to come to terms with the new ways of working that Fulton required. Certainly the Assistant Principal (AP) responsible for professional learning at the school expressed ongoing concern about reaching these few teachers and even on their self-selected departure wondered what more she might have done to deal with their resistance to change. These teachers often managed to work well in the new structure of the school and contribute to the innovative curriculum but their underlying beliefs about their role in student learning, their relationships with students and a desire to maintain a position of power in a school that had shifted its image of the student all appeared to be roadblocks to change. These teachers of course may have been highly effective in others schools who had different perceptions of the roles of teachers and students. They were mostly effective in teaching content at Fulton as well yet, there was an underlying resistance to educational change, in particular the shifting roles and relationships between students and teachers promoted by the school and its leadership. It may have been that their voice of judgment remained strong in an effort to protect their sense of professional identity. The AP theorised about these teachers’ resistance to change:

...it’s not because they are stubborn, it’s because they genuinely believe that the way they’ve been doing things has worked. For example, if a teacher’s been working in a particular stage 2 subject²⁵ for 25 years and we’ve got a number of staff in that position, and they know that they’ve got kids over the line and have got kids even achieving higher than what they perhaps were predicted to at the beginning of the year, why would you change, what evidence is there that’s going to make you want to change from your own experience?

²⁵ Stage 2 subjects are the equivalent of a final year 12 subject that is assessed external and contributes to a student’s overall Tertiary Entry Rank score.

The AP acknowledged that these teachers had grounds for holding on to what had worked for them, especially as the school was still bound to a system that required all students to be externally examined and ranked against each other to access preferred opportunities at tertiary education levels. She said, “we are bound by a system that doesn’t always fit with our vision so it’s understandable that we have some teachers that are questioning why they should change”.

The school was bound by several systems including the institutional notion of the standard template for schooling (Tyack and Tobin, 1994) which Tubin, (2009) identified as shaped by political, social and economic forces and seeks to ensure schools remain ‘efficient, equitable and easily replicable’ (p. 407). Fulton moved beyond some of the institutionlised constraints and in fact was well supported by the local department of education to be innovative, yet for some teachers moving beyond the institutional notion of schooling was more challenging. They found comfort in the familiar model of teacher-student hierarchy, teacher-directed forms of teaching and traditional bodies of knowledge with which they were well versed. Some teachers appointed to the school as humanities teachers also appeared to struggle with the prominence placed on the science and mathematics content areas. For example, one teacher in sharing his/her frustration about the challenges of working in curriculum writing teams said “I have written these units to be included in the central studies and have been forced to...come to believe that explicit teaching of literacy is denigrated. Reading for relaxation is not valued. The recognition of key learning areas, other than maths and science seems devalued or so it feels to me”. At the time this comment was contested by others in the group and generated another opportunity for debate and learning but the teacher maintained the belief that the humanities were a ‘poor cousin’ to science and mathematics.

Tubin (2009) in his research on the ability of innovative schools to maintain their innovative zeal believed that many schools regress towards more conventional directions if excessive levels of frustration are experienced. There was evidence that some teachers experienced heightened levels of frustration through the additional expectations placed on them and the reduced attention provided for individual subject specialists. It appeared that this was the case for some teachers, who ultimately moved to other schools.

The school was also bound by the state assessment authority which required that every student had an equal opportunity to meet the criteria of the South Australian Certificate of Education. The need to meet such criteria was non-negotiable as Fulton was a public school. Although meeting such criteria influenced several practices and structures within the school many changes to the way secondary students were learning and teachers were working were still possible. The changes occurred in negotiation with the state assessment authority and open channels of communication were critical for support of the school’s innovative practices. Changes to curriculum and styles of delivery, grouping of students and flexibility in timetables

were embraced by the majority of teachers and students at the school and as such many stories of transformations emerged. Teachers who did not experience the same levels of transformation in their beliefs and practice still experienced working in an innovative environment that offered ‘food for thought’ that in time may contribute to shifts in paradigms.

Scharmer (2009:246) said that an organisation’s ability to truly transform is directly connected to the:

...degree that the system deals with the forces and challenges of resistance. Anybody can have a peak experience. But only those who develop the discipline to face down these forces of resistance will be able to operate reliably from the deeper levels and spheres of social emergence.

The school appeared to ‘face down’ resistance as the collective commitment to the vision of the school provided more dynamic than a few resistant individuals. Fullan (2007) talked of “wise and courageous politicians” (p. 235) promoting capacity building over accountability and at Fulton the leadership team acted in wise and courageous ways to maintain a focus on achieving the school’s vision. However, they often did this by giving a voice to resistance and embracing contested views as this provided powerful opportunities for ongoing critical analysis of actions and the vision of the school. The consistent and sustained dialogue between leadership, staff, students, parents and other stakeholders served to build a foundation of the collective commitment needed to maintain energy and focus when confronted by resistance and, as an outcome, resistance at Fulton appeared minimal. However, I considered there was much to learn from any sense of resistance, be it about the school’s vision or the work of teachers.

I reflected on the value of the explanatory model for understanding and explaining teacher resistance. It would seem the strength of the model should be in its ability to not only account for positive outcomes but for why resistance or less successful outcomes were also evident at Fulton.

Two specific affordances appeared to be relevant for making sense and meaning (Moon, 1999) of some teachers’ resistance and minimal change in beliefs and practices. The teacher-located affordance of *openness* is of particular relevance and lack of openness, as noted by Scharmer’s findings, appeared to be a roadblock to new learning and change in beliefs and practices. Success in teaching, particular at the Year 12 level also appeared to reduce some teachers’ *motivation* to make changes. Guskey (2000) identified that teachers are less likely to see a need for changes in practices if they are already supporting students to achieve successful outcomes. By removing the affordances of openness and motivation from the model a gap emerges. Such a gap could serve to suggest that the success of the school’s professional learning strategy hinged on individual teacher’s characteristics, capacities and sense of personal agency. This presents two dilemmas, the possibility that the effectiveness of the professional learning

model is highly dependent on teachers' dispositions and that the rest of the model has little effect if individual teachers are resistant to change.

Fulton was fortunate that the majority of teachers chose to teach at the school and were open to change. Indeed the quality and complexity of the professional learning opportunities made available certainly led to some significant transformations in teachers who were initially resistant to many of the changes required of them. Such outcomes suggested that through the ongoing interactions of affordances resistance to change was minimised. However, the real challenge as to the whether the model of teachers' learning that emerged served to explain all teachers' experiences and outcomes would be for Fulton to employ a group of teachers who were highly resistant to change, or for the model to be trialled in a school where all affordances other than the teacher-located ones were present. The present research was limited in its scope to determine the impact of individual teacher disposition on the robustness of the explanatory model in supporting learning that led to improved teaching practices. Future research could examine this question. Desimone (2009) also recommended that future study of professional learning models should engage 'non-volunteers' as volunteers often seek out professional learning experiences and as such they are motivated participants.

Persinni, Borko, Romagnano, Knuth, and Willis (2004) identified that few impact studies of professional development have paid attention to the role of teacher identity and although my research identified that teachers' engagement in professional learning contributed to shifts in their sense of professional identity it did not attempt to define individual teacher's identity prior to the research process and how this then influenced their engagement with professional learning. Future examination of the explanatory model at Fulton, and indeed other schools, would benefit from paying close attention to teacher identity prior to determining the quality and level of engagement with professional learning as defined by the model.

The exploration of how teachers who were resistant to change were represented by the explanatory models suggests there is potential for the model to be used to identify gaps in affordances, and whether the lack of these affordances provides a roadblock to engagement in quality professional learning. It may be that gaps in the teacher-located affordances give rise to connections with other affordances in the model, for example, lack of openness might be addressed by providing such teachers with opportunities to act as a leader via the affordance of distributed leadership. However, it would seem a limitation to use the model as a checklist as each affordance in itself represents a complex idea. Scharmer's findings, as discussed previously, identified that affordances such as openness are not always easy to define and such capacity may be influenced by voices of judgement, fear or cynicism. Once again, it would appear that additional research on the use of the model for the purpose of tracking specific teachers' trajectories of development is required before the proposed explanatory model could

reasonably be considered as supporting and explaining transformation of teachers' beliefs and practices. The possible value of the explanatory model as a framework for 'measuring' the quality of professional learning and its effects on outcomes for teachers, students and school is considered in the following section.

7.4 Connect teachers' learning with outcomes for teachers, students and the school.

A leadership team member, when asked about outcomes of teachers' learning that were significant for the school, commented:

There are so many tangible things, like teachers leading innovation in curriculum but they are easy to see. It's the deeper levels that are harder to capture. I think we have made significant contributions to policy level discussion and our staff's involvement in that at a systems level has been critical. How do you actually quantify that we've had a significant effect on system level policy but we have certainly developed a capacity amongst teachers in our school for them to engage in conversations about learning and about learning environments that need to be created to support raising opportunity, increasing participation and engagement. How can you quantify that? I don't know how you can do that but I do know it's happening...and if we can change the system's perception of quality schooling then we've really made a difference...this was our big agenda.

This reflection highlighted the important role played by teachers' learning and teachers in affecting change at an institutional and system level, and that teachers' learning and subsequent leadership was crucial to leading and succeeding in educational innovation and reform. However, the reflection also clearly acknowledges the challenges associated with how to 'quantify' the connections between teachers' learning and outcomes. My research did not seek to 'quantify' these links although the qualitative data provided much evidence of teachers' learning influencing outcomes at many levels at the school and, based on the leader's reflection, beyond the school as well.

My research did not 'measure' hours spent in professional learning or how this may have varied for some teachers or specific professional learning activity for example, drug awareness or use of new ICT. The lack of documenting presents an opportunity for future research to determine if more detailed analysis of time and engagement provides a basis for understanding whether 'quantity' of professional learning makes a difference in achieving desired goals.

Desimone (2009) stated that although research in the area of professional learning appears to have achieved a consensus on the features of high-quality professional learning there are still gaps in our knowledge about the thresholds for these features. She stated:

For example, how much professional development is enough? More than a decade ago, Stout (1996) said that "no evidence exists to allow a sensible policy decision about the amount of staff development needed to accomplish a given purpose" (p.6); we still have little guidance on this issue. An exploration would require

comparing activities with the same content but varying amounts of time and then relating amounts of time in the professional development to the extent of the change in instruction and student learning. (p. 192)

There is potential to document time spent on specific initiatives at Fulton and the explanatory model could provide a framework for teachers to consider how much time they spend engaging in specific activities located in the organisational elements domain. For example, time spent engaging in the professional learning strategy activities and/or curriculum writing teams. They could then assess differences in time commitment and the resulting quality of outcomes for self and students. They could also take note of the other affordances, for example, specific use of language, and report on the quality of their influences on directly improving outcomes for students. It may be that some affordances proved more significant to some teachers than others (as evidenced in the teachers' stories in chapter 5). In reflection, a weakness in my research design and methods may have been the lack of documentation on specific elements of professional learning that directly accounted for changes in practices. Clearly there were examples of this, including Johann's story. However, the research did not establish whether one form of professional development proved to be more effective than others, for example, whether the professional learning strategy emerged as more significant than the incidental learning that occurred as a result of the physical environment or curriculum writing teams.

The TALIS project (OECD, 2009) provided some interesting data on which to contrast the types of professional learning reported as valuable to teachers at Fulton with teachers across the world. A more detailed discussion of the similarities and contrasts between the TALIS project and the teachers' learning at Fulton occurred in the summary of Chapter 4 (see pg. 172). The connection between the TALIS results and professional learning at Fulton is that all of the activities described by teachers as having impact were *all* available to teachers at Fulton on a consistent basis and the two identified in the TALIS project as having the greatest impact, 1) individual or collaborative research and, 2) qualification programs were prioritised in the Fulton's professional learning strategy. Although the teachers at Fulton engaged in these activities and many achieved post graduate qualifications they were not identified as individual affordances rather they were contained within the larger affordance of the school's professional learning strategy (PLS). Teachers talked often of the time available for learning made possible through the PLS but working in curriculum writing teams and having opportunities for leadership and engaging with colleagues were explicitly identified more often than working in action research team or completing a topic for post graduate qualifications. Therefore while there are certainly many connections with the outcomes of the TALIS project, the explanatory model that emerged from my research reflected slightly different activities of impact. This may be due to the unique contextual conditions of Fulton where many of the opportunities for

learning reflected ‘newness’, that it, they were activities that were less traditional in nature. For example, curriculum writing teams as opposed to post graduate study. However, it was clear from the teachers’ stories and outcomes of surveys that not one form of professional learning could be easily identified as having the greatest impact; rather, it was a combination of interactions between the four domains of the explanatory model and their underlying affordances.

Desimone (2009) presented a convincing call for greater attention to ‘measuring’ the impact of teachers’ professional development on outcomes for teachers and students. She suggested that there is clear recognition that teachers’ learning is critical to the success of educational reforms and that enough is known about high quality professional development so that it is possible to identify its core features and then study the effects of these features. Her conceptual framework (introduced in Chapter 6, see p. 247) for researching teachers’ professional development highlights that core features of effective PD are content focus, active learning, coherence, duration and collective participation. Fulton provided a focus on critical content including the new sciences, interdisciplinary curriculum and understanding the learning process. This content focus occurred in a coherent way over time and involved active learning and collective participation.

While Desimone’s core features appear sound they fall well short of the complexities associated with understanding teachers’ learning and its influence on outcomes for teachers, the school and students presented in this thesis. My research identified the important role played by teachers’ dispositions, the leadership team, policy, students, environments and several other specific affordances. Desimone does acknowledge that teacher and students characteristics, curriculum, school leadership and policy environment all play a role in influencing the quality and outcome of teachers’ learning but she does not include these as core features noting:

Future work may establish one or more of these as warranting inclusion in a foundational, common model of teachers learning, but as yet these features are not backed by as many substantial conceptual and empirical studies as are the core features (e.g., content focus, active learning). (p.186)

From my research it would appear critical to include such factors in any future examination of the impact of professional learning. However, the inclusion of such factors adds to the complexity of ‘measuring’ impact due the diverse nature of some of the factors, in particular teacher and student characteristics and leadership styles. The explanatory model of professional learning at Fulton does have the potential to be used in a similar way to Desimone’s call for the use of her framework. She says “We too often use the complexity and interactive nature of teacher learning as a justification for why we do not build on prior work” (p. 186). She argues that additional research using a shared conceptual framework will serve to

“provide sensible, meaningful research-based evidence on impact that is useful for educational practitioners” (p. 187) and I would hope policy makers as well. I believe the explanatory model has the potential to be used as a framework for additional research on professional learning at Fulton and beyond as well. Indeed it would be the use of the model in other schools that could assist in determining the value of it for documenting the quality and impact of professional learning in context.

7.5 Reflecting on the sensitising ideas of the thesis

The research process provides an example of the grounded theory process, as it commenced with several sensitising ideas generated from my ontological perspectives. These ideas shaped my initial interests and many early research questions. In reviewing the outcomes of the thesis it is interesting to note the shifts in focus along the way and how this represented being grounded in the data generated by the research process. However, it is beneficial to consider whether and how the initial literature reviewed proved relevant to the explanatory model.

The literature covering the characteristics of professional learning and change processes provided useful conceptual models from which to analyse data and teachers’ learning stories. However, I found some aspects of the literature on learning and pedagogy more relevant than others in my analyses and theorising. For example, stages in learning and particularly Moon’s Map of Learning provided strong reference points for understanding teachers’ transformation and my own learning processes. However, I made fewer connections with concepts such as facets of learning (Wiggins & McTighe, 1999) and learned capabilities and knowledge categories (Gagne et al., 1986). These models did not feature in the school’s professional learning strategy or in teachers’ descriptions of effective learning and perhaps it was this lack of explicit use that distracted me from reflecting on them in any depth as well. Clearly the areas have a sound research base and are useful frameworks for understanding different types and levels of learning. The initial questions I posed about learning for understanding included “Did teachers’ descriptions of effective learning include reference to concepts associated with learning for understanding?” and “What were the outcomes of teachers’ developing knowledge about learning for understanding? Did it influence their curriculum design and teachers practices?” While the teachers did not explicitly use the language of Wiggins and McTighe and Gagne et al.’s models, they did use language connected to the concepts proposed by these researchers. For example, in responding to the survey question on the characteristics of deep learning teachers responded:

- The ability to communicate understandings in a language that is appropriate to a number of audiences.
- The ability to analyze, construct meaning and reconstruct meaning
- Assimilation of sound, informed information and from varying perspectives

- The ability to illustrate, amplify or summarise ideas using examples, models of links to other areas

These descriptions link well with Wiggins and McTighe's facets of understanding including the ability to explain, interpret, apply and take perspectives. The remaining facets of empathise and self-knowledge were also evident in the teachers' planning for students. For example, the focus on personal learning plans prioritised self-knowledge and many inquiry projects positioned the students as 'others' so as to develop their empathetic knowledge. Whether these outcomes were a direct result of the professional learning opportunities provided at Fulton or were based on teachers' existing beliefs and practices is difficult to determine from my research.

I questioned whether the lack of my attention to these models might suggest teachers were drawing on existing beliefs, or other models of learning and pedagogy that were made explicit in the school's professional learning strategy, for example, the work of Harpaz, Atkin, Senge and Moon, or that I found them of less relevance as other outcomes emerged. In reflection I can see that they are still highly relevant but other models were promoted and used by the teachers instead. These models emerged from the leadership team, teachers and me as well. The culture of research and learning generated the sharing of many different ideas and some stayed with the school and others dissipated over time. For example, there was a significant focus on the work of Julia Atkin in the early stages of the school but fewer references are made to her specific propositions now. However, it is important to acknowledge that such learning is foundational, as was my initial literature review, and foundational knowledge allows for making connections to new and perhaps more complex ideas. This certainly reflected the process of my learning throughout the research and over the time of my engagement in the field, and provides additional evidence of grounded theory in action.

The sensitising ideas that guided the initial literature review were important in the research process and yet on completion of the thesis they appeared somewhat limited. My initial focus on learning processes seemed less significant than the fields of learning organisations and teacher identity that emerged from the research process. Once again this is an outcome of the use of grounded theory. However, the sensitising ideas certainly helped to generate a range of questions that provided an opportunity to gather significant data that contributed to understanding the role of specific affordances that supported teachers' learning. Each of these questions could be reviewed at this point but in essence many have already been answered in the previous chapters. There were aspects of initial interest that I did not follow up in details, for example, where teachers using the pedagogical practices identified by Hattie. These practices were certainly discussed by teachers in the PLS. However, they did not become the focus of detailed observation from me. This is possibly due to my interest in other issues emerging from the data or that teachers appeared effective in their roles.

In summary, teachers brought existing beliefs and practices to Fulton but through incidental and intentional learning these beliefs and practices were expanded and often changed. Teachers developed deep understanding of many factors associated with effective pedagogy including learning and learning processes, new content, effective curriculum design and authentic assessment processes. They were open to challenges and recognised their roles as learners in achieving the vision of the school. There were varied outcomes for different teachers but the outcomes had an influence on students and the school as a learning organisation. The following section considers additional outcomes of the thesis from additional perspectives.

7.6 Learning from the outcomes of the thesis

Fulton is a school that in many ways epitomises what has been called for from such world renowned educational researchers as Senge, Fullan, Hargreaves, Claxton, Argyris, and Wenger to name a few. The school is a dynamic learning organisation that has sustained its ability to be innovative largely due to its recognition of, and emphasis on the power and influence of teachers' learning. Many other educational institutions and authorities may look at Fulton and draw on Scharmer's (2009) voices of judgment and cynicism to reflect that it would not be possible to achieve such outcomes without similar contextual condition and that very few schools would have access to such resources, particularly existing schools. Some visitors to the school shared their admiration for what Fulton had achieved but noted it would not be possible in their own context. Many teachers could not see how they could make some of the pedagogical changes promoted at Fulton without similar access to ICT or an open space environment. What some of these teachers and school leaders appeared to overlook was the importance of the learning culture that developed at Fulton (Hord, 2008). The 'newness' of the school both from a building and cultural perspective proved an asset to avoiding the voices of judgment and cynicism as much as being tried for the first time. There was openness to doing things in new ways and no expectation that brilliant transformations in student learning would occur overnight. The learning culture developed over time and underpinned an optimistic rather than defeatist attitude in teachers at the school when faced with new challenges. An optimistic attitude was possible based on the support of the leadership team and colleagues for continuing to be innovative and from experiencing successful outcomes for students and self. One teacher commented:

Giving students the opportunity to develop their own knowledge, and develop their own personalised learning strategies does have a dramatic effect on the productivity, quality, efficiency and confidence of the student and their work.

The word 'student' in this quote could be replaced by 'teacher' to reflect the dramatic effect that a respectful and supportive learning culture can have on outcomes for teachers too. Teachers who are prepared to be productive and efficient and generate quality work in which they have

confidence are probably at the heart of quality schooling no matter what school they may be working in. No doubt this may be much harder to achieve in existing school where cultures of negativity in the face of new initiatives often results in judgment and cynicism (Darling-Hammond & Friedlander, 2008). However, if the unrelenting support for teachers as learners at Fulton resulted in such outcomes then it would seem that other schools might do well to emulate them.

7.6.1 Commitment to and clarity of the vision

The visitors to Fulton who could not see beyond the concrete experience of the open spaces and rich ICT environment failed to understand the elements that were significant for the transformations at Fulton are present in every school. Key to the success of Fulton were explicit and sustained attention to everyone ‘getting’ the vision for the school – not just the surface level vision of innovative curriculum and increasing student enrolment in mathematics and science but what it meant to have a deep understanding of something, what is meant to be a young learner in the 21st century, what it meant to be a teacher of young learners in the ‘knowledge era’, how to be a learner individually and collectively and why schooling needs to change. The attention to vision at Fulton did not cease once the school was in operation as it often does in other schools but it was a consistent and continual platform for the evaluation of actions and future directions of the school. Such deep recognition of the vision for the school allowed teachers, leaders and students to move beyond a focus on surface level aspects of schooling and make resource and financial commitments to issues and actions that contributed to the success of the school’s vision. Tubin (2009) cited Kondra and Hinnings (1998) stating that ‘organisations with a well-developed vision that perform above the institutional range can transform the nature of an organisational field, when others mimic them for their success’ (p.417). Fulton has the potential to support other schools to build dynamic learning cultures but those schools would need to understand that school culture transcends the physical environment and ICT resources.

7.6.2 Insightful leadership

Recognition of the powerful role played by vision is one lesson to be learned from this research. However, there are others lessons that are not always obvious to those visiting the school. The role of the leadership team in enacting the vision of the school was often difficult to quantify but there was always attention to the daily work and needs of all community members with a constant eye to the future. Fullan (2007) in the quote that introduced this chapter said it would be ‘a wise and courageous politician who declares that capacity building is more important than accountability (and it will take a wise and courageous teacher union leader to declare that professional learning communities take precedence of individual teacher autonomy’

(p.235). The leadership team at Fulton needed to be wise and courageous in their thinking and action and they followed the path of capacity building in their adherence to a model of ‘genuine’ distributed leadership. Distributed leadership was not given lip service but was actively promoted in ways that even teachers did not initially recognise as significant leadership opportunities. Distributed leadership was based not only on trust and respect for teachers but on a deep commitment to providing all teachers with the opportunities to develop leadership skills so that power was shared. The leadership team at Fulton publicly acknowledged the importance of their own actions and the generation of leadership capacity in the following statement published in a professional teachers’ journal.

Like any other leadership function, creating a culture of learning requires high energy and public demonstrations of desire to make a difference and self discipline to maintain the focus. These leader behaviours provide the foundations for the generation of leadership capacity throughout the school community. Trust and integrity are enhanced by leaders who “walk the talk” and consistently display congruence between what they say and what they do. Other leaders develop their leadership when the ideas, goals, thinking, debating and collaborations are actively shared, particularly when a leader is able to consistently demonstrate an ability to place the leadership activities, with a degree of humility, in the context of those working around the leader. Regularly recognising and celebrating team accomplishments, and the individual contributions within the team, generates the attitudes that feed the development of the ethos and culture about learning. It is as much about giving power away as using the authoritative power of leadership. (Davies et al, 2004,).

A lesson on the role of leadership from my research was about the insight of using distributed leadership and giving away power to generate a more powerful and sustainable learning organisation.

7.6.3 Personalised professional learning

There were several affordances for teachers’ learning identified through the research that could be recognised here as slightly more significant than others, including explicit time for learning, curriculum writing in teams, physical proximity (suggesting the need for attention to the design of schools) and access to expertise. However, the big idea significant to other contexts is the ‘unrelenting’ expectation that every teacher would engage as a learner and that resources would be directed to ensure this was possible. Teachers’ learning was not an afterthought at Fulton it was a priority. Prioritising of teachers’ learning through the provision of rich and multiple opportunities for learning was not only insightful it was well justified by the outcomes that have been achieved.

The recent TALIS project (2009) highlighted many of the affordances identified in this research as influential to effective learning. One outcome of the report stated:

The close associations that TALIS shows between factors such as a positive school climate, teaching beliefs, cooperation between teachers, teacher job satisfaction, professional development, and the adoption of a range of teaching techniques provide indications that public policy can actively shape the conditions for effective learning. At the same time, the fact that much of the variation in these relationships lies in differences among individual teachers rather than among schools or countries underlines the need for individualised and targeted programmes for teachers rather than just whole-school or system-wide interventions that have traditionally dominated education policy.

The final sentence supports the concept of individualised professional learning programmes already in use at Fulton. However, the notion of individual learning in preference to collective learning is not well supported by the stories of teachers at this school or in building a culture of learning. There needs to be scope for individuals to learn in personalised ways but the strength in the Fulton model was collective learning and collective responsibility for student learning. Fullan (2008) also prioritises collective learning in his ‘Six secrets of change’ model including as one of his secrets, ‘connecting peers with a purpose’.

7.7 Reflections on the research process

Desimone (2000) argued that methodology texts “emphasise that research questions should drive methods” (p.190). The nature of the research questions in this thesis required methods that generated rich and extensive data so that an in-depth understanding emerged of how teachers’ learning was supported and sustained in the context of Fulton and how outcomes influences teachers, students and the school. Data gathered from surveys, interviews, observations and participation in the daily life of the school all contributed to the theorising about teachers’ learning at Fulton. Desimone suggested that the use of such methods is ideal if the research is seeking to:

provide narratives, examples, and anecdotes to answer research questions directed at questioning models of teacher interactions; generating hypotheses; and describing and understanding the complexities of professional development in a specific context, how beliefs and attitudes change, and the process through which teachers change their instruction. (p.190)

The purposes identified by Desimone were core to my research aims. The use of grounded theory methods enabled me to theorise about teachers’ learning and generate the explanatory model and an historical account of teachers’ learning at Fulton.

The thesis, particularly through Chapters 4 and 5, provides an audit trail of the thinking and analyses that underpinned the explanatory model. Ezzy (2002) said, “The dangers identified by grounded theory are twofold: either, through *overemphasising theoretical deductions*, the researcher will not be prepared to reformulate theories in response to new evidence or an

overemphasis on inductive theory grounded in ‘data’ will result in a failure to be explicit about the pre existing theoretical sources of ideas.” I paid particular attention to how the outcomes of my research connected or contrasted with similar research. However, I recognised that the extent of research on teachers’ professional learning currently has resulted in missed opportunities to include other very relevant research. This may present as a weaknesses as even in the final days of writing I found material of high relevance that I certainly could have included to strengthen the critical analysis of the research outcomes. Fortunately ongoing research in the field presents as an opportunity to do so, and I perceive ongoing contrasting of the explanatory model with other researchers’ findings to be a worthy undertaking.

Constant sharing of the research with the teachers and leaders at the school throughout the process added to the credibility, validity and trustworthiness of the thesis. Maxwell’s Framework for Reflexive Responding as modified by Smith (2000) (see Chapter 3 page 83) provided an excellent scaffold for my conduct and reporting process and also for the evaluation of the outcomes of the research. The framework makes note of threats to validity including the problem of “going native” and privileging comfortable ways of viewing a phenomenon. I became critically aware of this issue particularly as the writing up of the thesis appeared at times to be a “glowing account” of the school and the people in it. I constantly wondered what I was missing. There is no doubt I may have missed some valuable data from more reticent teachers. However, the high percentage of responses to surveys, the fact teachers had self selected to teach at the school and the opportunity to develop long term connections with the school provided opportunities to hear the majority of voices. I specifically chose Barry as a case study as he appeared to be the least enamored with the school and its commitment to professional learning yet even he presents a powerful story of teacher learning. Perhaps the dilemma in finding little to criticise about the school’s commitment to teachers’ learning and the subsequent outcomes is not in the school but in a weakness in my research design and methods. I listened with interest more closely to students and in particular parents about their experiences with the school and through the outcomes of the Honours’ research referred to in Chapter 6 I am aware that ‘glowing outcomes’ are not evident for everyone associated with the school. And certainly now that this research has been completed it would be timely to broaden the scope of informant to determine if aspects of teachers’ learning worked against improved outcomes for students. For example, one parent I met through a social event commented on their concern that their son had gaps in his learning for some year 12 subjects based on lack of explicit coverage in the Central Study model. Such information had me questioning whether I could have paid more attention to the quality of the content matter teachers were engaging with in their learning. From the research process it is clearly evident that there are many opportunities to extend and expand on my current research. To have included them all would have broaden the research scope to an

unmanageable level and possibly resulted in less effective coverage and understanding of the question posed in the present research. For the purposes of responding to the research questions, the methods used to provide a sound vehicle for developing a deep understanding of the processes and outcomes of teachers' learning at Fulton.

7.8 Future research

I have made several suggestions for future research as an outcome of the present research throughout this chapter which included further examination of the explanatory model in other schools, both innovative and those struggling with creating a culture of learning. The foundational features of the explanatory model could serve as a tool for others schools to consider what affordances are currently evident and what possibilities there are for generating new ones. In this way the model could be 'tested' for its generalisability to diverse contexts. As mentioned previously it would be of particular interest to use the model with teachers and schools resistant to professional learning as also proposed by Desimone.

Further research could be conducted at Fulton to seek students' perceptions of the role of teachers' learning on improving their own learning outcomes. Students at the school are well aware that teachers engage in regular learning and it would be valuable to determine whether the students acknowledge any direct links between the teachers' learning and their own improved outcomes. The school is gathering data on its graduates and this may prove an opportunity to connect their outcomes with teachers' learning as well. Developing empirical research to provide more explicit links between enhanced student learning and teachers' learning is constantly called for in the literature, most recently by Desimone (2009). However, this has proved to be a challenging area (Ingvarson and Meiers, 2000, Timperley et al, 2007). The task of making such connections is a difficult one due to the many variables involved and yet, the stories from Fulton provided some evidence of links between teachers' learning and supporting students as successful learners even without verification of elusive 'test scores'.

I believe the richness of the data collected also provides an excellent opportunity to 're-look' and see in new ways (Senge, et al. 2004) and from new perspectives. The extent and quality of the interview data could be analysed using critical discourse methods to consider how leaders and teachers' identities are reflected and positioned and the implications this may have for schooling in the 21st century.

7.9 Final reflection

Fullan's (1991) recognition that, "Educational change depends on what teachers do and think. It's as simple and complex as that," (p.117) was a starting point in the thesis and therefore

it is timely at the conclusion to reflect as to how his words represented the Fulton story. The ‘simple’ aspect of teachers’ learning at Fulton was that through specific organisational elements and environmental factors teachers engaged with learning opportunities and changes in practices occurred. At times the learning was supported by simply being in the same place as a colleague. However, the ‘complex’ aspect was the ability to identify the many factors that interacted to generate affordances for greater or lesser teacher engagement, learning and/or change. An additional complexity was the identification of how teachers’ learning influenced outcomes for the teachers, students, the school as a learning organisation and the broader educational community. The outcomes of the research process clearly identified that teachers’ learning was pivotal to the success of Fulton achieving its vision and that teachers’ learning in an innovative school was both incidental and intentional, and simple and complex.

Although the school is unique, there is much to be learned from those willing to redefine traditional paradigms of schooling and it would be wise not to dismiss the outcomes of this research due to the unique nature of the school. One particular outcome clearly worthy of consideration by those interested in ‘re-envisioning’ not just science and mathematics education but all schooling was the role of the learning space. Fulton’s learning space was reflective of Greenman’s (1988) view:

An environment is a living, changing system. More than physical space, it includes the way time is structured and the roles we are expected to play. It conditions how we feel, think and behave; and it dramatically affects the quality of our lives. The environment either works for us or against us as we conduct our lives. (p.5)

Fulton was an environment that ‘worked’ for many teachers, students and other educators and although it represented a large economic and human resources investment the outcomes proved insightful and important in understanding what is possible for schooling in the senior secondary years. The following comment from one visitor to the school in April 2009, seven years on from the opening of Fulton might be valuable advice on using the outcomes of the research too; “This school brings real meaning to, ‘if we want to shape the future, we must create it’.”

Appendix A

[Fulton's] Professional Development Strategy

The Professional Development Policy applies to all staff at [FULTON]. It recognises the value of professional learning to the improvement of student learning outcomes.

The Professional Development Policy is underpinned by the following beliefs.

Quality professional development includes:

- focusing on improving student engagement in learning
- involving teachers in the design and planning of professional development programs
- basing activities in a school context to ensure relevance
- continuous and ongoing involvement of teachers in observation, critique and reflection of their practice
- being supported by multiple sources of information
- opportunities for teachers to develop theoretical understanding and skills
- involvement of school teams in action research programs
- being part of a comprehensive change process and school improvement plan

The following principles underpin this policy:

- learning is a lifelong process
- honesty, openness and transparent processes
- focus on continuous improvement
- equity and fairness
- mutual obligation
- explicit agreed expectations
- empowerment and supportive culture.

Aims

The [FULTON] Professional Development Policy aims to enhance the quality of student learning by supporting the development of educators who are able to:

- develop, disseminate and adopt leading edge teaching and learning practices in science and mathematics across the state;
- promote and adopt pedagogical practices which support and engage all students;
- contribute to the development of a culture of continuous learning for teachers involved in mathematics and science education focusing on the new and emerging sciences; and
- develop partnerships between DECS, Flinders University, industry, government agencies and professional associations for the purposes of improving teaching and learning practices in mathematics and science.

Teaching and learning principles

The following teaching and learning beliefs and principles are the basis for professional development programs/activities.

- Students are acknowledged as young adults, building on their confidence, knowledge, skills, understandings and capabilities to succeed in Science and Mathematics to high levels
- Teaching and learning programs use multiple sources of information and explore a range of perspectives in order to develop deep understanding of Science and Mathematics
- Students are guided in active inquiry, providing opportunities for research, problem solving and communication of their ideas. They take part in a range of activities that explore historical, social, cultural and political perspectives at personal, local and global levels. Transference of learning is encouraged through practical application of knowledge.
- Students have the opportunity to achieve a range of qualifications and demonstrate their knowledge, skills, experience and attributes in a range of Science and Mathematics related contexts.
- Collaborative learning is a feature of the school, with opportunities to develop skills in innovation and enterprise. Students will work in groups and individually to investigate authentic problems or issues and to communicate their findings to the wider community.
- Demonstration of learning focuses on assessing understanding and its application to Science and Mathematics related contexts and skills in investigation, analysis and communication.
- Individual learning Plans are negotiated for all students. Students have the opportunity to make choices in both the breadth and depth of curriculum, facilitating increasing specialisation according to their interests and pathways.
- Details of student learning will be recorded through Individual Learning Plans and e-portfolios in consultation with personal tutors within a program of personal care and support.

[FULTON] Learning Community

Working in partnership with Flinders University is a critical component of the professional learning of [FULTON] staff. The learning community of the school therefore includes all students, staff, Flinders University staff from the School of Education & Faculty of informatics and science, parents, industry and businesses and schools working with us in curriculum enhancement and professional development programs.

[FULTON] aims to establish a network of individuals and organisations interested in the education of young people with a particular focus in mathematics and science. The acknowledgement that staff and students are learners leads to the establishment of [FULTON] as a learning community in which we provide opportunities to learn from each other and from current local and global research. Working with EDICT recognises the importance of research in learning and reforming curriculum in senior years.

Lifelong learning

FULTON] is committed to lifelong learning. Staff are supported in pursuing professional learning activities.

SciMaS and [FULTON] role

[FULTON] will play a significant role in the DECS science and mathematics strategies. As a school with a focus on teaching and learning in these curriculum areas, staff will be involved with many aspects of the strategies. This will provide opportunities for [FULTON] staff to work alongside leading professionals in science and mathematics and will require staff to have skills at a level that supports their involvement in professional development activities.

Professional development activities may include:

- Professional discussions with visitors to the School about teaching practices, learning programs, and [FULTON] policies and procedures
- Mentoring new graduates, pre-service mathematics and science teachers
- Working collaboratively and supporting colleagues in their work and learning as a member of the [FULTON] team
- Participating in discussions related to how ICTs can enhance learning
- Being a member of a virtual community of practice involving people with an interest in mathematics and science education from around the globe
- Engaging in professional learning such as conferences, action research, professional reading and publishing and post graduate studies to enhance curriculum and pedagogical knowledge
- Participating in work placement programs

Key Elements

The following key elements make up the Professional Development Policy:

- Explicit and up to date **role or duty statement**, or **job and person specification** which reflects the skills and competencies required of the staff
- **Individual professional development plan** which provides a link between the schools aims and agreed professional development activities
- A clear process for **monitoring** professional development activities
- Regular **evaluation** of individual professional development plans and the school professional development policy
- Opportunities for professional development activities to be **recognised within a qualifications framework**
- Outcomes related to the national **quality teacher standards**
- Provision of **feedback** which enables staff to identify professional learning and development opportunities.

Outcomes

It is envisaged that as a result of staff involvement in professional development there will be improved learning outcomes for students and the development of educators who:

- have an extensive knowledge of their students needs, learning styles, and backgrounds

- work with staff and students to achieve high quality learning outcomes especially in mathematics and/or science;
- are reflective, committed to improvement and active members of their professional community; and
- promote the principles of equity and social inclusion.

Roles and responsibilities

Staff will work in teams to develop, monitor and evaluate their professional development plans. Teams will meet as negotiated to

- establish priorities for IPD Plans inline with [FULTON] teaching and learning principles
- determine outcomes of PD activities
- identify reporting requirement if appropriate
- outline budget implications of PD activities
- identify activities which can be accredited towards the 371/2 hours

Staff have a responsibility to:

- Be actively involved in professional development opportunities,
- Establish a documented process, in negotiation with their team and the AP Professional Development, which reflects personal goals, the school's teaching and learning principles and strategic priorities

[FULTON] Leadership Team has a responsibility to:

- Ensure staff have a clear, up to date and explicit role or duty statement or job and person specification
- Model active involvement in professional development which is consistent with the identified principles of this policy

Assistant Principal; Professional Development has a responsibility to:

- Ensure that PD teams are established with clear expectations
- Document IPD Plans and associated processes are clear
- Ensure opportunities for professional development are shared
- Establish and monitor the professional development budget
- Negotiate professional development activities for recognition accreditation framework
- Prepare annual report of professional development activities of staff
- Monitor staff access to professional development opportunities to ensure fair access
- Monitor professional development activities to ensure links with identified school priorities
- Ensure staff who are new to a role or the worksite of the [FULTON] participate in an PD induction program

Support documentation

Individual Professional Development Plans
Job and Person Specifications

Appendix B

Example of [Fulton's] personalised professional development plans

[Fulton Senior Secondary School]

Individual Professional Development Plan

2009

Name

Date

Goals	Strategies	Resources	Outcomes
1. Develop pedagogical content knowledge	Work with members of the MAT team to develop learning resources for students. Lecture/Tutor 4 th yr Education students in their final curriculum studies (Senior Maths specialisation) from Flinders University and develop a reflective journal/dialogue in response to desired outcomes, perceptions and observations made throughout the process.	Stage 1 & 2 Curriculum statements for Mathematics from SSABSA and newSACE. EDUC4700 materials and resources. [FULTON] mathematics materials.	Develop key competencies in the 4 th year students in regards to their fundamental understanding of stage 1 & 2 mathematics and the pedagogy underpinning the delivery of curriculum. Complete the Graduate Certificate in Education. Develop a deeper understanding of my personal pedagogic practices in conjunction with student observations of my teaching approaches to student learning and engagement.

<p>2. Action Research Project</p> <p>Can the availability of Stage 2 Specialist Mathematics in disadvantaged schools be improved through the provision of an interactive online learning environment?</p>	<p>Develop online learning resources to be made available to [FULTON] Specialist Mathematics students and trialled throughout the year. Participate in the DECS e-teacher program through 2009 to facilitate the development of these resources.</p>	<p>e-teacher assistance via 0.2 leave from school. Laptop for the duration of the program. Open Access information regarding specialist mathematics curriculum in place already. Live Comms software through [FULTON] portal. CENTRA through DECS. Online video resources, various mathematical software (eg. Peanuts suite, Geometers Sketchpad, Mathematica, TI nSpire software)</p>	<p>Develop a unit of work that can be delivered online, via DECS or through [FULTON] infrastructure, for the conceptual development of curriculum in Specialist Mathematics, trialled with my current students. Improve conceptual understanding using 3D modelling software to display complex concepts in 3D space. Provide students with an interactive platform that can facilitate their learning processes through peer mentoring outside of school hours.</p>
<p>3. Individually determined/Build leadership capacity</p>	<p>Acting Coordinator 3 – Interdisciplinary Curriculum (Mathematics) for term 2. Develop key leadership skills and strategies as the leader of the MAT team.</p>	<p>Time allocated for leadership role, MAT team members, student feedback and responses. Leadership team at [FULTON].</p>	<p>Survive. Enact strategies to improve the student uptake of the abstract thinking component of MAT at the [FULTON]. Improve student results in tests through increased engagement in the Learning Journal component.</p>
<p>4. Publish, present and/or share your experiences and practices at the [FULTON] with educators.</p>	<p>Present at MASA workshops re Stage 2 Mathematics at the [FULTON].</p> <p>Work with fellow e-teachers throughout the program to develop electronic learning materials for use in schools across the state.</p> <p>Present at AAMT (Fremantle) regarding the work done in MAT around Metacognition and the interdisciplinary nature of the course through the Sacred Geometry art exhibit.</p>	<p>Time to develop resources and presentation materials. Financial coverage for the accommodation and enrolment fees for the conference.</p>	<p>To improve understanding in the wider mathematical education community of how the [FULTON] operates. To increase awareness on the availability of diverse teaching and learning tools to improve student engagement along with conceptual and contextual understanding.</p> <p>Share developed resources with other educators across Australia to improve the quality of Mathematics education.</p>

Appendix C

Self Inventory developed by John Mason (2002, pp. 255 – 256)

I see my self primarily as a...

The people I serve are primarily...

My principle (sic) professional activity is like...

Being on the other end of my professional practice is like...

What I like most about what I do is...

What I like least about what I do is...

For me, the least important part of what I do is...

For me, the most important part of what I do is...

Whereas I used to...

I have recently begun to...

What I do is important to the institution because...

What I do is socially or culturally important because...

What I liked most about being trained (becoming professional) in what I do was...

What I liked least about being trained (becoming professional) in what I do was...

What I look for in professional development opportunities now is....

Appendix D

Initial survey questions (conducted via Zoomerang) November 2004

Beliefs about deep learning and teaching that supported deep learning

What do you believe are the characteristics of deep learning?

What do you believe are the processes that learners use to arrive at a deep understanding?

What do you believe schools and teachers can do to foster deep understanding in their students?

Outcome of teachers' learning and processes that supported the learning

What are the most important things that you have learned about teaching and learning since being at [Fulton]?

In what ways has this learning occurred?

Changes in teachers' beliefs and practices and sources that supported the change

What have been major changes in your beliefs about teaching and learning since commencing at [Fulton]?

What have been major changes in your teaching practices since commencing at [Fulton]?

What have been the major contributors to these changes in beliefs and practices?

Follow –up survey questions (conducted via Zoomerang) August 2007

Name: Optional

Length of time teaching at the [Fulton): Optional

1. During my time at [Fulton] the most significant learning from me has been.....
2. This learning has influenced by beliefs and/or practices in the following ways....
3. The learning was supported by engaging in

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