Assessment “for learning” approaches in the development of work-ready paramedic graduates

By

James Thompson

Thesis
Submitted to Flinders University
for the degree of

Doctor of Philosophy

College of Education, Psychology and Social Work
November 2020

Contents

Figures and Tables

Figures

Tables

Abbreviations and Acronyms

AfL	Assessment for Learning
(A)	Area of concern
AHPRA	Australian Health Practitioner Regulation Agency
AQF	Australian Qualifications Framework
AR	Action Research
ATAR	Australian Tertiary Admission Rank
CAA	The Council of Ambulance Authorities
CPG	Clinical Practice Guideline
CPR	Cardiopulmonary Resuscitation
(F)	Framework of ideas
GPA	Grade Point Average
HE	Higher Education
HERDSA	Higher Education Research and Development Society of Australasia
HERGA	Higher Education Research Group of Adelaide
MCQ	Multiple-Choice Question
(M)	Methodology
OSCE	Observed Structured Clinical Examination
PAL	Programmatic Assessment for Learning
PBL	Problem-Based Learning
PT	Progress Test
RP	Reflective Practice
SRL	Self-Regulated Learning
STCA	Student-tutor Consensus Assessment
SAAS	South Australian Ambulance Service
VET	Vocational Education Training
WIL	Work Integrated Learning

Prologue

At a forum held early in the last decade, a theatre was filled with many of the leaders and key decision makers of the Australian ambulance industry. Amongst them a small scattering of representatives from the nation's university education providers completed the audience. The keynote, a prominent figure in the industry, took to the stage and proceeded share his vision for the future of the nation's paramedic industries and proposed workforce agendas linked to the planned moves towards being recognised as a profession. The presentation shared insights into the perceived clinical, operational and legislative challenges on the horizon for the discipline. Following his talk, a question came from the audience:

"Where do you see the role of universities and paramedic academics in your future vision?"

His response was swift:

"Well, we can't ever let the tail to start wagging the dog, now can we?"

This thesis is about the dog's tail.

Abstract

The professional capabilities of graduate paramedics are a critical concern of many stakeholder groups, not least the communities they serve. Following the transition of paramedic education from apprenticeship-style vocational training to professional education within universities, paramedic courses have faced criticism from industry partners, who have challenged the “work-readiness” of graduates entering the national paramedic workforce. Decisions about graduate work-readiness are complicated by complex tensions, including changing modern healthcare demands, student expectations, university practices, and industry agendas. These tensions result in conflicting opinions about expected performance standards, how these are best achieved, how to assess and assure that these expectations have been met, and who is best qualified to determine these.

This thesis presents findings from a series of interlinked projects with the shared objectives of gaining a better understanding of and responding to the challenges of developing work-ready paramedic graduates. The strategies employed to meet these challenges are evidenced through eight peer-reviewed publications that report the outcomes of multiple separate research projects. These largely focus on the final period of study within a paramedic program and on the unique needs of graduate students as they prepare to enter employment and practice as paramedic professionals. This final period of education in paramedic programs presents a critical interface between university education, students, and industry and has had a volatile history following the transition from vocational to university education. The focus for these projects is university assessment practices, recognising the critical responsibilities of universities in assuring learning attainment and the role assessment plays in shaping student learning.

This thesis explores the use of assessment as an instrument for educational reform using an overarching action research methodology. This methodology unites multiple, interrelated projects that are the basis for the eight publications. Each publication complements and provides a foundation for the next and collectively they contribute to the generation of new knowledge and new theory regarding paramedic education. Key findings emerging from the studies include; a description of the process of care which defines the modern paramedic role, construction of the first complete professional knowledge taxonomy, and detail and interpretation of the meaning of work-readiness. The collective findings offer validation of a new student-centred learning design, with personalised assessment *for* learning approaches, that have produced evidence of enhanced validity and reliability in making a determination of students’ work-ready capability.

Declaration

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed [redacted]

Date.....20/05/2020.....

Acknowledgements

The popular board game, Snakes and Ladders, dates back to ancient India in 2 AD, and is said to have been originally developed to educate about the pitfalls and opportunities which accompany life's journey. The game is a suitable metaphor for my career experiences, where I have observed others climb quickly while my own progress has been frequently set back through encounters with snakes. Having the good fortune to discover people who have been willing to invest in me and help to raise me up has been humbling. I hold the greatest appreciation for my supervisors, Jan Orrell and Don Houston, two of the finest ladders indeed. There is little question of how pivotal they have been to any growth or success I have experienced in recent years. University restructures and retirement have meant that they chose to take me on and stick by me, with no obligations to do so, and their generosity with time and expertise has proved a powerful motivator for maintaining a strong personal work ethic. Beyond what they have taught me about the crafts of writing and research, they have been exemplary role models, and shown me attributes I aspire to emulate in my own future supervision undertakings. Critical friend is a term truly befitting of Don; his criticism and friendship both have played major roles in helping sustain these projects over the years. Thanks to Don, I find it now ingrained to ask "*So What?"* to all arguments that I read or write. With over a decade of continued collaboration, the influence of his critical lens has been well imprinted. Additional gratitude to Jane Jarvis who stepped up to the plate to help get things over the line with many excellent recommendations, and to Abby Sesterka and Richard Draper for editing support.

It is unfair to describe this PhD journey in terms of my own commitment and great personal sacrifice when, ultimately, this has in many ways been a selfish venture and one which those who have been burdened most are the people closest to me. While my wife and children won't appear on the parchment for this award, they are the ones who have had a great many hours stolen from them. For Max and Sid, this has meant their dad has been noticeably absent and unavailable for too many important moments. For my wife, Fiona, it has meant forgoing her own opportunities while she has taken on the lion's share of tasks required to keep the family wheels turning. Thank you for supporting me and much love to you and the boys.

Presentations Associated with this Thesis

Thompson, J., Nelligan, S., Cayetano, A., & Houston, D. (2019, September). *Progress testing in a single subject* [Conference Session]. Higher Education Research Group of Adelaide Conference, Adelaide, Australia.

Thompson, J. (2019, July). *Making Progress: Introducing progress testing approaches to a single semester paramedic subject* [Conference Session]. Prideaux Centre Annual Symposium, Translating Educational Research into Practice. Adelaide, Australia.

Thompson, J. (2018, November). *It's not your tools it's how you use them. Assessment design in a paramedic capstone program* [Conference Session]. Prideaux Seminar Series. Prideaux Centre for Research in Health Professions Education. Adelaide, Australia.

Thompson, J. (2018, June). *Partnerships in Assessment* [Conference Session]. Work Integrated Learning (WIL) Forum, Flinders University, Adelaide, Australia

Cayetano, A., Thompson, J., Couzner, L., Pope, S., & Houston, D. (2018, September). *Evaluation of Student-Tutor Consensus Marking Model in First Year Paramedic Undergraduate Degree: Developing Skills in Self-Evaluation* [Conference Session]. Higher Education Research Group of Adelaide Conference, Adelaide, Australia.

Thompson, J., Houston, D., & Couzner, L. (2018, September). *Making progress: Helping students to know where they are going and where they have been with the use of progress testing: Design & Implementation* [Conference Session]. Higher Education Research Group of Adelaide Conference, Adelaide, Australia.

Houston, D., & Thompson, J. (2017, July). *A bridge to being a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject* [Conference Session]. Higher Education Research and Development Society of Australasia 40th International Conference: Curriculum Transformation, Sydney, Australia.

Thompson, J., & Houston, D. (2017, September). *Simulated job interview as an oral tool for assessment: personalised assessment of personalised learning* [Conference Session]. Higher Education Research Group Adelaide Conference: Bend or Break: flexible institutions, teachers and students, Adelaide, Australia.

Thompson, J., & Houston, D. (2016, September). *Using Wikis to Enhance Problem Based Learning* [Conference Session]. Higher Education Research Group Adelaide Conference, From Research and Policy into Practice, Adelaide, Australia.

Thompson, J. (2016, November). *Individualised student learning: Approaches and innovations within a capstone paramedic course* [Conference Session]. Flinders University Learning and Teaching Week Conference, Adelaide, Australia.

Thompson, J., Dansie, K., & Houston, D. (2016, November). *Teaching Students to think like a Paramedic: Improving Professional Judgement through Assessment Conversations* [Conference Session]. Paramedics Australasia International Conference, In Shaping the Future: Challenges, Changes and Opportunities, Auckland, New Zealand.

Thompson, J. (2016, October). *Assisting graduate transitions to practice* [Conference Session]. SA Ambulance Education Forum. Adelaide, Australia.

Thompson, J., & Houston, D. (2015, May). *Customising a capstone experience around assessment for learning: A case study for paramedic education* [Conference Session]. International Conference on Assessment for Learning, Hong Kong, China.

Thompson, J., Pointon, T., Rayner, T., Pope, S., Cayetano, A., Mitchell, B., & Houston, D. (2015, September). *Student and tutor consensus as a basis of assessment: Developing undergraduate skills in self-evaluation* [Conference Session]. Higher Education Research Group of Adelaide Conference, Brave New World: The Future of Teaching & Learning, Adelaide, Australia.

Thompson, J., Grantham, H., & Houston, D. (2014, September). *Developing better graduates through individualised learning: A case study of a Paramedic Capstone Experience* [Conference Session]. Higher Education Research Group Adelaide Conference, Changing Horizons: Local Learning for Global Impact, Adelaide, Australia.

Awards Associated with this Thesis

Conference Prize. (2019). Higher Education Group of South Australia Conference, Adelaide, Australia.

Edith Cowan University Prize. (2017). Best Paper on an Authentic Learning Environment. HERDSA Annual Conference, Sydney, Australia.

Executive Dean's Award for Teaching Excellence. (2014). Flinders University, Adelaide, Australia.

Educational Performance – Runner-Up. (2012). The Council of Ambulance Authorities Awards, Hobart, Australia.

Structure of the Thesis

This thesis is submitted for the award of Doctor of Philosophy by Prior Publication. As such, the format of this work reflects the unique expectations for this type of higher degree. The thesis begins with a chapter that introduces the problem and the significance of the research.

The second chapter provides a contextual statement that offers background information about the issues which helps frame the work. It introduces the historical legacies of the paramedic discipline which continue to impose on current practices and conceptualisations of the modern paramedic role.

Chapter Three describes the action research features and processes used in line with recommendations and specific requirements of this methodology. My role as the participant researcher is introduced, along with several key elements which have shaped my own motives and beliefs. These include personal experience as a student, clinician and educator within both nursing and paramedicine throughout periods of major educational and professional change. The action research is structured and presented in accordance with the recommendations of Checkland and Holwell (1998), identifying the area of action (A), the framework of ideas shaping the research (F), and the methodology (M).

Chapter Four presents eight peer-reviewed publications that are the central focus of this thesis. These have been formally reviewed and published prior to submission of this thesis. These publications chronicle separate but interrelated projects that collectively contribute to greater understanding of the challenges associated with determining the work-readiness of paramedic graduates. The publications describe development, validation and evaluation of a number of novel assessment approaches that are used as a vehicle to effect educational reform. Each of the projects described in these publications had the common underlying purpose of improving the educational approaches for equipping students with the necessary knowledge, skills and dispositions required to be recognised by industry as being appropriately prepared to commence practice.

The fifth chapter presents a critical discussion of findings arising from the complete body of work, identifying knowledge created and the new theory, along with their significance and consequent implications for future practice.

The final chapter offers conclusions on this research.

Chapter 1. Introduction

This introduction provides a background from which to view the complete work. In contrast to a traditional doctoral format, this thesis by prior publication features a review of pertinent literature largely within each of the included publications. While some of the relevant literature is reviewed outside those publications, deliberate efforts have been made to avoid repetition of material and argument previously presented inside those publications.

1.1 Research Problem

The research problem focuses on ensuring and assuring the expected capabilities of university paramedic graduates, and what is needed to ensure that the ambulance industry recognises graduates as having achieved suitable work-ready standards. The transition of pre-employment paramedic education into the universities originally addressed the need for the advancing discipline to be underpinned by an expanded and improved education of its workforce. This corresponded with a shift from paramedic programs addressing level 5 education requirements of the work-based vocational diploma of the Australian Qualifications Framework (Australian Qualifications Framework Council, 2013) to having to meet the level 7 standards of a bachelor's degree qualification. Industry criticism of university programs has remained constant, despite university education offering students access to greater breadth and depth of knowledge, taught by academic staff who have both theoretical and practice expertise. While several critical discussions being presented concern local South Australian events, anecdotal reports of these themes appear consistent with those nationally and internationally.

Previous attempts to clarify the specific detail of concerns have highlighted the difficulties industry responders have in articulating the precise issues and these difficulties, in turn, have hampered efforts in universities to address industry criticism (Willis et al., 2010). Even 20 years after universities first became the established providers of paramedic education, critical comparisons between the work-ready capabilities of university graduates and the former vocationally trained paramedics persist (O'Meara & Furness, 2013). This problem has influenced the exploration of what universities can do to ensure their graduates possess sufficient knowledge and skills required of the paramedic role, as well as being able to persuade recruiters that they possess the capabilities to be work-ready.

1.2 The Research Questions

The research questions and the specific detail which underpins each of them is discussed in chapter 2. In line with the methodology employed which unites the studies reported in this thesis, key research questions are presented in chapter 3, which collates them as

contributions to a framework of ideas which steered the research. These are detailed in table.1. A summary of these questions are presented below to guide the scope and focus of the research which is to be discussed throughout this thesis.

The questions:

- What are the roles or activities which define the modern paramedic?
- What do graduates need to know and be able to do to perform these roles?
- What does work-readiness mean?
- How can the individual needs of each student learner be recognised and responded to within a large class?
- What needs to be understood about learning at different stages of a student's study path when designing teaching?
- How can teaching design contribute to improved student learning behaviour?
- Can an alternative, more authentic campus-based paramedic pedagogy better respond to the limited scope of work integrated learning experiences?
- What can be done to integrate an assessment for learning approach into an existing curriculum design?
- How can an assessment for learning re-design contribute to an improved attainment of graduate paramedic preparedness?
- What would be required of an assessment design to enable students to effectively develop critical self-regulated learning skills, and contribute to high stakes assessment decisions?

1.3 Overview of the publications in the context of the research aims

The thesis presents and critically evaluates the contributions of 8 peer reviewed publications which respond to the research questions summarised above in chapter 1.2. These publications report on findings generated from 5 separate areas of study (Paramedic process Study, Capstone studies, Student-tutor consensus studies, Progress test study and the 1st year reflective practice study.) These are discussed in detail in the following chapters. The Action Research methodology being employed (which will be discussed in detail within chapter 3), was characterised by each of the projects revisiting and compounding on the understanding gained from previous projects. This meant that while each project initially set out to respond to specific research questions, there was a significant overlap of the how these questions were answered and reported. Figure 1. (p 25) presents an illustration titled 'Research Question, Project, Reported Outcomes Matrix', which demonstrates the relationships and connectedness of the publications, the projects and initial research questions.

1.4 Significance of the Research

There is a paucity of published literature relating to paramedic education, and that which exists predominantly reflects a critical industry narrative (Edwards, 2011; Willis et al., 2010). This thesis and the eight publications included respond to the limitations of existing literature regarding educational theory relating to the paramedic discipline. As paramedicine emerges as a new profession, these publications represent important contributions to the development of a unique body of evidence and theory essential to support this new professional status (Reynolds, 2004).

As an alternative to the critical narrative, this thesis offers a view of paramedic education through the lenses of paramedic academics and students, as well as the wider contemporary literature on learning and assessment in education for practice. Identified is the need for a shift from a “local employer is always right” perspective, when it comes to decisions about work readiness, to a perspective that is representative of a more inclusive group of stakeholders linked to the advancing profession, including university academics. The thesis attempts to balance industry traditions and agendas with the needs of universities, students, and the profession, in a way that ensures all perspectives are acknowledged equally. New approaches to assessing and determining graduate capabilities are provided and are shown to have enhanced effectiveness, providing greater assurance that students’ academic results are a faithful indication of the attainment and retention of required paramedic skills and knowledge. A narrative of ‘assessment for learning’ is introduced to paramedicine, with illustrations provided of personalised teaching and learning design, together with a defensible regime for assessment rigour that aligns with all credentialing expectations.

The significance of achieving work-ready paramedic graduates has direct implications for all stakeholders, not least the community of patients dependent on the standards of care graduate paramedics can provide. If paramedicine is to succeed as a profession, it is important that the education of its professionals is both effective and accepted by the industry. The work of this thesis seeks to respond to both goals, while also making fundamental contributions towards the evidence base of this early stage profession. The significance of this work reaches beyond defending the university pre-employment training of paramedics as an adequate substitute to vocational programs. Instead it argues for the greater depth and breadth of the modern curriculum, as well as recognition of the educational knowledge and expertise of university teaching staff.

Chapter 2. Contextual Statement

2.1 A Critical Turning Point

The setting at the centre of the concerns which led to this body of research, was an Australian university responsible for the pre-employment education of paramedics. Criticism of the local paramedic degree has existed since its transition from work-based vocational training, although several incidents were critical catalysts for this body of work. Examination of one specific incident central to a particularly volatile chapter in the history of the degree provides some valuable insights.

Management of one of the final subjects in the degree program had been coordinated by a casual staff member. Relationships between the university, local industry, and students were significantly strained at the time. The tutor, a highly experienced educator within the former work-based training programs, set a summative, exam-based assessment organised in such a way as to act as a *'de facto'* gatekeeping process: the tutor could pass and fail students based largely on his personal perceptions of their competency and work-readiness. The form of this assessment included confronting students with simulated emergencies that challenged their knowledge and practical skills, and reflected the traditions and culture of a discipline that requires its clinicians to be able to demonstrate knowledge on demand, and be unquestioning of the judgements, commands and criticisms of those holding a higher rank. Many students who experienced this assessment were deeply concerned at being judged as unprepared for practice based on the outcomes of a single assessment event and, worse, being unable to graduate after three years of otherwise successful study. Additionally, many academic staff were equally disconcerted that their teaching efforts in previous subjects were brought into question and blamed for students' perceived practice deficits. Friction with local industry escalated when questions were raised by the university regarding the appropriateness of gatekeeping assessment practices and performance standards previously used when industry was solely responsible for such education. Formal student evaluations of teaching, as well as a series of written and verbally raised complaints at the time detailed their dissatisfaction. Similar academic unrest was expressed during faculty based meetings, where teaching staff conveyed concerns regarding student behaviour linked to assessment. Ethical concerns are linked to providing detail beyond an anecdotal summary of these accounts.

The events in this example coincided with a challenging formal accreditation review of the teaching program by the national regulator, whose findings were highly critical of the perceptions of poor graduate standards and student dissatisfaction with their educational experiences. Issues were further fuelled when local industry recruitment decisions at the time

seemed to favour interstate graduates. Based on this set of circumstances, an urgent and comprehensive intervention was warranted.

The body of work contained within this thesis reflects the measures that were developed and tested to gain a critical understanding of, and solution to, a complex problem. The work explains efforts to understand and respond to a local dilemma. Industry and University tensions relating to the preparedness of university-based graduates features within the literature for other practice-based disciplines, such as nursing and teaching, and remains a topical debate (Jordan et al., 2019; Kneafsy & Haigh, 2006).

2.2 Paramedic Industry

The following section provides a general description of the paramedic industry and the historical contributors to the contemporary challenges which confront the discipline.

2.2.1 Introduction to industry context

Ambulance services are an identifiable constituent of most established global healthcare systems, yet there are significant differences in how such services are staffed, the roles their personnel play and the scope of care they offer. Those undertaking ambulance roles around the globe range from volunteers, through to fire department employees, to clinicians based within community and private clinics. Because the tasks and expectations of these roles differ considerably, there remains no clear consensus about defining the science that underpins the disciplinary practice known as paramedicine (Long et al., 2018). In the absence of any widely accepted definition from primary sources of literature, Wikipedia describes paramedicine in terms of an “emerging concept of paramedic theory” (Wikipedia, 2019, section 1, para. 3), based on an intersection between “health care and medicine, public health, and public safety” (Wikipedia, 2019, section 1, para.1). Noteworthy omissions from this modern definition are the terms “emergency”, “resuscitation” and “trauma”, terms that have long been synonymous with the identity of the paramedic role (Johnston & Acker 2016).

2.2.2 Origins of paramedic practice

The modern paramedic role is traceable through ancient military history (Williams et al., 2009; Pollock, 2013), with evidence of battlefield first aid documented on Grecian pottery dating back to around 500 BC (Pearn, 1994). Globally, all early examples of the role were exclusively linked to retrieval, treatment and later transport of those involved in human conflict. Credited with the introduction of a specially modified horse-drawn cart for the transport of wounded crusaders or sick pilgrims in the 11th century, the Order of The Knights of St John is widely regarded as a pioneer of organised ambulance practice (Pollock, 2013). The order’s emblem of the Maltese Cross is still widely used and continues to emblazon all Australian St John uniforms as well as logos for each of the state-based professional

ambulance services (Williams et al., 2009). The “St John” title, which remains synonymous in many countries with first aid provisions (Pollock, 2013), was adopted with the establishment of the St John Ambulance service in the late 1800s. Arising out of the Royal Herbert Military Hospital in London, the innovations of military surgeon, Peter Shepherd, were published in the first training manual designed to support the use of battlefield bandaging and splinting techniques for a civilian population. This manual guided the training of newly established brigades coordinated and specially trained to provide basic care and a transport service to Britain’s community outside of war time (Pearn, 1994). Shepherd’s work, *A Handbook Describing Aids for Cases of Sudden Illness*, was later renamed *First Aid to the Injured* and served as a mandated text for civilian first aid training world-wide, and is the basis of what continues to be the principal literary resource of the current St John first aid courses (Williams et al., 2009).

2.2.3 Modern Australian ambulance

The St John Ambulance title has remained linked to the altruism of its volunteer workforce, who provide the basic care and transport of the injured and ill in communities they serve (Historical Society St John Ambulance, 2019). However, changing societal expectations eventually forced the modernisation and expansion of its basic first aid practices. The late 1970s and early 1980s was a period of turmoil caused by a succession of industrial disputes that culminated in the replacement of the volunteer St. John brigades with a paid workforce. The passing of the *Ambulance Services Act 1992* (SA) led to the launch of the SA Ambulance Service within South Australia and the introduction of a paid workforce that is now responsible for emergency pre-hospital responses within the state (Brooks et al., 2018). Similar to legislation in several of the other Australian states at the time, the act authorised the newly forged organisation to assume sole responsibility for the training and accreditation of its staff. Retaining the militaristic title of ambulance officers, staff were trained to administer selected drugs and to conduct additional emergency procedures governed by strict protocols. This meant a scope of care could be expanded beyond simple trauma to include a selection of medical emergencies. As paid employees, training became an employment obligation that mostly occurred on the job, working alongside experienced staff who had learned from those who previously supervised them. The addition of annual short blocks of attendance at training colleges enabled the qualification to be expanded to a vocational diploma. The knowledge, skills and credentialing of the entire South Australian ambulance workforce under this local model could be largely traced back to a medical director of the time, who was a general practitioner with no specific training in the specialities of emergency care nor in education. Those deputised to deliver training were required to replicate his teachings using basic training manuals and very few primary sources of evidence. The original diploma curriculum

was highly pragmatic and almost exclusively aimed at the acquisition of prescribed clinical skills or the authority to administer additional drugs.

The legacies of the bygone military past are still visible within each of the state-based ambulance organisations in Australia today. Protocols and guidelines represent standing orders within differing emergency cases and are routinely used to underpin many of the decisions regarding graduate capabilities (Abben et al., 2013; Clawson et al., 1994). Thus far, the different ambulance services in Australia have resisted national standardisation, resulting in the maintenance of different practice rules around the country.

2.2.4 Modern community ambulance needs

Ambulance guidelines and protocols are predominantly used as support for practice decisions within critical or emergency patient cases (Gray & Wardrope, 2007). This focus on emergency fails to reflect the modern patient case-mix (Brewis & Godfrey, 2019) which has changed dramatically following the introduction of a user-pay pre-hospital system in Australia. Major trauma and time-critical responses represent only a small fraction of current case load, with complex, low acuity cases that place greater demands on the breadth of clinician knowledge and skills being far more common (Lucas et al., 2019; Thompson, 2013). While data for recent years regarding case-mix demographics are no longer made freely available to the public, the SA Ambulance Service 2014-15 Annual Report depicted that, within that period, ambulances responded to just over 274,000 reported incidents. Less than half of these incidents met the criteria for emergency ambulance call outs, with most receiving urgent (lower priority) or non-urgent (routine transport) ambulance responses instead (SA Ambulance Service, 2015). Thompson (2013) highlighted that, of those patients who initially met the emergency dispatch criteria, a much smaller fraction retained this high priority once crews were able to assess them, leading to the suggestion that only approximately 5-10% of all ambulance call outs were considered emergency cases (Thompson, 2013).

Tension between ambulance indstries and the communities they serve is also well documented, with Lucas et al, (2019) reporting that since first gaining professional registration in 2007, UK paramedics have remained the most complained about profession of all sixteen health professions under the national regulator. The role that patients will play in contributing to the future design of ambulance is currently being reconsidered in many other parts of the world, with the US based EMS Agenda 2050 seeking more patient centred approaches to care delivery (EMS, 2019). Patient engagement was not sought for this project, however is being considered for future study directions.

Studies have cited these changes to ambulance workload as factors that contribute to a mismatch between staff expectations of their role and the realities of working within the profession, and resentment and low morale due to their perception that their critical care skills

and training are being underutilised (Lucas et al., 2019). It is reported that, when it comes to expectations of care delivery, a misunderstanding exists between consumers of health care and paramedic staff, a misunderstanding that is accompanied by a belief that existing industry measures are unsatisfactory for making decisions about the modern role of the frontline staff (Heath & Radcliffe, 2010).

Meanwhile, developers of university curriculum have made deliberate efforts to cater to the changing healthcare climate. Chronic disease, comorbid and complex patient conditions and understanding social determinants of health all are core components of modern degree programs, reflecting changing paramedic workloads and associated changes to knowledge requirements. There is currently no evidence to suggest that ambulance recruitment processes consider the full capabilities of the modern graduate, meanwhile concerns remain for recruitment practices which remain fixated on resuscitation skills (O'Meara & Furness, 2013).

2.2.5 University context

The transition of pre-employment paramedic training to the university sector underscored a nationwide push to have paramedicine recognised as a profession. All states except New South Wales have now completely transitioned to mandatory undergraduate qualifications (Reid et al., 2019). Relocation of paramedic pre-employment education to universities has resulted in a significant expansion in the curriculum, emphasising the need for paramedics to increase their understanding of evidence-based sciences and professional practice principles, further leading to calls for paramedicine to contribute to its own unique body of evidence as it matures into a profession (O'Meara, 2015).

The experiences of friction at the interface between industry, students, and university were not isolated to the local context, but are reported to exist across Australia (Edwards, 2011; O'Meara & Furness, 2013; Willis et al., 2010).

Since December 2018, each of the independently governed, state-based ambulance services in Australia fall under the Australian Health Practitioner Regulation Agency (AHPRA). This change marked, for the first time in Australia, formal recognition of paramedicine as a profession. For universities, there is now a new national regulator that requires future accreditation of programs to be completed by a body that is more representative of the profession and includes both industry and academic membership. It is unclear what the implications of this change will be.

2.4 Paramedic Education Conceptualized as a Wicked Problem

A wicked problem is understood to be a problem that is unable to be tackled through conventional empirical scientific inquiry (Rittel & Webber, 1973). Wicked problems exist deep within social constructs, with multiple parties bringing competing agendas, in which each problem is a symptom of, or influenced by, another interrelated issue (Coyne, 2005). In these circumstances, issues are constantly re-emerging in new configurations, making scientific enquiry paradigms unfit for purpose (Head, 2008; Peters, 2017). Wicked problems are a feature of the social professions.

Rittel and Webber (1973) highlighting that it has only been since the emergence of professional competencies that criticisms of the professions have become prolific, and that most criticisms have originated from within the professions themselves. As seen earlier in this chapter, this is the case for Paramedic education.

Paramedic education can be considered a wicked problem on the basis of the complex features and competing agendas that provoke persisting tensions between key stakeholders. The complex and changing health demands of modern communities, the professional and academic mandates of university awards, the learning and education requirements of modern students, and local expectations of industry, intertwine and complicate efforts at simple solutions or easy improvements.

The projects of this thesis commenced at a point in local paramedic education at which:

- Graduates were dissatisfied with their educational experience, in particular, the assessment process and its outcomes.
- University curriculum, despite attempts to meet to the needs of the profession, was criticised for failing to ensure graduates acquired basic emergency skills.
- A competitive student climate was associated with student difficulties in receiving and accepting critical feedback.
- Industry focus on acute emergency care and resuscitation appeared to overlook evidence that underscored a need for the curriculum to focus on contemporary health care needs of the community.
- Graduates and the university had difficulties in convincing industry, work-ready capabilities had been attained.

During a period in which concerns for the future of paramedic academia has become topical (O'Meara & Furness, 2013; O'Meara, 2015), these local concerns posed significant concerns which directly influenced the recruitment and retention of skilled academic staff.

Chapter 3. Research

This chapter discusses the overarching action research methodology that has been used to inform and unite the individual projects as a collective response to the complex problems just outlined in the opening chapters.

Specific methods employed for each project are reported in the publications (Chapter 4) and are not repeated here.

3.1 Action Research

In order to respond to the wicked problem presented within paramedic education (Section 2.4), an action research methodology was adopted. Action Research (AR) was developed for understanding issues that exist within social contexts, where actions of the involved parties mean that the problems are forever changing (Stewart et al., 2019). AR responds to an assumption that social theory is not homogenous through time, and that the study of real-life events and social phenomena are incompatible with methods that seek to control the research environment artificially (Tickle, 2001). The AR methodology, originally credited to Lewin in the 1940s (Lewin, 1946; McTaggart, 1991), responds to these challenges through an iterative approach to research.

AR is based on the accumulation of theory through multiple, interlinked studies, each study influenced by the findings of the last (Baum et al., 2006). Establishing the need for change and improvement, AR employs repeated cyclical stages of planning, acting, observing and evaluating (McTaggart, 1991). The researcher is regarded as a pivotal insider to the studies, who may be required to modify different elements actively and to make incremental adjustments to the studies throughout iterative cycles (McKay & Marshall, 2001; Susman & Evered, 1978). As each successive project is completed, an improved understanding of the problem guides interventions and innovations for the next study.

Additional considerations in designing AR include:

- There is a need to identify the investigator as an insider to the research and as one who will have an agenda to effect change and generate improvement (Baum et al., 2006).
- It is important to identify a researcher's assumptions and intentions because they have the potential to influence outcomes and interpretations of the studies due to being deeply embedded as a participant within the research process.

Checkland and Holwell (1998) also propose that all research, regardless of methodology, comprises three common elements: *area of concern (A), framework of ideas (F) and methodology (M)*.

The next sections of this chapter adopt Checkland and Holwell's concept of AR as an organising framework and, as such, present overarching research method through:

- Identifying the researcher.
- Describing the area of concern (A).
- Outlining a framework of ideas (F).
- Describing the methodology (M).

3.2 Identifying the Researcher

This section provides a declaration of personal influences, motives and agendas that are associated with my project involvement. I describe these in relation to my own experience and positions as a current academic, former paramedic and former student of an early nursing degree program and vocational education training (VET) based paramedic education.

I currently hold a teaching specialist appointment within the paramedic division of a university college of medicine. For 14 years I have been a major contributor to the design and delivery of the paramedicine curriculum. Along with other academic staff, I share responsibility for ensuring that approaches to curriculum content, teaching, learning and assessment contribute to graduates' work-readiness. As an academic, my success in the role is directly linked to favourable teaching and learning outcomes for my students (Chrichton & McDaid 2016). Over time, I have been forced to question my own teaching and many of the practices of others within and around the paramedic discipline. This questioning has been influenced by my continued professional learning and collaboration related to educational practice. I have been led to question the motives and effectiveness of approaches commonly associated with paramedic education, and, in particular, assessment practices.

Through ongoing reflection, I considered my own experiences as a student. As a school leaver, I entered a university-based nursing degree during a time of transition from hospital-based training for nurses. I recall the constant critical comparisons of my university training with that of the traditional, hospital apprenticeship model. This criticism impacted the value we university students placed on our qualification. Whether criticism of the early university programs was valid remains debatable, but for students wishing to enter the nursing profession, criticism that their training and qualification was inferior, based on a theory-practice gap, was detrimental. Despite this negativity about my nursing education, my nursing career progressed to senior clinical positions.

Later, I experienced paramedic industry-based vocational diploma training, which was significantly different from my earlier undergraduate nursing education experience. The paramedic VET model featured small classes and was based principally on successfully

learning a set of instructions for practice. This was very different from the theory and evidence-based education I had encountered previously in nursing. Successful progression through the VET paramedic program was a condition of employment and assessment decisions were made solely by our employers. Assessment in the VET program was entirely summative and based on my experience as a student of the program there was little evidence or transparency regarding how our results were determined. Such practice is reported to perpetuate power inequity for students (Taras 2008). Recent anecdotal reports relayed from both graduates and industry partners, suggest these conditions continue to promote existing power hierarchies between students, graduate interns and their more senior instructors. Preparatory paramedic education was followed by employment as a paramedic, in which I was able to advance an international career to senior clinical ranks. I was also an observer to the initial launch of university paramedic degrees and, once again, witness to unsubstantiated rhetoric of a theory-practice gap in relation to graduate clinical performance. My observations were part of the motivation for the series of studies and publications that are the basis of this thesis.

This background experience, and the requirements of my current role, position me as an insider to the problems researched through this thesis. I bring an intimate understanding of the historical legacies of paramedic education and practice, as well as insight into the contemporary tensions between university and industry. I acknowledge that I hold a deeply personal relationship with these problems. The research projects presented significant challenges in managing my personal biases and potential systematic errors that could challenge the trustworthiness of findings arising from the work. As a result, several strategies were employed across the body of work to allay potential concerns of bias.

Consistent with the suggestions of Pannucci and Wilkins (2010), bias considerations were reviewed at each of the three core research phases: trial planning, trial implementation and post-trial interpretation of findings. Given the nature and context of the problems being investigated, I was conscious of the vulnerability of the work to cultural bias. I was forced to recognise that there were contrasting values and agendas between researcher, university, broader profession and industry. Differing contexts are noted for their potential to claim exclusive access to the truth and the real narrative (Hammersley & Gomm, 1997) that this work needed to navigate. One strategy involved a personal shift towards a position of cultural relativism, an approach that offers a heightened awareness of assumptions and enables the cultures and agendas of other key parties to be embraced unconditionally. This strategy prioritises the transparency and reflexiveness of researchers when they are an integral part of the research (Galdas, 2017).

3.3 Areas of Concern (A)

The principal area of concern (Checkland & Holwell, 1998) for these projects relates to the work-readiness of paramedic graduate students. This theme is described in the following subsections:

- Defining work-ready in graduates.
- Developing work-ready graduates.
- Determining work-ready graduates.

3.3.1 Defining work-ready graduates

Central to the issue of graduate work-readiness is the lack of clarity as to what this actually means. This has become a source of confusion and efforts to clarify the definition have been unconvincing. Universities have established their own set of graduate qualities, identifying generic characteristics and attributes that each graduate across all courses is expected to acquire by the completion of their studies (Bridgstock, 2009). However, not only do these broad statements fail to directly align with the specific attributes required by the paramedic profession, but there is also a lack of consistency between university providers (Williams et al., 2010). These varying positions on graduate qualities and attributes prove problematic in profession-based degree programs when attempting to establish benchmarks for a nationally and globally mobile workforce.

A study by Willis et al. (2010) sought to better understand the concerns around work-readiness and to formalise an industry position by interviewing paramedics across multiple states, encouraging participants to express concerns they had with university-educated paramedics. This study has since guided much of the narrative regarding how university educated paramedic graduates should be viewed in Australia. Its findings highlighted the difficulties industry participants had in clearly articulating specific detail of concerns, yet general deficits existed when graduates were compared critically to their former work-based (VET) trained peers. It was concluded that, due to the comparative lack of clinical exposure, graduates were considered less competent and should be considered as *advanced beginners* in line with the novice-to-expert classifications of Benner (1984).

The credibility of this characterisation, however, is challenged. Benner's original design sought to apply a conceptual model to the developmental milestones of nurses across their career span. Benner's study based on college hospital trained nurses, outlined five key levels of capability (*novice, advanced beginner, competent, proficient and expert*) that are assigned on the basis of duration of service within a role and level of clinical autonomy demonstrated (Benner,1984). Applying these criteria to paramedic graduates, Willis et al. (2010) concluded that paramedic graduates were befitting of the *advanced beginner* ranking, consistent with the

two to three years of service criteria and an inability to work unsupervised. The assignment of the second-tier ranking, *advanced beginner*, has, however, proved problematic, as this is below the level of *competent* that was assigned to the former vocationally trained paramedics. With competence widely regarded as a status of being "functionally adequate" (Miller, 1990 p63), it has been contentious to position graduates below this level, as this arguably carries unfair stigma that is unhelpful to graduates at the start of their careers.

Any suggestion that graduates of modern university programs are less competent than their former VET counterparts is unsupported by objective evidence. Meanwhile comparison between the breadth and depth of university curriculum and VET programs and consideration of university delivery methods, highlights the limitations of the VET programs. VET programs were mostly limited to several weeks of annual block training (in contrast to typical three-year undergraduate university programs).

Benners' research explored developing capabilities across the career progression of college hospital trained nurses during the early 1980's (Benner, 1984). Benner's framework has limited salience for different disciplines, especially because it was developed in a different era, with a very different education and training format. The use of Benners' novice-to-expert framework in paramedicine has further limitations as two of its principle gauges of expertise ("levels of autonomy" and "years of experience") are not applicable to the modern paramedic profession. A paramedic student or newly commencing employee has clinical practice that is closely supervised and subject to senior clinical governance. Independent, autonomous graduate demonstrations of practice would be regarded as unacceptable, making graduate autonomy an inappropriate indicator of capability. The use of the level of clinician experience can also be an unreliable measure of capability levels in a new profession. Many currently serving paramedics did not obtain a tertiary qualification or have not received formal training within many of the recognised core domains of the profession. This point is supported by the findings of Lucas et al. (2019), who identified that many older paramedics did not possess the same skills and knowledge in some areas of practice as their junior, university-trained colleagues. At the time of the Willis et al. (2010) report, university programs in Australia were still very young, borrowing theoretical frameworks from other disciplines while they were building their own academic workforce capacity. A decade on, it can be argued that university programs and the demographic profile of those teaching in them have changed considerably (Caldwell, 2020).

3.3.2 Developing work-ready graduates

Each of the university pre-employment paramedic programs in Australia has a unique curriculum that reflects the diverse expertise of academic staff, institutional resourcing and the different expectations of their state-based ambulance service providers. Although programs commonly involve three years of study, they consist of a diverse range of subjects that have

been considered relevant to a particular institutional and state-based vision of the requirements of the professional paramedic role. Students complete their subjects incrementally, satisfying summative assessments before progressing to the next subject, until they complete their award on the basis of an aggregation of results.

This approach presents several concerns. Firstly, the use of an atomistic aggregation of student achievements to determine holistic capabilities is problematic. According to Schuwirth and Ash (2013), assessment decisions regarding competence-to-practice demand more than just a simple sum of component parts from previous learning events. Secondly, the practice of satisfying one component of study before moving to the next area of curriculum, presents concerns as to whether student learning is sustained for the longer term, particularly if this learning is not reviewed nor reassessed (Boud, 2000; Boud & Soler, 2016). University systems and teaching conventions tend to support an atomistic, incremental curriculum design and assessment process, with a focus on demonstrations of competence in compartmentalised areas of knowledge and practical skills, with the sum of these parts being an intended graduate outcome. This approach, however, seldom focuses on a holistic assessment of a work-ready graduate.

In assessing competence to practice, the need to adopt integrative “whole knowledge” approaches is increasingly advocated (Rethans et al., 1991; van Der Vleuten & Schuwirth, 2019). Delivering teaching and assessment practices that reflect the knowledge and skills required of the paramedic has been largely limited to university use of classroom simulations (O’Meara & Furness, 2013). These artificial environments are routinely introduced to explore a specific, narrow focus of skill or knowledge through a more immersive, active learning experience. However, these learning experiences have been criticised for their lack of authenticity in preparing students for real-world cases (Reid et al., 2019).

Since the transition from work-based ambulance training, industry-based student practicums, which are used to expose students to authentic work expectations and professional culture, have remained a point of contention. These placements are thought to offer valuable opportunities for students to gain insight into worksites, contextualise their learning, and experience professional socialisation, developing team etiquette in the process (Crosbie et al., 2002). As such, placements are regarded as an essential work-integrated learning (WIL) opportunity and illustrate university and industry unity in the co-development of student learning. As an interface between university and industry, they are also notoriously complex, challenging and political. Industries around Australia struggle to accommodate the volume of undergraduate students and associated work of placement coordination and supervision (Kennedy et al., 2015). Increasing tertiary enrolment numbers have resulted in reductions to industry placement opportunities for each student, already minimal by comparison to the block placement hours of most other disciplines, including nursing, physiotherapy and medicine.

Whether the placement model is useful in bridging theory and practice or is potentially detrimental to the developing students' future career prospects is still not clear. A growing number of studies now report unfavourable experiences of students while on placement. Michau et al. (2009) found that over 50% of participants reported significant restrictions placed on them by crews, preventing them from practicing the skills they had learned. Other studies have suggested that ambulance placements are neither consistently able to add value to student learning, nor considered an effective tool in addressing perceived theory-practice gaps (Lazarsfeld-Jensen, 2010). It has been argued that this is partly due to the supernumerary role assumed by students on placement, which positions them as a third party to tasks that have been practiced and refined for a crew of two. Students are commonly excluded from playing active roles in activities designed to support their learning in the field (Reid, 2019). A study of Australian and UK paramedics relating to the preparedness of paramedic graduates found no significant correlation between the increased time students spent in practicum and the ability of new graduates to practice independently (Reid, 2019).

3.3.3 Determining work-ready graduates

The assessment of work-readiness in a graduate paramedic is a major area of interest for this thesis. The VET-styled summative assessments that were a catalyst for this body of work, exposed concerns regarding assessment practice throughout the wider degree and the discipline. Summative assessment emphasises credentialing of students, whereas formative assessment supports student development of self-regulated learning skills. Students' self-regulation capability is important for ongoing, longer-term professional development (Pintrich & De Groot,1990).

Questions have been raised about the purpose of assessment and who should benefit from it. Such questions are not limited to the final stages of paramedic degrees but apply to many professional, practice-based courses (Abdulmajed et al., 2015; Heritage, 2007; Popham, 2009). As previously discussed, aggregation of assessment outcomes to determine readiness to practice, assumes that summative instruments are valid and reliable indicators of student ability and that student knowledge is retained once it has been confirmed by assessors. This concern extends to most of the common assessment instruments in paramedic education, namely, multiple-choice examinations and practical skills testing. Exams with a multiple-choice question format (MCQ) are commonplace across curriculums (Haladyna et al., 2002; Lesage et al., 2013). With large question sets, MCQs offer assessment designers the capacity to explore student knowledge across broad areas of curriculum (Lesage et al., 2013). However, there are many factors that impact on the quality of questions that can undermine the validity and reliability of the MCQ instrument (Haladyna et al., 2002). There is also a question of sustainability of student learning assessed by MCQ tests (Burton, 2001). Major end of semester exams are synonymous with cramming behaviour, which is considered to

have limited effects on student knowledge retention (Burton, 2005). Feedback on student performance based on scores alone fails to provide adequate support for learning development (Burton, 2004). In addition, marking systems provide another contentious aspect of MCQ tests. When students are asked to select a correct response from a limited list of options, they are effectively encouraged to guess their answers to questions when no negative marking system is in place to penalise incorrect responses (Schuwirth & van der Vleuten, 2012). The consequence is potential inflation of grades by chance, which does not reliably reflect student understanding.

Testing of skills within simulated practical scenarios is also standard practice in paramedic assessment (Boyle et al., 2007). Students are presented with a practice scenario and are required to demonstrate a particular, focused skill set for an observer, who judges the performance against a predetermined rubric. Routinely, these assessments are used to inform decisions regarding student competence to practice as autonomous, critical thinking clinicians, these being obligations of paramedic work. As such, the importance of instilling these graduate skills and assuring them through assessment are paramount, yet, this type of assessment frequently excludes the student from critical decisions about their own practice. Instead, all judgement responsibility is retained by the assessors (Eva et al., 2004; van der Vleuten & Schuwirth, 2019).

Caution is encouraged when considering members from industry as the foremost or exclusive authority for judgement of the standards and graduate benchmarks. As a newly emerging profession with only relatively recent mandates for entry level tertiary qualification, considerable variance exists in the credentials of those who make up the workforce. Modern university curriculum that emphasises physiology, pathophysiology, pharmacology and professional streams of social science, features detail that is arguably unfamiliar to many industry supervisors who are tasked with making decisions regarding graduate aptitudes. The reliability of industry judgement, specifically of professional behaviour, has been previously highlighted as an area of concern (Lazarsfeld-Jensen, 2010). This concern was echoed in a study by Lucas et al. (2019), who asserted that, in contrast to qualified paramedics, university trained students were far more “immersed in the values of professionalism…and were more likely to insist on doing the right thing” (Lucas et al. 2019, p.4).

In addition to concerns about practicing paramedic judgement of student professional standards and familiarity with modern university curriculum, another issue surfaces with regards to knowledge and skills maintenance. Growing numbers of published studies note the concerns of paramedic skill decay, particularly surrounding resuscitation skills which are used comparatively infrequently (Dyson et al., 2017; Latman & Wooley, 1980; Wik et al., 2005; Skelton & McSwain, 1977; Zautcke,1987).

It can be argued that industry claims of a theory-practice gap may be misplaced if decisions about a graduate's skills and capabilities fail to consider current evidence and optimal practice standards.

3.4 Framework (F) of Ideas

The research questions relating to the studies were constructed as a component of a broader framework of ideas, in line with the AR methodology recommendations (Checkland & Howell 1998). This enabled the questions which steered the research to be framed within the broader context of a number of areas of assumption. Checkland and Howell (1998) suggested it is important that AR projects identify driving theoretical constructs. In this thesis, the theoretical framework is outlined in a series of assumptions which frame each of the research studies. Five assumptions have been generated addressing five key areas: *paramedic role*, *work-readiness, paramedic student learning experience, theory-in-practice curricula and assessment for learning*. The assumptions in turn, inform and frame the detail of the specific research questions.

A summary of the assumptions and key questions that steered the research is presented in Table 1. Details of the assumptions are contained in Subsections 3.4.1 through 3.4.5.

Table 1. Framework of ideas. Assumptions and Research Questions that steered the research.

Assumptions	Research Questions
Paramedic role An improved understanding of the modern paramedic role is central to resolving the work readiness problem.	• What are the roles or activities which define the modern paramedic? • What do graduates need to know and be able to do to perform these roles?
Work-readiness Improved definitions of work-readiness, and decision-making frameworks for work-readiness are essential to responding to the modern paramedic graduate challenges.	
Paramedic student learning experience Each student has unique learning needs that can alter throughout their study. These need to be understood and addressed in curriculum design, learning experiences, and assessment in order to ensure that students are "work-ready".	• How can the individual needs of each student learner be recognised and responded to within a large class? • What needs to be understood about learning at different stages of a student's study path when designing teaching? How can teaching design contribute to improved student learning behaviour?
Theory-in-practice curricula University paramedic curricula and pedagogical design needs to reflect a focus on "theory-in-practice", in order to respond to current perceptions of a theory-practice gap.	• Can an alternative, more authentic campus-based paramedic pedagogy better respond to the limited scope of work integrated learning experiences?
Assessment for learning The implementation of a new paradigm of "Assessment for learning" approaches will improve students' reflective practice, and self-regulated learning skills, both of which	• What can be done to integrate an assessment for learning approach into an existing curriculum design?

will enhance graduates' paramedic work-readiness.	• How can an assessment for learning re-design contribute to an improved attainment of graduate paramedic preparedness? • What would be required of an assessment design to enable students to effectively develop critical self-regulated learning skills, and contribute to high stakes assessment decisions?

3.4.1 Assumption: Paramedic role

Assumption: *An improved understanding of the modern paramedic role is central to resolving the work readiness problem*.

There is considerable difference in understandings of what is expected of a modern-day paramedic. A major focus on acute emergency cases, such as trauma and resuscitation, remains linked to the identity of the paramedic role, despite being poorly representative of a contemporary paramedic workload (O'Meara et al., 2017; O'Meara & Furness, 2013; Thompson, 2013). The university-accredited paramedic curriculum must provide students with the necessary skills and knowledge to respond professionally to the full scope of the paramedic case load, much of which is neither acute nor emergency.

The changed nature of paramedic roles and responsibilities has received mixed levels of acceptance within industry (Reid et al., 2019). An important step in addressing the problems raised is to gain agreement regarding definition and scope of paramedic practice and the nature of the paramedic process.

As a result, the assumption raises these questions:

- What are the roles or activities which define the work of the modern paramedic?
- What do graduates need to know, understand and be able to do to perform these roles?

3.4.2 Assumption: Work-readiness

Assumption: *Improved definitions of work-readiness and decision-making frameworks for work-readiness are essential to responding to modern paramedic graduate challenges.*

An absence of formal standards or benchmarks for paramedic graduate capabilities contributes to tacit, ad hoc industry conceptions of graduate work-readiness. This leads to industry's subjective and inconsistent practices in interpreting the capabilities, knowledge and skills of individual graduates. Equally, universities fail to articulate clearly the indicators of graduates' work-readiness so that students can understand and regulate their learning to achieve what is expected.

Results obtained from earlier attempts to define paramedic graduate standards using models borrowed from other disciplines are questioned. The creation of a recognised set of characteristics and standards for a work-ready graduate, agreed and accepted by both

universities and multiple levels of industry, has the potential to provide benefit to all stakeholders.

3.4.3 Assumption: Paramedic student experience

Assumption: *Each student has unique learning needs that can alter throughout their study. These need to be understood and addressed in curriculum design, learning experiences, and assessment in order to ensure that diverse students are work-ready.*

University paramedic curriculum places students within a sequenced study path requiring satisfactory achievement of the minimum requirements of each subject before commencing the next. Curriculum design is largely based on a presumption that each student has a similar starting point and will achieve similar end points in each subject. Teaching and assessment are intended to be identical for all students, despite vast variability in student performance, strengths and learning gaps. This is approach persists despite evidence that most contemporary student populations are diverse. Just as the student transitioning to university for the first time is known to face unique challenges (Briggs et al., 2012), so too does the student preparing to leave. Pedagogical research advises that consideration of individualised abilities, motives and support needs are pivotal to student success (Ashma, 2010; Henfield & Waldron, 1988; Joseph et al., 2013; Konstantinou-Katzi et al., 2013; Owens & Straton, 1980).

The assumption leads to several questions for the research:

- How can the individual needs of each student learner be recognised and responded to within a large class?
- What needs to be understood about learning at different stages of a student's study path when designing teaching?
- How can teaching design contribute to improved student learning behaviour?

3.4.4 Assumption: Theory-in-practice curricula

Assumption: *University paramedic curricula and pedagogical design needs to reflect a focus on "theory-in-practice", to respond to current perceptions of a theory-practice gap.*

Rhetoric of a theory-practice gap underscores industry concerns regarding the capability of the university programs to educate work-ready graduates (Carson & Carnwell, 2007; Michau et al., 2009; Sibson & Mursell, 2010). Comparisons between practice-based VET teaching and the processes used by universities to replace exclusively hands-on learning, remain commonplace (Kennedy et al., 2015). It remains difficult for universities to effectively refute claims of theory-practice gaps while they continue to adhere to several traditions of academic practice, such as lectures, tutorials, summative exams and essay writing. These ritualised

practices largely limit classroom learning to theoretical propositions that may lack relevance and authenticity for students (O'Meara & Furness, 2013).

Learning activities and assessment tasks are recognised as having a pivotal influence in shaping student learning (Biggs, 1998; Biggs, 2003). The continued use of traditional teaching conventions that have little in common with the activities performed by paramedics help perpetuate questions about their relevance. These practices also increase pressure on the limited number of clinical field placements as the sole source for authentic learning experiences.

Challenges associated with placements have led to an area of project enquiry:

- Can an alternative, more authentic, campus-based paramedic pedagogy better respond to the limited scope of work integrated learning experiences?

3.4.5 Assumption: Assessment for learning

Assumption: *Implementation of a new paradigm of "assessment for learning" approaches will improve students' reflective practice and self-regulated learning skills, both of which will enhance paramedic graduates' work-readiness.*

Assessment is recognised as having a major influence upon student learning (Biggs, 1998) and has three key functions that are of equal importance in higher education. Assessment defines for students what is important to learn, it shapes a student's approaches to learning, and it provides assurance to the community that key learning attainment has occurred (Orrell, 2011). Current programs tend to focus on traditional summative "assessment of learning" as a means of providing assurance that learning objectives have been met.

Research on higher education assessment, however, has shown that a learning paradigm that emphasises formative feedback-driven assessments is more effective in engaging students with the learning objectives and fostering students' self-reflection and self-regulation of their learning (Lawrie et al., 2013; Lipnevich & Smith, 2018; Pintrich & De Groot, 1990; Tang & Logonnathan, 2016; Yorke, 2003). Despite this, paramedicine has been slow to embrace formative assessment appropriately and effectively. Learning designers typically assign lower weighting to assessment tasks in which they *allow* students to judge for themselves. Low grade weighting assigned to formative assessment and reflective task activities means that these tasks are seldom afforded the same priority by students as summative tasks (Brookhart, 2001).

There is a need for paramedic degree programs to take seriously the development of graduate reflective practice skills. Reflective practice is identified as a core capability required of registered paramedics in Australia (AHPRA, 2019) and is essential to the paramedic often working in unpredictable and unsupervised contexts. It is argued that existing paramedic

programs offer students little opportunity to formally address the development of these core skills, particularly in relation to the critical evaluation of their own practice. Students do not routinely critique their own work as part of high-stakes assessments and, instead, default to a dependency on their assessors for judgement about quality of practice (Ryan & Weinstein, 2009). It is proposed that a redesign of assessment practice can better engage students in the development of these essential skills.

Questions arising from the assumption include:

- What can be done to integrate an assessment for learning approach into existing curriculum design?
- How can an assessment for learning re-design contribute to improved attainment of graduate paramedic preparedness?
- What would be required of an assessment design to enable students to effectively develop critical self-regulated learning skills and contribute to high-stakes assessment decisions?

3.5 Methodology (M)

The eight publications presented within this thesis (Chapter 4) reflect a collection of different projects and research studies which interconnect within the overarching action research methodology. Each of these projects is individually characterised by the AR components of planning, acting, observing and evaluating.

The publications are grouped into the following project areas:

- Paramedic process project
- Capstone projects
- Student-tutor consensus projects
- Progress test project
- First-year reflective practice project

These project groups are described in Subsections 3.5.1 through 3.5.5.

3.5.1 Paramedic process project

The Paramedic Process Project was designed to develop a description of the paramedic process by exploring processes used by other professions to underpin their practice. The project was prompted by the findings of an earlier Delphi study (Flinders University Social and Behavioural Research Ethics Committee Approval 4380) which found that tasks routinely performed by paramedics usually followed an ordered approach that was similar for each patient or case.

The project examined the evidence for the nursing process and presented a model for a unique paramedic process of care. This model was then utilised in redesigning of assessment frameworks reported within subsequent studies. This project informed the publication Carter and Thompson (2013) (see Section 4.1).

3.5.2 Capstone projects

The initial capstone design project introduced reforms to the teaching and learning design within the final period of a paramedic program. Planning focussed on learning and teaching approaches for a more holistic and more authentic curriculum experience. Action concerned a complete subject restructure and a significant shift in teaching conventions within the discipline. Observation followed implementation of teaching reforms and evaluation focused on the student responses to the key components of the redesign.

The first published work to be generated from this work was Thompson, Grantham and Houston (2015), which identified the need for change, and the emergent core themes of the original teaching innovations, which are discussed in-line with the relevant literature (see Section 4.2).

Refinements to the original subject then led to a formal study of the impact and effectiveness of the new design (Flinders University Social and Behavioural Research Ethics Committee Approval 6993). This generated a large data set which was analysed and reported in a number of differing ways, relating to specific features of findings and their implications.

Findings concerned with assessment specific areas of the study were presented in Houston and Thompson (2017b) (see Section 4.4). Additionally, data concerning the impact of a more authentic pedagogy as a means for improving work-readiness was analysed and presented in Houston and Thompson (2017a) (see Section 4.3).

3.5.3 Student-tutor consensus projects

Planning and development of the student-tutor consensus approach was initially in response to many of the learning challenges evident within the final capstone subject. It incorporated the earlier defined paramedic process as a basis of an assessment framework. As an action, an assessment instrument and new approach was applied to teaching and learning and its implementation was monitored and observed. Evaluation involved a specific set of data collection on student perceptions using the approach in the capstone study.

Findings were discussed in Thompson et al. (2016) (see Section 4.5). A second publication (Thompson et al., 2017) translated the teaching and learning theory to better communicate to a paramedic discipline audience (see Section 4.6).

3.5.4 Progress test project

Later iterations of the paramedic capstone subject design re-considered the innovations in terms of the literature on “programmatic assessment for learning”. Planning concerned the approach required to develop an effective and reliable test instrument that could capture an agreed set of paramedic capabilities. Action concerned appropriate consultation with stakeholders on the development, validation and implementation of a progress test. Observation concerned monitoring and overseeing of the test, while evaluation was conducted through a corresponding study on student performances and experiences (Flinders University Social and Behavioural Research Ethics Committee Approval 8034).

Findings were analysed, reported and discussed in Thompson and Houston (2020) (see Section 4.7).

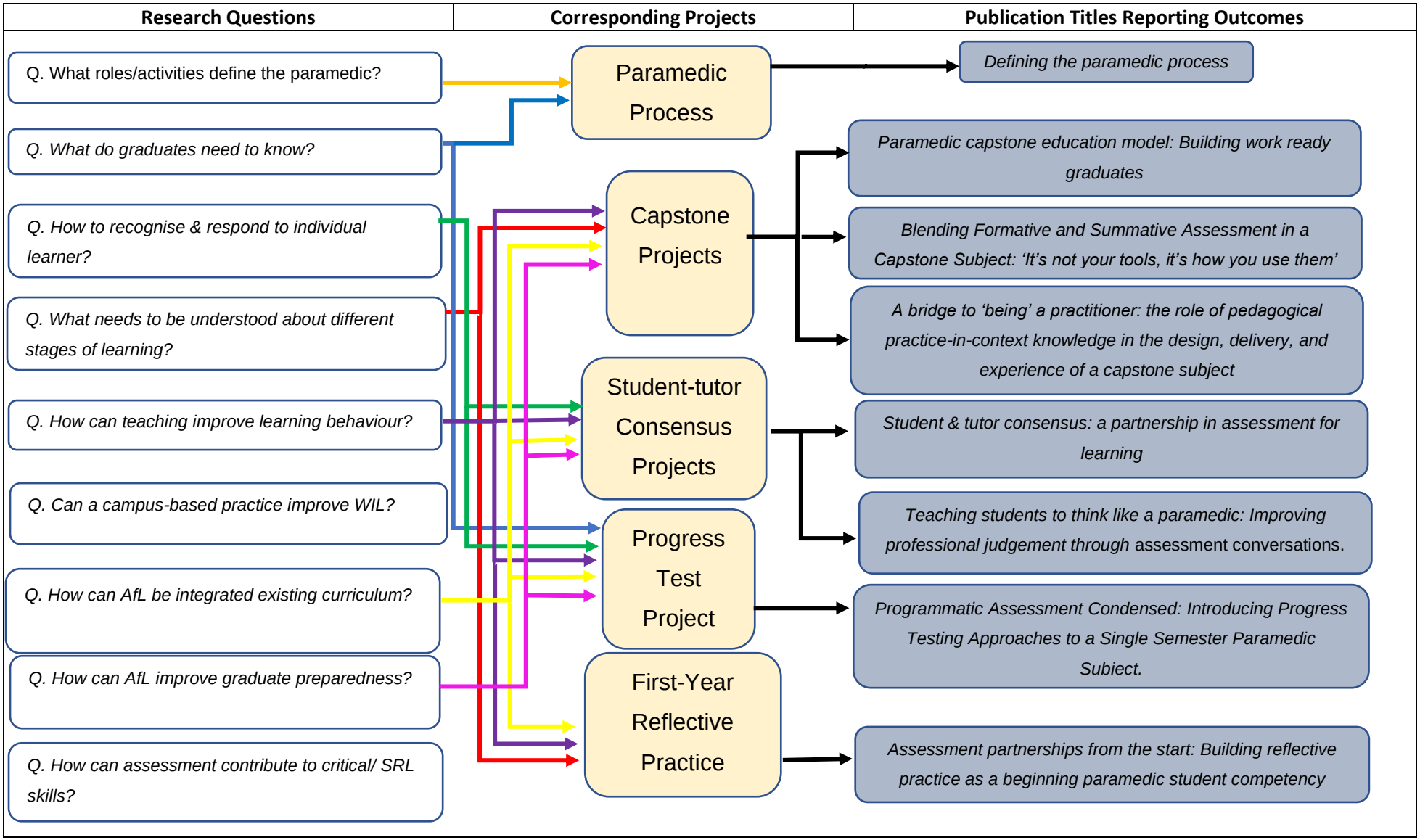
3.5.5 First-year reflective practice project

When the student-tutor consensus assessment format was introduced to a starting student cohort, a decision was made to formally study its effectiveness with these beginning students (Flinders University Social and Behavioural Research Ethics Committee Approval 7658).

These findings were analysed and discussed in Thompson et al., (2020) (see Section 4.8).

As a result of this final project, an illustration of the cycles of action research performed and the published work was assembled (Figure. 2).

Figure. 1 Research Question, Project, Reported Outcomes Matrix



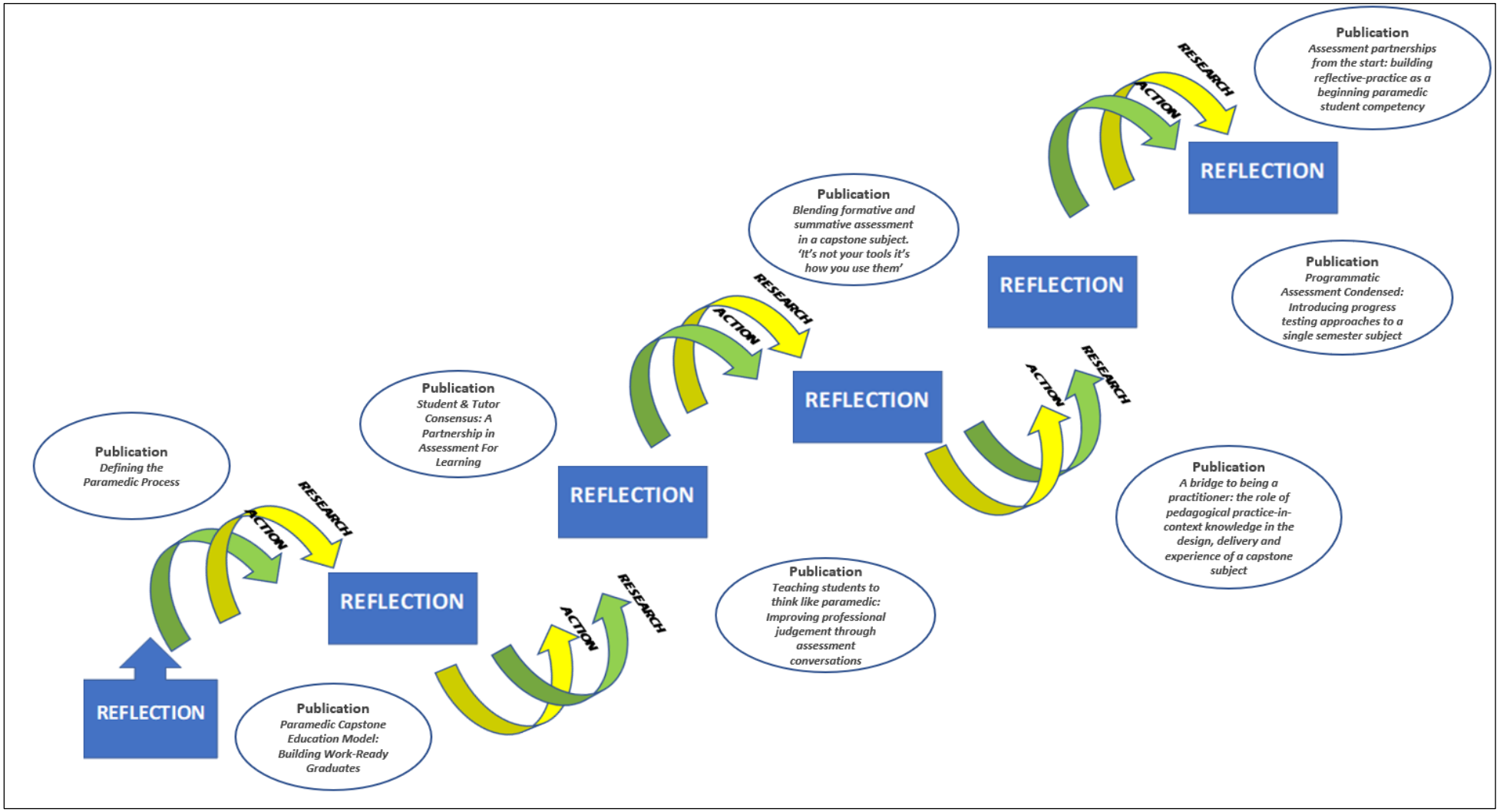


Figure 2. Action research cycles performed and published work.

Chapter 4. Publications

4.1 Paper 1. Defining the Paramedic Process

This section contains the publication *Defining the paramedic process* (Carter & Thompson, 2013).

4.1.1 Background to the publication

In 2008 I conducted a research project using a Delphi study of senior paramedic clinicians that identified a series of events that were consistent features of paramedic work, regardless of the case acuity. Later, as part of a faculty-based initiative to offer student opportunities to collaborate with academics in their scholarly projects, I shared all my relevant research literature and findings that I previously developed with a student co-author, Holly Carter. My findings formed the structure and design of the publication. Carter's contribution was to co-contribute to the drafts while I wrote and edited the publication and corresponded with the journal. We both contributed to the revisions. The publication features within the Australian Journal of Primary Health.

The order of authorship entirely reflects the vision of summer scholarship project of student engagement within extracurricular projects. An authorship declaration is included in Appendix 1.

The publication is included in the following pages. This is reproduced with journal permission.

4.1.2 Citation

Carter, H., & Thompson, J. (2013). Defining the paramedic process. *Australian Journal of Primary Health, 21*(1), 22-26. https://doi.org/10.1071/PY13059

Defining the paramedic process

Abstract.

The use of a ‘process of care’ is well established in several health professions, most evidently within the field of nursing. Now ingrained within methods of care delivery, it offers a logical approach to problem solving and ensures an appropriate delivery of interventions that are specifically suited to the individual patient. Paramedicine is a rapidly advancing profession despite a wide acknowledgement of limited research provisions. This frequently results in the borrowing of evidence from other disciplines. While this has often been useful, there are many concerns relating to the acceptable limit of evidence transcription between professions. To date, there is no formally recognised ‘process of care’-defining activity within the pre-hospital arena. With much current focus on the professional classification of paramedic work, it is considered timely to formally define a formula that underpins other professional roles such as nursing. It is hypothesised that defined processes of care, particularly the nursing process, may have features that would readily translate to pre-hospital practice. The literature analysed was obtained through systematic searches of a range of databases, including Ovid MEDLINE, Cumulative Index to Nursing and Allied Health. The results demonstrated that the defined process of care provides nursing with more than just a structure for practice, but also has implications for education, clinical governance and professional standing. The current nursing process does not directly articulate to the complex and often unstructured role of the paramedic; however, it has many principles that offer value to the paramedic in their practice. Expanding the nursing process model to include the stages of *Dispatch Considerations*, *Scene Assessment*, *First Impressions*, *Patient History*, *Physical Examination*, *Clinical Decision-Making*, *Interventions*, *Re-evaluation*, *Transport Decisions*, *Handover and Reflection* would provide an appropriate model for pre-hospital practices.

Additional keywords: ambulance, emergency medical services, EMS, nursing process, paramedic role, pre-hospital care.

Introduction

During the brief patient encounter, there are several elements unique to paramedic work that requires careful consideration. Unlike many other health fields, the central process that drives the activities of pre-hospital clinicians remains largely unexplored. This is consistent with a distinct paucity of published paramedic literature, which frequently impedes the validation of much pre- hospital practice (Ball 2005). Common comparisons between nursing

and paramedic work highlight these limited evidence provisions, specifically surrounding the areas relating to the improvement of care (Linwood *et al*. 2007). For paramedicine, evidence loaned from neighbouring professions has been commonplace, yet many are well aware of the shortfalls linked with the articulation of this evidence to paramedic practice. Searches of the literature relating to 'processes of care' uncover a prevailing connection to nursing. Interdisciplinary overlaps regarding approaches to patient care may be initially apparent, but it has been suggested that there is a limit to the principles that can be extrapolated (Linwood *et al*. 2007). Paramedic work remains distinctive from other health disciplines, with the variable and unpredictable work conditions encountered often challenging the outcomes of the research generated in more controlled settings.

The advantages that a process provides nursing are extensive. Minimisation of organisational error, increased problem identification, continuity of care, improvements to patient–carer communication and individualised patient care, all feature amongst the extensive list of benefits (Bryar 1987). The potential offered by such a tool has not gone unrecognised by other areas of health care, with midwifery also adopting a process of care. The formal care process incorporated by nursing and midwifery aids critical thinking for their clinicians, making this a concept that holds much appeal for paramedics (Hunter and Lops 1994). Central to the delivery of effective paramedic practice is an appropriate problem-solving process (Wyatt 2003). Preliminary work by the National Rural Health Association (USA) (1997,p. 184) proposed a framework for emergency medical services, a design which placed the patient at the centre of a cycle of stages: Pre-event planning, Access, Intervention, Completion and Evaluation. This formative framework design offers much value to contemporary definitions of a paramedic process of care. Today, mounting levels of responsibility connected with a paramedic's expanding scope of practice, has resulted in many questioning how paramedics are professionally classified (Joyce *et al*. 2009). It is unsurprising that accompanying this drive towards professional recognition are the repeated calls for a more comprehensive body of evidence to support this quest. A unique body of knowledge that is specific to paramedics is pivotal to the argument for paramedicine to be categorised as a profession (Williams *et al.* 2010).

What is known about the topic?

1. Much literature details the components and application of the nursing process. It is a widely accepted element of professional practice and identity.

What does this paper add?

2. The additional considerations required in order for the nursing process to be applicable to a paramedic role.

The nursing process

Formally introduced during the 1960s, the nursing process was supportive of the view that nurses' actions should be guided by theory, as well as identifying the need for a tool that could provide a structured and organised way for nurses to meet the needs of their patients (Mason 1997). Wide acceptance of the method followed, spawned by the American Nurses Association releasing several distinct nursing standards. The result was a broad revision of nursing practice to specifically include the steps of the nursing process (Daniels 2004). Since its conception, the process has remained integral to nursing practice, education and research, and has been also been broadly adopted internationally (Sibson 2005). Consensus within the literature identifies the features of a systematic, problem-solving approach to patient care (Carlson 1972), which affects care planning, delivery and record keeping (Attree and Murphy 1999). The pioneering of a central patient focus offered a considerable shift from the former priority of task-delivery approaches (Mitchell 1984). Incorporating such an organised way of thinking about care instigates predicted responses (Hood and Leddy 2006), and through integrating holistic views of both the patient's medical problem as well as its impact on the patient, the nursing process ensures interventions are suited to the individual (Alfaro-LeFevre 2010). Mitchell (1984, p. 216) detailed four steps within the nursing process: 'assessment, planning, implementation, and evaluation', which are all reflected within current practice. A subsequent fifth step between the assessment and planning stages, 'diagnosis', is also present in much of the literature (Hood and Leddy 2006).

The need for a paramedic process

The recognition of paramedic practice as having its own unique body of knowledge (O'Meara 2011) remains a quest aligned closely with the goal that it be classed as a profession. Considerations of the future agenda for EMS recognise the growing role for management systems, with Martinez (1998, p.595) recommending an approach that offers the elements of 'surveillance, identification, intervention, and evaluation of minor injuries and disease'. The systems model proposed by Turner *et al*. (2000) positions the patient centrally, where a set of decision points are followed in response to the unplanned health event. Distinct stages of this system are then representative of the chronological events for the patient and are identified as being *Pre-Event*, *Access*, *Intervention*, *Completion and Evaluation* (Turner *et al*. 2000, p. 184). These cyclical models represent key formative contributions of their day, with many of their proposals remaining relevant to the contemporary practice of paramedics.

Vital to the ability to successfully apply a process of care, and common to health workers across all sectors, are the principles of critical thinking and decision-making (Linwood *et al*. 2007). Although widely established, clinical reasoning is only recently receiving attention within the paramedic arena (Jensen *et al.* 2009). Decisions about the nature of the patient complaint, the initiation and evaluation of treatment actions and facilitating transport to the appropriate setting are all regular features of pre- hospital activities (Ball 2005). Any failure to address the needs of effective decision-making proves a major impediment in the avoidance of diagnostic error (Jensen *et al.* 2009). Weighing up the benefits and consequences linked with remaining at a scene to deliver treatment, or electing to rapidly extricate and transport the time-critical patient mandates that the paramedic considers the available evidence, uses their intuition and selects from possible alternatives to make an appropriate judgement for each patient (Tanner 2006). Simultaneously executing critical interventions within pressurised situations, without the luxury of detailed medical history and limited diagnostic equipment are all qualities of an expert practitioner (Wyatt 2003). Practitioners with poor clinical reasoning will undoubtedly fail to predict impending patient deterioration.

The single patient-centred approach popularised in nursing, while relevant, is quickly superfluous when the paramedic is confronted with multiple undiagnosed patients. The unpredictable and ever-changing work environment, which is standard for paramedic practice, also generates additional requirements of a process, as does the finite resources available at the scene or en route to hospital (Jensen *et al.* 2009). Any pre- hospital process must reflect the dynamic environment and have the ability to withstand change, as highlighted in Turner *et al*. (2000).

The nature of paramedic practice

Dispatch considerations

A difference from the nursing process of care is that paramedic activity commences before any contact has been made with the patient. The dispatch centre represents the first link in the chain for patients requiring pre-hospital emergency care (Maguire *et al*. 2002). It is at this moment that the process of care begins, with vital information collected and processed before the assignation of an appropriate resource (Andersson and Värbrand 2006). The dispatch centre first triages patients into levels of risk before determining the level of clinical intervention and speed of the response required. Dispatch considerations therefore embody a key stage within the pre-hospital process of care. This initial description of the nature of the patient complaint offers paramedics invaluable data. The paramedic has time to prepare for

the situation they are about to face, and must maintain this state of preparedness while avoiding assumptions based on preceding information (Sundström and Dahlberg 2012).

Scene assessment

The settings in which paramedics execute their skills distinguish the profession from other care providers (Campeau 2008). The unpredictable work environment represents a customary component of all pre-hospital work. Prevailing weather conditions, limited light, cramped work environments, the distractions and danger caused by onlookers, traffic or noise and the possibility of violence or abuse towards the paramedic all require safe, effective evaluation (Crossman 2009). The significant personal risk associated with delivering emergency medical services has prompted a good deal of research (Maguire *et al*. 2002), with Reichard *et al.* (2011) reporting the paramedic workforce to have higher rates of fatal injuries compared with the general working population. Workplace violence is a reality for many health-care employees in Australia (Boyle *et al*. 2007), making the effective assessment of scene risk a necessity for paramedics. However, 'sizing up the scene' is a stage not limited to immediate safety threats. This key formative stage of care also offers consideration to the nature of the incident, patient numbers, additional resource requirements and their access routes.

First impressions

The first impressions generated from the initial patient encounter represent a meaningful component of paramedic work and can be summed up with the simple question: 'Sick or not sick?'(Caroline 2008, p. 126). What can be visualised from the doorway, such as patient location, posture, and level of response, can provide several clues as to the seriousness of the patient's condition. These observations will guide a primary survey, which is namely whether the patient has satisfactory airway, pulse and breathing conditions that are consistent with sustaining life (Ogilvie 2010). A quick visual assessment based on the chief complaint, respirations, pulse, mental status and skin colour encompasses the major respiratory, cardiovascular and neurological body systems, and allows the paramedic to categorise the patient as being in a stable or unstable condition. It is at this point that the need for immediate lifesaving interventions can be assessed (Ogilvie 2010). Classifying whether the patient is sick or not sick is a vital medical decision, and making the decision whether to take immediate action is integral to pre-hospital care.

Patient history

Obtaining a patient history represents a core component of any patient assessment (McKenna *et al*. 2011). The purpose is to gather subjective data such as medical history, the reason for seeking care, current health status and family history. Establishing this

information before the examination of the patient can provide clues to guide the paramedic in the physical examination. By taking care to the patient in their own home, paramedics are able to gain an exclusive insight into a range of social factors influencing health. Information such as living arrangements, home tidiness, personal hygiene and general ability to cope with the activities of daily life have the potential to influence decisions made in the emergency department and affect future patient management (Yong *et al.* 2008).

Physical examination

Measuring patient observations forms a fundamental part of the data gathering process, as interpreting these results will become an integral part of determining the level of care required by the patient. While paramedics have a similar portfolio of assessment techniques to those used by many of their allied health peers, limited diagnostic tests are available for use in the field as well as limited time and data on which to base their diagnoses (American Academy of Orthopaedic Surgeons and American College of Emergency Physicians 2009). Paramedic work occurs within the community, rather than inside medical facilities (Mann and Hedges 2002), making pre-hospital patient assessment capacity more limited than their in-hospital counterparts due to the lack of specialised resources. Additionally, examination is not limited to the patient and will often include the careful evaluation of the surrounding environment in order to assess the mechanism of a patient's injury.

Clinical decision-making

The purpose of reaching a diagnosis (or diagnoses) is to elucidate the nature of the problem and highlight what needs must be addressed for the patient (Alfaro-LeFevre 2010). There is much debate about whether the sheer breadth of possible diagnoses in the pre-hospital setting is beyond the scope of paramedic practice and the abilities of pre-hospital practitioners (Ball 2005). The ability of paramedics to determine an accurate clinical diagnosis has been questioned, with some researchers finding support for pre-hospital precision in triaging patients and others finding an unacceptable rate of accuracy (Levine *et al*. 2006). Unlike the diagnostic processes used by physicians, who are often aided with pathology results and X-ray findings, paramedics offer provisional diagnoses. They are trained in the rapid identification of potentially emergent conditions and their immediate required treatment based on the presenting systems (Hauswald 2002).

Interventions

The once limited set of clinical skills and basic first aid understanding have now been replaced by far greater clinical knowledge and the capacity to provide advanced life support to patients. Linking pre-hospital treatment to a researched evidence base has recently become a theme for clinical guidelines and practice protocols (Lang *et al*. 2012). These

directives offer treatment parameters specific to a range of patient events. Systematic in design, clinicians are guided as they execute drug regimens, resuscitation and stabilising measures (Field and Lohr 1990). The range of interventions that paramedics are authorised to perform remains a controversial topic (Bissell *et al*. 1999), and the scope of practice for the paramedic clinician varies both within locally defined clinical hierarchies and between regions of practice. These are often reactive to workforce delivery challenges (Stirling *et al*. 2007).

Re-evaluation

Evaluation is a central part of the process, and is performed continually (Ackley and Ladwig 2011), and the extent to which treatment goals have been achieved requires objective measurements. Although preceded in the process by interventions, the clinician attaches a hypothesis of a desired or expected outcome from these actions. Re-evaluation determines whether the goals for patient care have been achieved, and compares changes in the patient's health status with the expected outcomes anticipated with the implementation of care (Hood and Leddy 2006).

Transport decisions

While there are increasing provisions for patients with minor ailments to be treated at home by paramedics taking on extended practitioner roles (Cooper and Grant 2009), for many patients, the ultimate goal is deliverance to definitive care at a hospital. This brings a consideration of how to remove the patient from the scene. It is rare for any home to be accessible for the stretchers used by ambulance services, and so the movement of a patient from their presenting location to the back of the ambulance poses potentially lengthy delays. Patients are often retrieved from the sides of cliffs, or from within cars that are now just a twisted mass of metal and may be down an embankment or wedged up against a nearby tree (Hedges *et al*. 1988).

Handover/documentation

Linked with the continuum of care delivery is the transition of patient responsibility from ambulance to the receiving health service. The handover process involves the relaying of all pertinent patient and case information to the receiving organisation (Yong *et al*. 2008). With paramedics and emergency department staff operating in significantly different environments, the brief interface between the two domains is paramount to patient outcomes (Owen *et al*. 2009). Much is written about the importance of an effective transfer of information between services, and the consequences associated with error with standardised tools becoming commonplace (Thompson *et al*. 2011).

Reflection

Sibson (2008) suggests that the process of critically analysing clinical events and outcomes is an essential element of all professional practice. While this is often both a subconscious and informal activity for paramedics, Sibson (2008) proposes that it become a more deliberate and systematic routine in paramedic practice, with several recognised reflective tools identified for consideration. Representing a final event within the paramedic process is the retrospective dissection of individual cases features and, which in doing so, serves to inform future practice. Walker (1996) suggests that reflection is integral to the practice of holistic patient care.

Conclusion

Many features of the paramedic role are unique to the pre- hospital discipline; most notably the random and unpredictable environment in which they perform their duties. A paramedic's approach to the environment and all the potential hazards and challenges it presents mandate that before the delivery of any patient care provisions, careful consideration and preparation are completed. These additional considerations limit the suitability of any existing 'nursing processes of care'. What has been identified from the literature is support for the chronological activities distinguishing paramedic function. These extend from well before the patient encounter and continue to a reflective stage beyond. Since its inception, the nursing process has become cemented at the core of the profession's identity. It is so fundamental to the role that it is difficult to separate any features of nursing that are not related or affected by the nursing process. The list of agenda items confronting modern pre-hospital emergency services are ever increasing. With each milestone achieved, new challenges are presented. Community awareness of the paramedic role, competing interests of states and territories as well private providers and professional registration debates are themes that are commonplace within the industry. While the future directions for paramedicine remain a point of much contention and disagreement, perhaps it is a suitable opportunity to recognise what currently unites the paramedic discipline. The precedent set by nursing cannot be discounted. With their process contributing to professional identity, education, research and clinical governance, it seems timely for our emerging profession to recognise 'the paramedic process'.

References

Ackley BJ, Ladwig GB (2011) 'Nursing diagnosis handbook: an evidence- based guide to planning care', 9th edn. (Mosby Elsevier: Philadelphia, PA)

Alfaro-LeFevre R (2010) ‘Applying nursing process: a tool for critical thinking.’ 7th edn. (Lippincott Williams & Wilkins: Philadelphia, PA)

American Academy of Orthopaedic Surgeons & American College of Emergency Physicians (2009) ‘Critical care transport.’ (Jones & Bartlett Learning: Sudbury, MA)

Andersson T, Värbrand P (2006) Decision support tools for ambulance dispatch and relocation. *The Journal of the Operational Research Society* **58**, 195–201.

Attree M, Murphy G (1999) Nusing process: paradigm, paradox or Pandora’s box? *Nurse Education Today* **19**, 592–597. doi:10.1054/nedt.1999.0391 Ball L (2005) Setting the scene for the paramedic in primary care: a review of the literature. *Emergency Medicine Journal* **22**, 896–900. doi:10.1136/emj.2004.019588

Bissell RA, Seaman KG, Bass RR, Racht E, Gilbert C, Weltge AF, Doctor M, Moriarity S, Eslinger D, Doherty R (1999) Change the scope of practice for paramedics? an ems/public health policy perspective. *Prehospital Emergency Care* **3**(2), 140–149. doi:10.1080/10903129908958923

Boyle M, Koritsas S, Coles J, Stanley J (2007) A pilot study of workplace violence towards paramedics. *Emergency Medicine Journal* **24**(11), 760–763. doi:10.1136/emj.2007.046789

Bryar R (1987) The nursing process: a literature review. *Midwifery* **3**, 109–116. doi:10.1016/S0266-6138(87)80021-9

Campeau AG (2008) The space-control theory of paramedic scene- management. *Symbolic Interaction* **31**(3), 285–302. doi:10.1525/ si.2008.31.3.285

Carlson S (1972) A practical approach to the nursing process. *The American Journal of Nursing* **72**(9), 1589–1591.

Caroline N (2008) ‘Emergency care in the streets.’ 6th edn. (Jones & Bartlett: Sudbury, MA)

Cooper SJR, Grant J (2009) New and emerging roles in out of hospital emergency care: a review of the international literature. *International Emergency Nursing* **17**(2), 90–98. doi:10.1016/j.ienj.2008.11.004

Crossman M (2009) Technical and environmental impact on medication error in paramedic practice: a review of causes, consequences and strategies for prevention. *Journal of Emergency Primary Health Care* **7**(3), 990 374.

Daniels R (2004) ‘Nursing fundamentals: caring and clinical decision making.’ (Cengage Learning: Melbourne)

Field MJ, Lohr KN (Eds) (1990) ‘Clinical practice guidelines: directions for a new program.’ (National Academies Press: Washington, DC)

Hauswald M (2002) Can paramedics safely decide which patients do not need ambulance transport or emergency department care? *Prehospital Emergency Care* **6**(4), 383–386. doi:10.1080/10903120290937978

Hedges JR, Feero S, Moore B, Shultz B, Haver DW (1988) Factors contributing to paramedic onscene time during evaluation and management of blunt trauma. *The American Journal of Emergency Medicine* **6**(5), 443–448. doi:10.1016/0735-6757(88)90242-2

Hood LJ, Leddy SK (2006) ‘Leddy & Pepper’s conceptual bases of professional nursing.’ 6th edn. (Lippincott Williams & Wilkins: Philadelphia, PA)

Hunter LP, Lops VR (1994) Critical thinking and the nurse-midwifery management process. *Journal of Nurse-Midwifery* **39**(1), 43–46. doi:10.1016/0091-2182(94)90043-4

Jensen JL, Croskerry P, Travers AH (2009) Paramedic clinical decision making during high acuity emergency calls: design and methodology of a Delphi study. *BMC Emergency Medicine* **9**, 17. doi:10.1186/1471- 227X-9-17

Joyce CM, Wainer J, Piterman L, Wyatt A, Archer F (2009) Trends in the paramedic workforce: a profession in transition. *Australian Health Review* **33**(4), 533–540. doi:10.1071/AH090533

Lang ES, Spaite DW, Oliver ZJ, Gotschall CS, Swor RA, Dawson DE, Hunt RC (2012) A national model for developing, implementing and evaluating evidence-based guidelines for prehospital care. *Academic Emergency Medicine* **19**(2), 201–209. doi:10.1111/j.1553-2712.2011.01281.x

Levine SD, Colwell CB, Pons PT, Gravitz C, Haukoos JS, McVaney KE (2006) How well do paramedics predict admission to hospital? A prospective study. *The Journal of Emergency Medicine* **31**(1), 1–5. doi:10.1016/j.jemermed.2005.08.007

Linwood R, Day G, FitzGerald G, Oldenburg B (2007) Quality improvement and paramedic care: what does the literature reveal for pre-hospital emergency care in Australia? *International Journal of Health Care Quality Assurance* **20**(5), 405–415.

Maguire BJ, Hunting KL, Smith GS, Levick NR (2002) Occupational fatalities in emergency medical services: a hidden crisis. *Annals of Emergency Medicine* **40**(6), 625–632. doi:10.1067/mem.2002.128681

Mann NC, Hedges JR (2002) The role of prehospital care providers in the advancement of public health. *Prehospital Emergency Care* **6**(S2), S63–S67. doi:10.3109/10903120209102685

Mason GMC (1997) The relationship between research and the nursing process in clinical practice. *Journal of Advanced Nursing* **26**(5), 1045–1049. doi:10.1046/j.1365-2648.1997.00472.x

McKenna L, Innes K, French J, Streitberg S, Gilmour C (2011) Is history taking a dying skill? An exploration using a simulated learning environment. *Nurse Education Practice* **11**(4), 234–238. doi:10.1016/j. nepr.2010.11.009

Mitchell JRA (1984) Is nursing any business of doctors? A simple guide to the “nursing process”. *BMJ* **288**, 216–219. doi:10.1136/bmj.288. 6412.216

National Rural Health Association (USA) (1997) Rural and frontier emergency medical services toward the year 2000.

O’Meara P (2011) So how can we frame our identity. *Journal of Paramedic Practice* **3**(2), 57.

Ogilvie W (2010) Patient assessment – getting back to basics. *Texas EMS Magazine*, Jan/Feb 2010, pp. 36–41.

Owen C, Hemmings L, Brown T (2009) Lost in translation: maximising handover effectiveness between paramedics and receiving staff in the emergency department. *Emergency Medicine Australasia* **21**(2), 102–107. doi:10.1111/j.1742-6723.2009.01168.x

Reichard AA, Marsh SM, Moore PH (2011) Fatal and nonfatal injuries among emergency medical technicians and paramedics. *Prehospital Emergency Care* **15**, 511–517. doi:10.3109/10903127.2011.598610

Sibson LE (2005) ‘The nursing process. Compendium of clinical skills for student nurses.’ (Whurr Publishers: London)

Sibson LE (2008) An introduction to reflective practice. *Journal of Paramedic Practice.* **1**(1), 121–125.

Stirling CM, O'Meara P, Pedler D, Tourle V, Walker J (2007) Engaging rural communities in health care through a paramedic expanded scope of practice. *Rural and Remote Health* **7**(4), 839.

Sundström BW, Dahlberg K (2012) Being prepared for the unprepared: a phenomenology field study of Swedish prehospital care. *Journal of Emergency Nursing* **38**(6), 571–577. doi:10.1016/j.jen.2011.09.003

Tanner CA (2006) Thinking like a nurse: a research-based model of clinical judgement in nursing. *The Journal of Nursing Education* **45**(6), 204–211.

Thompson JE, Collett LW, Langbart MJ, Purcell NJ, Boyd SM, Yuigi Y, Ossolinski G, Susanto C, McCormack A (2011) Using the ISBAR handover tool in junior medical officer handover: a study in an Australian tertiary hospital. *Postgraduate Medical Journal* **87**, 340–344.doi:10.1136/pgmj.2010.105569

Turner J, Judge TP, Ward ME, Johns BM, Wilby J, Roberts G, Trautner S (2000) A new worldwide systems model for emergency medical services: statement from the Cape Town EMS summit, South Africa, January 1998. *Pre-hospital Immediate Care* **4**, 183–188.

Walker S (1996) Reflective practice in Accident and Emergency setting. *Accident and Emergency Nursing* **4**, 27–30. doi:10.1016/S0965-2302(96) 90034-X

Williams B, Onsman A, Brown T (2010) Is the Australian paramedic discipline a full profession? *Journal of Emergency Primary Health Care* **8**(1), 990383.

Wyatt A (2003) Paramedic practice – knowledge invested in action. *Journal of Emergency Primary Health Care* **1**(3–4), 990057.

Yong G, Dent AW, Weiland TJ (2008) Handover from paramedics: observations and emergency department clinician perceptions. *Emergency Medicine Australasia* **20**(2), 149–155. doi:10.1111/j.1742- 6723.2007.01035.x

4.2 Paper 2. Paramedic Capstone Education Model

This section contains the publication *Paramedic capstone education model: Building work ready graduates* (Thompson, Grantham, & Houston, 2015).

4.2.1 Background to the publication

This publication captures the initial subject reforms that were intended to form a prototype to an assessment for learning approach in paramedic education. Producing this publication reflected efforts to contribute to the scholarship of teaching and learning around paramedic education. The publication reflects my design, implementation and initial evaluations of the capstone paramedic teaching approach. I was the principal author of the publication. Dr Don Houston provided key critical discussions relating to the production of the publication and editing contributions. Dr Grantham's inclusion reflects local requirements of his endorsement for the work. The publication features within the Australasian Journal of Paramedicine.

An authorship declaration is included in Appendix 2.

The publication is included in the following pages. This is reproduced with journal permission.

4.2.2 Citation

Thompson, J., Grantham, H., & Houston, D. (2015). Paramedic capstone education model: Building work ready graduates. *Australasian Journal of Paramedicine, 12*(3), 1-8. https://doi.org/10.33151/ajp.12.3.15

Paramedic capstone education model: Building work-ready graduates

SUMMARY

In Australia, the last decade has witnessed considerable changes to both the scope of paramedic practice and the education of these practitioners. Notably within education, there has been a national trend to move from on-the-job training, towards a pre-employment, undergraduate university qualification. Despite increases in depth, breath and consistency to the curriculum and delivery by subject experts with training in education, criticism remains targeted at the preparation of the graduate for readiness to undertake the paramedic role. Australian undergraduate courses are currently experiencing unprecedented enrolment numbers, with complex student learning expectations and requirements. Producing work ready graduates within traditional curriculum frameworks is a challenge. Capstone courses target the final preparation of the graduating student, with a strong emphasis on articulating them successfully with their chosen industrial settings. While widely accepted in other disciplines, such as engineering, capstone is a new concept to paramedicine. This paper discusses how a capstone topic was created and implemented at Flinders University within the Bachelor of Paramedic Science degree. It describes the differentiated student learning methodology employed and the strategies used to respond to specific student and industry concerns regarding university teaching.

Key Words

Paramedic Education, Capstone, Differentiated Learning, Active Learning, Graduate Qualities

Introduction

Criticism exists surrounding the effectiveness of Australian universities in preparing students for the expanding role of the paramedic (O'Brien, Moore et al. 2014). Central to much of the debate, is an industry lead challenge to paramedic graduate preparation (O'Brien, Moore et al. 2014). Undergraduates encounter many obstacles as they transition from student to a

road ready paramedic. There is an expectation of being able to instantly recall and contextualise all prior learning and seamlessly apply it to clinical practice, often in high pressure situations. Traditional models of ambulance education saw the student progressing chronologically through well-worn and quite confined study paths, being signed off for the areas they had satisfied before moving onto new fields of learning. With each pre-requisite learning milestone informing the next, there existed an assumption that all that was taught, was learnt and stayed learnt. Re-testing of previous learning was regarded as inefficient academic double jeopardy, and yet universities often were subject to criticism surrounding theory practice gaps. For the graduating paramedic student, the impact of having the value of their studies challenged was significant. An existing set of 'Graduate Attributes' served to benchmark the industry standard expected of the completing student, however these were mostly unfamiliar to industry partners, or were discounted in favour of their own valued principles regarding performance. Meanwhile, academics naively held optimism that curriculum would fall into place for students by the completion of their degree and that they would transition well into the next stage of their career.

The need to respond to these criticisms presented opportunities for the redesign of a culminating degree subject. In response to the need to integrate prior learning and produce a more rounded graduate with all the knowledge at their fingertips, a capstone topic was created. Capstone education methods are recognised as deliberate attempts to address theory-practice gaps through attending to graduate attributes, making them ideal for a final subject (Thomas, Wong et al. 2014). Teaching is aligned more closely with industry practices; curriculum is consistent with the real world that the graduate is about to enter and student performances are considered in parallel to standards of industry (Kerka 2001). The rewards of capstone models are not limited to the student. Feedback from capstone courses also provides invaluable insight into how successfully a course has been in achieving its curriculum goals (Berheide 2007).

The highly pragmatic subject ‘Applied Paramedic Practice’ was developed at Flinders University in response to the needs for graduate knowledge and skills consolidation. It is now locally recognised as a type of ‘finishing school’ for paramedic students.

The following sections provide, a description of the challenges, the proposed solution of a student-centred, technology enhanced capstone experience and the educational considerations behind the design. The final sections discuss student responses to the new learning experience created through the design and, the initial conclusions and implications from the design and implementation of the capstone experience for students.

Background: Defining the Problem

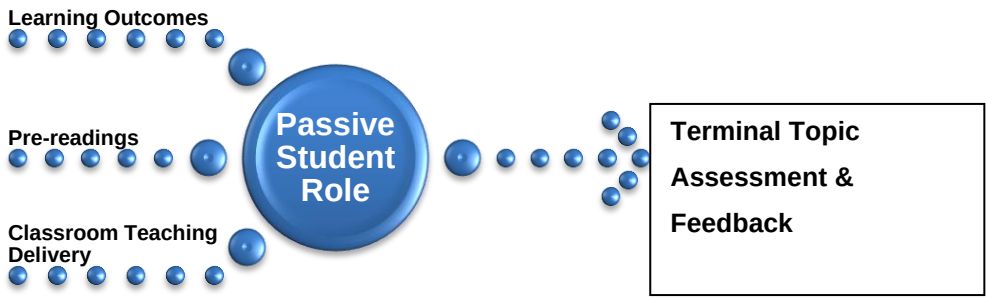
Prior to university involvement, ambulance education was delivered to small groups of students for whom attendance was an employment condition. Teaching delivery methods reflected first aid training conventions and available technology of the time, with assessments also serving as a control measure for career progression. Today, education of the paramedic undergraduate student is complex with high expectations of the student’s knowledge and ability to reason. At Flinders, paramedic students embark on studies from a myriad of enrolment pathways. School leavers with very high Australian Tertiary Admission Rank (ATAR) scores entering education, international applicants for whom English is an additional language, students using this program as a feeder program to medicine (who have no intention of practicing paramedicine), mature aged students embarking on a change of career, and sponsored students who may not have completed high school, all contribute to the modern cohort. Student needs and expectations differ considerably as a result. The compulsory attendance mandates and other employment expectations seen in the former vocational education training (VET) environment do not readily align with the adult learning and flexible delivery principles of the higher education setting. This is a setting where student opinions and satisfaction wield powerful influence and teachers must balance student attitudes regarding curriculum content and teaching, with standards and expectations from all levels of industry and the university alike. There is a further challenge of delivering this

learning to unprecedented enrolment numbers. For the completing student, they are also now for possibly the first time having to consider the uncertainty of the next stage of their lives, a feature which study programs had up until now mapped for them (Henscheid 2008).

In 2009, a course accreditation review committee noted student criticism that questioned the relevance and quality of the teaching. Simultaneously, industry criticism of teaching in the degree occurred whenever a gap in a graduate's knowledge or clinical skills were exposed.

The 'Applied Paramedic Practice' subject was the final academic requirement for the course, so carried an added demand of ensuring the student had "learnt enough" before being considered safe to practice on the public. The format of the final subject had students first being issued with subject guides and statements of learning outcomes. Lectures and workshops were preceded by encouraging students to access a selection of pre-readings. The design was approached mostly in isolation from other curriculum content. Practical sessions involved tutor demonstrations followed by student practice, with theory and practical assessments at the end of the topic. Electronic media was incorporated principally as a communication platform to support teacher student interactions and students would look to the teaching provisions with the view passing a single final test. Students received feedback after testing which largely related to their abilities to make the grade, with no capacity for the student to respond to the feedback through development. (Diagram 1). The intensity or complexity of the final testing was regarded as providing academic rigor.

Diagram1. Former final topic design



With class sizes exceeding 100 students, delivering intensive, focused learning tested the available resources. Unsurprisingly student engagement with learning appeared to be declining. It was considered essential to clearly identify the problems, and with many stakeholders in play, careful attention was afforded to all views. Each facet of the wider curriculum was explored, as were the assessment formats. A number of key areas of concern were identified:

- The pace of classroom based learning was a point of contention, with varied student levels and cultural backgrounds fuelling frustration. Both slower and faster teaching deliveries were sought.
- It was evident that much of the pre-requisite topic knowledge had not been retained upon commencing the final subject, and many students struggled to see the relevance of some of the earlier curriculum to their future career paths.
- While the convenience of online teaching provisions was recognised, students were largely critical of the level of engagement they generated.
- As local industry recruitment processes at the time were perceived by students not to give consideration to the graduate's academic performance, students were not connecting their university performance with their future career success.
- Industry partners were unfamiliar with the curriculum being taught: the depth and breadth of content were not well understood.
- Graduates were thought to be lacking in fundamental skills and knowledge when they underwent specific industry based internship testing methods. This served to perpetuate a cycle of graduate and industry disconnection.

For such a complex set of teaching and learning challenges, widespread reforms were considered essential. They would need to go beyond the teaching content to target student attitudes towards how they valued their learning experience as well as the role that local industry played in contributing to student regard for their education.

The solution: A capstone experience

There is emerging interest in the specific needs of the completing student (Brock 2004). Although new to paramedicine, capstone education has strong traditions within engineering and computing courses (Rowles, Koch et al. 2004, Hurtig and Estell 2009). The signature work integrated learning characteristics have resulted in growing popularity of capstone experiences within finishing year university subjects (Fernandez 2006). Their introduction has been historically linked with existing issues of articulation between university courses and industry need (Smith, Brooks et al. 2009, Thomas, Wong et al. 2014), a concept known well by many in health care education as the theory practice gap.

The purpose of a capstone experience is not always to introduce the student to volumes of new material, but instead to assist them to revisit and contextualise and integrate their existing knowledge. Characterised by strategies that cause students to look back on what they have been taught, while simultaneously looking forward to how the learning connects with their future work (Henscheid 2008), capstone experiences symbolise a movement away from education traditions. Capstone interpretations vary considerably between disciplines and range from a final project (Wilbarger and Howe 2006) to simulations which are faithful to industry practice (Dutson, Todd et al. 1997). Distinguishing capstone courses are a culminating education experience which unites the academia and industry through a partnership in the process of learning (Todd, Magleby et al. 1995). For students, their activities of learning are specifically targeted at authentic, real world experiences or standards (Dutson, Todd et al. 1997). Alongside the goals of developing skills and knowledge, consideration is given to the student acquisition of professional identity (Collier 2000).

The design of the Flinders Paramedic Capstone Pedagogy

Following careful consideration of the impacts of each of the characteristics of the existing provisions in conjunction with the wider systemic problems, the prototype capstone model was designed to place the student at the centre of a carefully contextualised and

individualised learning system. The design sought to replace all didactic delivery with a heavily student lead format and encourage the use of the paramedic process of pre-hospital enquiry (Carter and Thompson 2013). Periodic testing and feedback were integrated into the intended student experience.

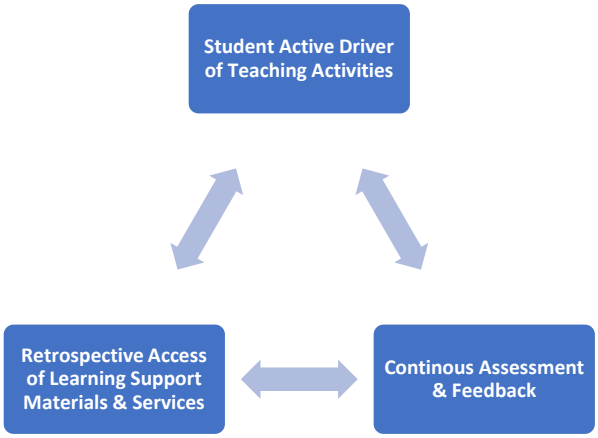


Diagram2. Illustration of the new capstone framework

To achieve student centric active learning as a core characteristic of the design, a complete overhaul of the subject was performed. A summary of the design innovations is listed below.

- *Diagnostic assessment at the beginning of the subject as the basis for a differentiated learning experience for each student*
- *The formation of small study groups to encourage engagement and peer-to-peer interaction and learning*
- *The use of Problem Based Learning scenarios supplemented by student generated wikis as a core learning experience*
- *Practical simulation testing of themes corresponding to the PBL content*
- *A mid-subject formative assessment to provide further diagnostic feedback to guide individual student learning pathways*
- *The involvement of practicing paramedics in assessment of clinical skills and reasoning*

- *Student maintained portfolio and skills records*

The broad design revised the role of tutors, placing them as support links to information, learning materials and clinical standards, compared to a former role as a source of central instruction. Students are allocated to study groups, with deliberate intent made to separate friendship circles, blend student skill mix and integrate cultural groups. This strategy was intended to develop a capacity to work confidently and effectively with unfamiliar people and not allow retreat into the comforting support networks of familiar peers. The specific components within this broad design and linkages between them are detailed in the following sections. Table 1. shows a summary of the new curriculum pathway.

Group Based Learning 	**Differentiated Student Learning** 
• **Pre-test**	• **Initial self-evaluation** • **Goal Setting** • **Portfolio & Curriculum Vitae (initiates professional image design)**
• **Practical Skills Testing**	• **Reflection on practice** • **Goal Setting** • **Directed skills practice**
• **Problem Based Learning**	• **Current understanding validated** • **Knowledge gaps self-identified** • **Learning reported on wiki**
• **Wiki**	• **Reports student learning** • **Student critiques submissions and has their own submission critiqued by peers** • **Pages inform formative exam content**
• **Formative examination**	• **Student nominated learning areas evaluated** • **Feedback identifies ongoing learning opportunities** • **Weakest area of performance informs Viva assessment (e.g., Cardiovascular Pathophysiology)**
• **Viva**	• **Personalised assessment of exam identified learning areas** • **Standards are benchmarked at road ready/ operational paramedic**
• **Exit Interview**	• **Student Portfolio & CV critiqued** • **Student receives tutor collated tutor feedback regarding their performance** • **Ongoing learning areas and recommendations suggested**

Table 1. Differentiated learning paths.

Initial diagnostic assessment

On the first day of the subject, students are given a multiple choice exam which samples questions from all the pre-requisite subjects. This practice attempts to establish the student's prior knowledge and understanding (Shepard 2000). Student awareness of their levels of understanding is considered an important feature if they are to have control of their learning (Schraw and Dennison 1994). Questions which are sampled for inclusion cover specific curriculum areas of anatomy, physiology, pathophysiology, pharmacology and clinical practice, with feedback on performance aligned with these. While initial testing does not directly contribute to the students' overall grade, students are required to reflect upon their performance in another of the initial assessments: a portfolio.

Personal Learning Portfolio

The student portfolio offers a valuable teaching tool within the subject. As an assessment item, it offers an authentic representation of the students' academic performance (Wood 2003). As it features an introductory student biography, coordinators are able to become more familiar with the individual characteristics of students. The portfolio captures the students learning experiences (Coffey 2005). Initial student reflections, self-evaluations and perceived areas of learning challenges further aid to personalise targeted learning. The portfolio maps achievements in learning (like a graduate 'growth chart') and is submitted at three points in the semester; commencement, mid-way and end. This record allows students to celebrate their own learning achievements.

Problem based learning and wikis

At the heart of the design are problem based learning sessions which are complemented by the student reporting of identified learning topics in their autonomously run wiki page. Learning arises from a series of plausible paramedic cases which are presented in class. The student led problem based learning sessions are constructed around the paramedic process, a systematic approach to pre-hospital care delivery (Carter and Thompson 2013). Case information is revealed to students as they undertake chronological investigations and share, via fellow student teaching and demonstration, an understanding of key features relating to the case. Akin to a complex emergency patient case, students must initiate enquiries, unpack the findings and apply their knowledge and clinical reasoning (Williams 2005). While the sessions are framed by learning outcomes with distinct linkages to whole of degree curriculum areas, students are required to make the connection between the skills and knowledge they require to manage the case and the relevance of the previous teachings that provided their underpinning foundational learning. Using a collaborative approach, learning benefits include knowledge, skills and attitude (Sangestani and Khatiban 2013).

Unlike traditional delivery models where pre-reading materials are provided before a class, support material and direction are provided retrospectively, reinforcing the relevance and value of other subject matter. Students are in charge of the learning pace and support each other with coaching and identification of learning gaps.

Some critics of the PBL methods highlight the resource implications linked with very small class sizes, with increased numbers linked with diminished participation levels and reduced group reporting (Boyer 1990, Chen, Cannon et al. 2005). Funding and resource limitations constrained our minimum group sizes to around twenty students, so a wiki activity was introduced as a way to extend these learning interactions outside of the classroom. The wiki provides a common electronic page where students are able to report upon the material they identified in the classroom as being important to revisit. With all students contributing to its content, information is entered, critiqued and edited by the group resulting in a collection of information which shows the consensus of its twenty student authors.

Practical skills and Reasoning Assessment

- Following an intensive morning of theory within the PBL, student groups divide again to enable reduced class sizes, as students commence intensive clinical simulation assessments with tutors who are recruited directly from local industry. These tutors undergo educational development within the university prior to teaching students. Supervised and assessed by the same industry paramedics they are soon to work alongside, students respond as ambulance crews to simulated emergency cases which are aligned with the theoretical themes introduced within the PBL. Within the class, every student has an active role to play during the assessment, which may be any of; timekeeping, peer assessment, equipment logistics or scenario coordination, as well as individual and teamwork responses within the scenario (see table 2.). This represents a multidimensional learning partnership between the student, their peers, the university and industry. Each simulated case is graded and students must satisfy a level of competence with each intensive session, with the performance standard set at the level of a practicing paramedic (by a practicing paramedic). This may take multiple attempts. Students are encouraged to reflect in their portfolio on the cases, the skills they demonstrate and their own ongoing development needs.

<table>
<tr><td colspan="4">Industry Paramedic Supervisor

• Ensures Standards of Practice
• Delivers direct performance feedback to all</td></tr>
<tr><td>Student Scenario Instructor Role

• Delivers a pre-prepared clinical scenario</td><td>Student Peer Assessors Role

• Critiques performance
• Feedback to students being assessed</td><td>Scribe/Time Keeper Role

• Records clinical events in real time</td><td>Logistics Role

• Identifies resource use during scenario
• Restocks equipment post each scenario</td></tr>
<tr><td colspan="4">Student Paramedic Being Directly Assessed

• Principle clinical attendant during the scenario
• Coordinates care
• Executes Clinical Decisions</td></tr>
<tr><td colspan="4">Student Paramedic Crew Mate(s)

• Works under direction of assessed student
• Demonstrates clinical skills</td></tr>
</table>

Table 2. Active student roles during practical scenarios/assessments

Formative Examination & Feedback

Students sit a formative mid-way examination, which is presented in a series of sections which reflect the broad themes of the PBL cases and the specific topics that students have published on the wiki sites. In essence, the students have contributed to writing their own examination items as these were the self-identified areas for development. As student understanding has up until this point only been validated by their peers and industry paramedics, the assessment by academic staff serves to endorse student knowledge and identify areas for ongoing learning focus. An automated marking programme returns detailed prompt feedback to students soon after the test. Results reported against each section in the assessment indicate to the student where the focus of their study needs to be invested next.

Final Viva & Exit Interview

The final assessment component of the subject is an individualised oral examination (or viva) for each student. Viva interviews have long been a recruitment tool used within ambulance services. Offering insight into a potential candidates' understanding of physiological concepts and reasoning skills, practice in the viva situation can often be the

difference between gaining an appointment or not. There have been many anecdotes of very capable and high performing graduates not coping effectively under the pressure of the viva or interview, or not being able to confidently respond to the questioning, ultimately costing them employment after 3 years of undergraduate preparation. Students are made aware of the area in the formative exam that they scored the least well in and this area subsequently defines the students' individual learning path, with this specified material forming the focus for a viva assessment at the end of the topic. Themes are very broad (for example, cardio-thoracic) so each student must review a great breadth of material in preparation for the 15 minute interview. This prepares the student to respond under stressful conditions, where their performance may be affected by nerves and confidence as well as their clinical understanding.

Exit Interview

Shortly after the viva, each student has an exit interview with the subject coordinator. This one on one private forum offers an opportunity for both parties to discuss the learning that has taken place throughout the semester and to provide each other with candid feedback. It is a time when students are encouraged to speak freely of their learning journey and its challenges and share their future goals and plans. The subject coordinator in turn can offer advice about ongoing development needs and opportunities and acknowledge the student has completed a demanding subject. While the interview is designed to provide the student closure on the subject and their studies, it also aims to reinforce that the students' learning is not yet over.

Discussion of results: the student experience

Any student expectations of being gradually eased into the subject were quickly removed: the initial diagnostic assessment proving to be confronting for many students. With a mean class score of around 60%, it served as an immediate trigger for each student's personal reflection and topic engagement. Formative portfolio entries identified that, even at the

earliest stages of the semester, students were looking to analyse gaps in their understanding.

Despite having been involved with the PBLs previously, students were slow to get started and find their voices within their unfamiliar groups. This initial hesitation was eventually overcome through tutor persistence and patience with a student led method. After uncomfortable periods of silence, a period which would have traditionally filled with a lecturer's voice, student thoughts and ideas started emerging and soon grew to healthy debates. Tutor roles were essentially aligned with umpiring student engagement and stimulating appropriate discussions. This strategy helped to grow student confidence, particularly when it came to communicating their understanding. The gamble of offering 130 students absolute control over a wiki proved to be one of the biggest successes of the design. In an age where social media and instant information acquisition is ubiquitous, any fears about how a new technology would be embraced proved poorly founded. Of particular note was the online confidence it afforded the international student cohorts. In contrast with traditional classroom challenges associated with participation and integration, the wikis witnessed an eagerness of this cohort to become involved in these group activities. In fact, the volume of data entered by students onto the wikis was so extensive that it actually crashed the allocated course computer network.

The incorporation of practical assessments conducted by local industry partners was a highly effective strategy. With approved on-road paramedics judging the standards of clinical performance and delivering instantaneous, often blunt feedback to students, those previously critical of teaching standards became the teaching team. An unprecedented amount of interest in teaching in the degree has now emerged from industry partners, with many clinically based instructors requesting to share university teaching and assessment material. The partnership has helped to bridge the understanding gap between students, industry and the university.

An unexpected feature that emerged from the formative exam, was the rich data related to learning content that the students had either not retained or misunderstood that could be fed back to teaching staff in previous subjects. The data provided indicators of areas of teaching that could be revisited or revised to promote better student learning. This will now become a standard feedback loop for all members within the teaching team. Students embraced the portfolios as a pre-employment preparation tool. Student pride with their portfolio was evident with a number who presented evidence of their work to potential employers during recruitment interviews.

Although students experienced considerable anxiety relating to the oral assessment task, many reported that it helped them to perform well during subsequent recruitment interviews. Industry parties echoed a perception of improved graduate confidence also. Nearly 130 students were able to all undertake a different viva assessment, based entirely upon their unique specific learning requirements. Student evaluations of the subject and teaching demonstrated a considerable improvement when compared with earlier responses. Feedback praised the personalised investment into student learning.

Conclusion

Our exploration of the causes of student and industry dissatisfaction with the paramedic degree clearly indicated that the problems associated with delivering a successful subject for the completing paramedic were systemic. Enrolment numbers, complex student requirements and a culture of industry complaints about teaching, all perpetuated an ill-fated cycle of misunderstanding and cross-communication. Simultaneously tackling diversified student learning, knowledge retention, university-industry relationships, student morale and learning engagement, was a sizeable challenge. The paramedic capstone pedagogy was developed as a multi-faceted response to this complex problem. The fundamental re-design of the final degree subject as an integrative capstone experience brought together multiple design aspects to create a student focused learning system to guide the student transition into industry practice. The results from the implementation of the design are encouraging.

For university based paramedic academics, most roles encompass Boyer's four scholarships of; *discovery, integration, application and notably; the scholarship of teaching and learning.*[24] Effectiveness within this domain requires that teaching and learning are researched, tested, reflected upon and peer reviewed. This paper seeks to contribute to the dialogue between those linked with educating paramedic graduates towards being more effective beginning practitioners. Despite them being new innovations to paramedic education, most practices incorporated into the subject are not new to higher education. The case described here illustrates the benefits that can be gained by looking beyond our discipline boundaries to explore opportunities to improve practice. The subject also demonstrates that it is possible to considerably improve graduate work-readiness, without having to include an additional year of university, as some are suggesting is necessary (O'Brien, Moore et al. 2014). It is clear from the research that no single teaching approach or assessment method offers the panacea of paramedic education, but what is clear is a need to recognise the different way students learn and be adaptable to embrace new methods and generational technologies.

REFERENCES:

O'Brien, K., Moore, A., Dawson, D., & Hartley, P. An Australian story: paramedic education and practice in transition. Australasian Journal of Paramedicine. 2014. 11(3): 1-13

Thomas, K., Wong, K, and Li, Y. The capstone experience: student and academic perspectives. Higher Education Research & Development. 2014. 33(3): 580-594

Kerka, S. Capstone Experiences in Career and Technical Education. Practice Application Brief No.16. ERIC Clearinghouse on Adult, Career, and Vocational Education 2001.

Berheide, C.W. Doing Less Work, Collecting Better Data: Using Capstone Courses to Assess Learning. Peer Review. 2007. 9(2): 27-30

Henscheid, J,M. Preparing seniors for life after college. Open Campus.2008 (Nov-Dec):21-25

Brock, P.A. From Capstones to Touchstones: Preparative Assessment and Its Use in Teacher Education. Assessment Update. 2004. 16(1): pp 8-9

Hurtig, J.K., & Estell, J.K. A common framework for diverse capstone experiences. Frontiers in Education Conference, 2009. FIE '09. 39th IEEE, Issue Date: 18-21 Oct. 2009

Rowles, J., Koch, D.C., Hundley, S.P., & Hamilton, S.J., Toward a Model for Capstone Experiences: Mountaintops, Magnets, and Mandates. Assessment Update. Progress, Trends and Practices in Higher Education. 2004. 16 (1): 1-16

Fernandez, N.P. Integration, reflection, interpretation: Realizing the goals of a general education capstone course. Assessment matters. 2006. 11(2): 23-26

Smith, M., Brooks, S., Lichtenberg, A., McIlveen, P., Torjul, P., & Tyler, J., (2009). Career development learning: Maximising the contribution of work-integrated learning to the student experience.

Willbarger, J., & Howe, S. Current practices in engineering capstone education: Further results from a 2005 nationwide survey. In IEEE/ASEE. Frontiers in Education.2006.:TIE5-TIE10

Dutson, A.J., Todd, R.H., Magleby, S.P., & Sorensen, C.D. A review of the literature on teaching engineering design through project-orientated capstone courses. Journal of Engineering Education. 1997.86(1): 17-28

Todd, R.H., Magleby, S.P., Sorenson, C.D., Swan, B.R., & Anthony, D.K. A survey of capstone engineering courses in North America. Journal of Engineering Education.1995. 84(2): 165-174

Collier, P.J. The effects of completing a capstone course on student identity. Sociology of Education. 2000. 73(4): 285-299

Carter, H., & Thompson, J. Defining the paramedic process. Australian Journal of Primary Health. 2013.

Shepard, L.A., The role of assessment in a learning culture. Educational Researcher. 2000. 29(7): 4-14

Schraw, G., & Dennison, R.S., Assessing metacognitive awareness. Contemporary Educational Psychology. 1994. 9(4): 460- 475

Wood, D.F. Problem based learning: ABC of learning and teaching in medicine. British Medical Journal. 2003. 326: 328-330

Coffey, A., The clinical learning portfolio: a practice development experience in gerontological nursing. Journal of Clinical Nursing. 14(8): 75-83

Chen, H., Cannon, D., Gabrio, J., Leifer, L., Toye, G., & Bailey, T. Using wikis and weblogs to support reflective learning in an introductory engineering design course. Proceedings of the 2005. American Society for Engineering Education Annual Conference & Exposition, Portland, Oregon

Williams, B. Case based learning-a review of the literature: is there scope for this educational paradigm in prehospital education? Emergency Medical Journal. 2010. 27: 794-799

Sangestani, G., and Khatiban, M. Comparison of problem-based learning and lecture-based learning in midwifery. Nurse Education Today. 2013. 33(8): 791-795

Boyer, E.L. Scholarship reconsidered. Priorities of the Professoriate. Carnegie Foundation for the Advancement of Teaching. Princeton. NJ. 1990.

4.3 Paper 3. Blending Formative and Summative Assessment

This section contains the publication *Blending formative and summative assessment in a capstone subject: "It's not your tools, it's how you use them"* (Houston & Thompson, 2017a).

4.3.1 Background to the publication

This publication responded to the need to formally evaluate the teaching and learning innovations being employed as part of reforms designed to improve graduate outcomes. I was responsible for the design, the implementation and the evaluations of the research, as well as the coordinator and principal educator of the subject being evaluated. The publication was otherwise co-authored with equal contributions to the writing and editing. The publication features within the Journal of University Teaching & Learning Practice.

An authorship declaration is included in Appendix 3.

A copy of the questionnaire instrument used for the data collect presented in this publication is attached in Appendix 9.

The publication is included in the following pages. This is reproduced with journal permission.

4.3.2 Citation

Houston, D., & Thompson, J. (2017). Blending Formative and Summative Assessment in a Capstone Subject: 'It's not your tools, it's how you use them'. *Journal of University Teaching & Learning Practice, 14*(3), 2.

Blending Formative and Summative Assessment in a Capstone Subject: ‘It’s not your tools, it’s how you use them’

Abstract

Discussions about the relationships between formative and summative assessment have come full circle after decades of debate. For some time formative assessment with its emphasis on feedback to students was promoted as better practice than traditional summative assessment. Summative assessment practices were broadly criticised as distanced from the learning process. More recently discussions have refocused on the potential complementary characteristics of formative and summative purposes of assessment. However studies on practical designs to link formative and summative assessment in constructive ways are rare. In paramedic education, like many other professional disciplines, strong traditions of summative assessment - assessment ‘of’ learning - have long dominated. Communities require that a graduate has been judged fit to practice. The assessment redesign described and evaluated in this paper sought to rebalance assessment relationships in a capstone paramedic subject to integrate formative assessment for learning with summative assessment of learning. Assessment was repositioned as a communication process about learning. Through a variety of frequent assessment events, judgement of student performance is accompanied with rich feedback. Each assessment event provides information about learning, unique to each student’s needs. Each assessment event shaped subsequent assessment events. Student participants in the formal evaluation of the subject indicated high levels of perceived value and effectiveness on learning across each of the assessment events, with broad agreement also demonstrated relating to student perceptions for preparedness: ‘readiness to practice’. Our approach focused on linking assessment events, resulted in assessments providing formative communication to students and summative outcome information to others simultaneously. The formative-summative dichotomy disappeared: all assessment became part of communication about learning.

Keywords

formative assessment, summative assessment, paramedic education, personalised learning, integrated assessment, communication

Introduction

Designing curriculum that is responsive to broad student learning needs and disciplinary values, as well as to the expectations of graduates' potential future employers, is a constant challenge for educators. This challenge extends to the ways content is provided and learning assessed, enhanced and certified. Of all the key aspects of the learning process, assessment practices remain some of the most contentious. Assessment in higher education has long been the focus of theorising, debate and disagreement. The points of debate encompass the appropriateness and utility of particular assessment methods and instruments; the nature of assessment as objective measurement or testing versus subjective judgement; purposes of assessment; and the relationship of assessment to learning (see, for example, Boud 1998; Elton 2004; Elton & Johnson 2002; Knight 2002). The relationship of assessment to learning can be characterised in many ways, as separate and independent, interconnected, integrated and even itself as learning (Dann 2014).

The multiple perspectives on the purposes of assessment and the relationships between sustainable (Boud & Soler 2015), summative and formative assessments together present real, practical dilemmas and challenges for academics as teachers, who are tasked with promoting student learning as well as certifying student performance. A key challenge is accommodating and balancing summative assessment of learning and formative assessment to support future learning beyond the course of study. Paramedic education provides an example of the interplay of these challenges. The body of this paper presents a case study of the redesign and implementation of a final-year paramedic subject; the project was intended to shift the focus of assessment from exclusively assessment for certification of learning to a broader, more balanced perspective integrating formative and summative purposes. The critical component of the redesign was not using different assessment tools – although that did occur – but rather reconceptualising assessment as a communication process about learning.

The next section provides a brief discussion of the debates about assessment and, in particular, perspectives on the relationship between formative and summative assessment. This sets the educational perspective of assessment as a complex communication process about learning that underpinned the design. We then outline the challenges concerning assessment in the context of paramedicine, before providing a detailed description of the new design, which aimed to address those challenges in practice. Student responses to their experience of the design-in-practice gathered through a formal evaluation of the design strongly indicate that students found the design beneficial for their current and future learning. The final section of the paper reflects on the benefits gained by representing

assessment as integral to a communication process about learning both within and beyond the subject, with formative and summative assessment purposes working together.

Perspectives on assessment

Student development through learning is a core function of universities. Student entry into the system, progress through subjects, graduation and entry into higher degrees all require the certification of student attainment. Traditional summative assessment is a well-established tool for documenting and communicating student achievement. Usually linked with the end of a learning experience, such as a subject or course, summative assessment serves to judge the learning achieved by the student (William 2000). For external stakeholders, these summative judgements are seen to offer an indicator of whether a student has “made the grade”. However, while there may be a relationship between grades awarded and learning achieved, the former do not always assure the latter. Nevertheless, the traditions of summative assessment practices within higher education are deeply entrenched, despite longstanding, extensive criticism of the assumptions underlying established practices, as well as the practices themselves (Boud 1998; Elton 2004; Knight 2002). Major emphasis continues to be placed upon credentialing student performance in a way that can be interpreted by others external to the educational environment. Knight (2002, p.276) describes summative assessment as serving to “feedout” information on student achievement.

At much the same time as the assumptions, practices and value of summative assessment were being widely questioned, other purposes for and approaches to assessment were being explored. Bearman et al. (2014) identify three distinct purposes: certification of achievement, support of student learning and providing the learner with the skills to judge their own work that they can continue to use beyond their studies. Over recent decades, assessment theorists have increasingly advocated the use of assessment as a tool *for* learning (van der Vleuten et al. 2017; Nicol & McFarlane-Dick 2006). Assessment is seen to have value in helping inform students’ learning, instead of just judging how well they have learned up to a given point in time. Formative assessment is broadly synonymous with the notion of assessment for learning. It looks to student future learning that can occur as a result of assessment events, rather than to the outcomes of prior learning (Nicol & McFarlane-Dick 2006). It focuses on feeding back information to students to guide subsequent learning; hence Knight (2002) labels formative assessment as serving a feedback purpose. In summary, formative (feedback) assessment is intended to help students with future learning, whereas summative (feedout) assessment warrants or certifies student achievement to others, including potential employers.

Lau (2016) recounts some developments in assessment thinking and practice that she identifies as contributing to a dichotomy in the assessment literature between formative assessment and summative assessment, including attempts to promote assessment for learning. The terminology of summative and formative assessment traces back to the work of Scriven (Tyler et al. 1967) in educational-program evaluation. He distinguished but linked formative and summative evaluation as processes leading to judgements about opportunities for improvement in ongoing activities and about the worth of a completed activity, respectively. In the late 1960s and early 1970s Bloom introduced the terms “summative” and “formative” into the lexicon of the assessment of student learning. Again, formative assessment was attached to improvement of learning in progress, whereas summative assessment was attached to making judgements about achievement at the end of a course. In a period of increasing external pressure for certification and accountability, the language of summative assessment was adopted, but the connection to formative assessment was lost.

The language and practices of formative and summative/traditional assessment became the key focus of contestation between two contrasting paradigms of learning: the pushback in support of formative assessment and the “new” learning and assessment paradigm created a (false) dichotomy in the literature. That apparent dichotomy continues to impede some contemporary assessment thinking and much practice. Lau (2016, p.523) observes that “it is time to move away from this dichotomy”: this observation is supported by a growing body of assessment literature. More actively, Lau (2016, p.510) “invites those in higher education to consider the fundamental idea that formative and summative assessment need to work in harmony, and should not be seen as contrary to each other”.

Knight (2002, p.277) identifies a series of similarities between formative and summative assessment: all assessment looks for evidence of achievement; judgements are made about the match between evidence and criteria; judgements invoke information and communication. A key difference is the intended recipient of the information about learning produced by formative and summative assessment events. Knight suggests that progress can be made by focusing not on the tools and methods of assessment, but rather on “exploring assessment as complex systems of communication, as practices of sense-making and claim-making” (Knight 2002, p.285): in other words, as practices of learning.

If assessment events are positioned as components of complex communication processes for learning, then the focus of attention can be shifted from the tools of assessment to considerations of the qualities and utility of the judgements and information those events produce, and of the communication that flows from them. From a communications

perspective, formative and summative assessment are distinguished by the characteristics of the information produced, the communication channel through which the information is transmitted and the main intended recipient/user of that information (Johnson & Johnson 1991; Winstone et al. 2016). Formative assessments provide rich information and judgements about student learning that are mainly fed back into the central dialogue between teachers and learners to inform future student learning.

Summative assessment produces representations of highly aggregated information and judgements in the form of grades or marks that are fed out to communicate with other interested parties external to the central dialogue between teachers and learners. Both of these communication processes can begin from the same assessment event: the formative communication channel contributes to sense-making from the event, while the summative channel contributes to claim-making about the event. Seen in this context, the false dichotomy – "formative good, summative bad", as Lau (2016) labels it – dissolves: formative and summative become interdependent, as formative assessment feeds into summative and enhances the quality of information on which final judgements are made and communicated.

In the case described below, framing assessment as integrated with learning in a complex communication process, rather than as a separate testing/measurement process, had multiple benefits for all involved, but particularly for students. This paper adds to the growing body of work, such as that by Broadbent et al. (2017), that illustrates ways to bridge in practice the often- perceived "gulf" to reconnect formative and summative assessment as parts of a communication process about learning.

Assessment challenges in paramedic education

Paramedic education provides a clear example of the interplay of the challenges of balancing and integrating assessment purposes. The broader community assumes that graduates have been certified as having learned enough to practice safe and effective care of emergency/pre-hospital patients. Employers expect that graduates are "road-ready". Paramedic educators expect that graduates can function as critically reflective practitioners in the discipline, able to judge the quality of their own in-field performance and learn from reflection and feedback on their performance. End-of-course assessment needs to provide information that feeds out to other parties to verify that graduates are competent to begin practice, but also feeds forward to help graduates' future learning as reflective practitioners; that is, it needs to serve both summative and formative purposes. The challenges of accommodating and balancing summative assessment of learning and formative assessment for (future) learning beyond the course of study are particularly evident in subjects scheduled towards the end of a student's study program.

Previous versions of the final-year, final-semester subject that is the focus of this paper had featured exclusively summative assessment at the end of the subject. The final intensive assessment event served as a gatekeeping exercise. Students were required to pass this final hurdle to progress beyond their degree and into the industry. Teaching targeted preparation for this test. However, feedback from both students and external stakeholders confirmed the views of teaching staff that the assessment design was prompting grade-seeking behaviours from students, and that it inhibited, rather than promoted, learning. Moreover, students' grades were not seen as an accurate indication of their learning or capability (Thompson et al. 2015). In response to these criticisms and concerns, the subject was redesigned as a capstone experience, with particular attention given to integrating assessment events of various types into the whole learning experience. Key intentions were to improve the student relationship with assessment while simultaneously satisfying the broader stakeholder interests in graduate capabilities.

The design solution: combining formative and summative assessment events in a capstone experience

The unifying concept behind capstone experiences is the intention to help students look both back and forward as a bridge between theory and practice. Durel (1993, p.223) describes a capstone as:

> coming at the end of a sequence of courses with the specific objective of integrating a body of relatively fragmented knowledge into a unified whole. As a rite of passage, this course provides an experience through which undergraduate students both look back over their undergraduate curriculum in an effort to make sense of that experience, and look forward to a life by building on that experience.

Capstones are a significant personal and professional transitional experience for students as they prepare for their post-graduation lives (Lee & Loton 2013). The challenge of designing capstone subjects is to “bring it all together” for the students. While there are many variants, most share common features of immersing the student into simulated or actual real-world practices that draw upon their earlier curriculum experiences. Those involved with the design of assessment for these subjects are especially challenged: to offer students the detailed feedback and guidance required to help them bring their previous learning together as well as to ready them to face industry or other expectations. They must also provide others beyond the course with assurances of final student learning and achievement.

While the incorporation of capstone experiences is well reported in several disciplines, such as engineering and business, fewer examples exist within the health-education literature. At the time of the initial design of this project, no literature was found on capstone experiences within paramedicine. However, extensive literature highlights the challenges of the theory-practice and student-practitioner gaps between university paramedic education and the industry (Kennedy et al. 2015). To be successful, any design solution would need not just to develop student skills and knowledge in context of their future profession, but also to address the differences between identifying as a student and identifying as a paramedic. Two key influences were central to re- shaping the subject.

Students as individual learners

First, consideration was given to individual student needs and expectations. It was clear to academic staff that, despite all students having met prerequisite subject outcomes, they were seldom starting the subject from the same place. They held very different levels of understanding and mastery of the prior curriculum, as well as differing levels of confidence and maturity, previous life experiences and prior clinical experiences. Different starting

places for students meant that there would also likely be different student expectations and requirements. The redesign needed to invest effort into the specific requirements of each student simultaneously.

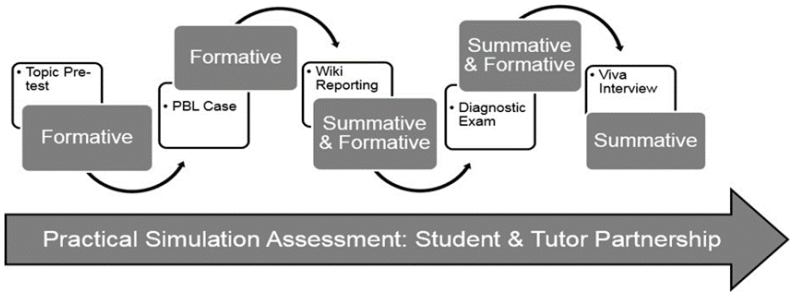
Bringing industry practice to the classroom

The long-established teaching formula for the subject comprised lectures, practical classes and tutorials with a final examination. Despite efforts to contextualise content to the pre-hospital industry, classes remained far removed from the day-to-day practices of paramedics. Students experienced assessment events infrequently, which was at odds with actual practice, in which every component of a paramedic's work is potentially scrutinised. Every case paramedics attend has the potential for high-stakes consequences, yet during training, judgement decisions were usually reserved for the completion of a block of study. The subject redesign sought to provide a learning environment that more closely aligned the teaching practices in the university with the practices and standards of the industry. Another unique feature of paramedic work relates to the extremely random and unpredictable case mix. With paramedics having little advanced warning of the cases they are called to, they have no way of fully predicting the skills and knowledge they will need, and at times they have only a few minutes to prepare. University learning and assessments, by comparison, are traditionally clearly forecast, with performance expectations clearly defined and optimal preparation time and support provided. The subject redesign sought to mimic the uncertainty of paramedic practice throughout the subject.

The assessment: Redesigned and redefined

Assessment was at the centre of the design to accommodate the complex of relationships between the students and industry and university expectations. Figure 1 provides an overview of the assessment events and the connections between them. The subject included two parallel streams of assessed learning activities: one focused on broad knowledge and application, the other on developing practical skills and thinking like a paramedic. The text provides a detailed explanation of each event, the information it produces and the relationship to subsequent learning and assessment activities.

Figure 1. Formative: summative assessment relationship



Diagnostic pre-testing (feedback)

Without prior warning, the students' first encounter with the capstone subject is a multiple-choice exam that samples content drawn from across the full prerequisite curriculum. The time-restricted online quiz offers each student diagnostic feedback regarding their readily accessible understanding of curriculum content (as opposed to traditional tests where the student can study in advance). The test is purely formative, offering students insight into their knowledge retention from earlier study, while highlighting gaps in their understanding. The immediate feedback loop to students simultaneously affirms areas of mastery and provides guidance on areas for the student to revisit and consolidate as a solid foundation as they embark on new paths of study.

Problem-based learning and wiki reporting (feedback and feedout)

Problem-based learning (PBL) has a long history of use within health-care education. The hallmark of PBL is students directing classroom enquiry, sharing their existing knowledge as the class attempts to unravel the features of a clinical dilemma or case. With a proven track record in medicine and a student-centric approach to learning, PBL presented an alternative to the former teacher-centric format of the subject examined in this study. The PBL process readily lends itself to the use of authentic paramedic cases, where distinct features of the chronological paramedic process of care (Carter & Thompson 2013) can be applied. However, in contrast to the usual teaching practice of providing clear and prescriptive learning objectives before each session, all information is deliberately withheld from students. Students arrive at class with no information about what curriculum themes are to be explored, or what knowledge is likely to be called upon. This mimics the authentic problem-solving faced by paramedics, who are routinely dispatched to patient cases with very limited information. The broad learning objectives are instead summarised at the end of the PBL session, with an additional list of student-nominated specific learning needs. Through minimising opportunities to prepare or rehearse prior to class, this approach encourages students to become aware of their own working levels of understanding. Student self-directed reading that targets their uniquely identified requirements for learning replaces traditional pre- reading activities.

The reporting component of PBL was also modified. In the traditional PBL format, students leave the class with a selection of self-identified learning topics to research before returning to present what they have learned to their peers. Optimal PBL class sizes, often fewer than 10 students in medicine programs, allow all students to routinely report back to the class. A minimum class size of around 20 students in the paramedic program challenged the viability of inclusive, participatory, in-class reporting. Our solution was to amalgamate the in-class and online environments, with each PBL group being assigned a case wiki. The university-based wiki platform enables the participants to develop and control the content on the page. Students are not constrained by limited face-to-face reporting opportunities, and can continue the process of constructing knowledge within their group beyond the classroom. As controlling authors of the case wiki, they can collaborate through sharing, editing and annotating as they assemble a single document that reflects the contributions and scrutiny of multiple users. Students are assessed on their participation and contributions within both the PBL format and the wiki. As the wiki page is dynamic, it offers both formative and summative assessment opportunities: student contributions are scored, as well as feeding back into and guiding ongoing individual and peer learning.

Practical application: Student-tutor consensus (feedback and feedout)

The ability to make effective judgements and apply a wide range of clinical skills on demand is a constant requirement of paramedic practice. The subject had always featured practical student activities, acknowledging a need for a paramedic graduate to be able to act on their knowledge when needed. However, in contrast to the high stakes and potentially catastrophic consequences linked to every paramedic patient encounter, the subject originally only offered a single summative assessment at the end. Moreover, despite students being expected to achieve the key learning objective of developing critical thinking and reasoning skills, all judgement about how they performed in practical scenarios remained solely with tutors. Now students are assessed by others, but also assess their own performance in each class they attend, contributing to a change in the student relationship with assessment. The development and introduction of a student-tutor consensus marking approach (Thompson, Houston et al. 2016) sought to capture both the summative aspects of how a student performs (as determined by a tutor) and the learning that the student achieves through the assessment event. The assessment has two parts. First, a tutor observes and judges a student performance against set criteria informed by the paramedic process of care (Carter & Thompson 2013). This outcome score constitutes half of the student's result for the assessment. This tutor judgement, however, is initially withheld until the student has critiqued the effectiveness of their own efforts against the same criteria. Where student and tutor reach consensus on the effectiveness of the performance, a score is awarded:

disagreements are the focus of “calibrating conversations” to clarify understanding. This encourages students to apply a “paramedic lens” to critique their own work. Rich in feedback and useful as a benchmark for student performance, the student-tutor consensus approach combines formative and summative assessment purposes.

Diagnostic multiple-choice question exams (feedback and feedout)

The capacity of multiple-choice question (MCQ) exams to assess a large amount of knowledge in a short period has made them a popular tool for final summative assessment events. Our capstone methodology includes the use of an MCQ exam at a midpoint in the semester, as a diagnostic tool to evaluate student understanding at this point and a guide for ongoing learning. The material being examined is extracted from the class wikis, which in turn has been informed by the students themselves during the PBL classes. In other words, the students have effectively contributed to the design of their own exam through indicating what specific areas within the broader curriculum that they need to learn. The MCQ exam feeds back to the student on how effectively this has been achieved.

The exam is divided amongst a number of key themed sections, which correspond directly to each of the PBL events. Students receive a detailed summary of their individual performance, usually within 24 hours of the assessment. The summary includes a learning profile featuring their score within each themed section, as well as key learning topics to review within that theme. Students can readily identify their strengths and weaknesses across the assessed content and recognise the areas of the curriculum requiring their greatest investment for learning. Summative grades are assigned for the MCQ exam, but the personalised student performance profile with specific direction to areas for attention also provides formative feedback to guide learning.

Final oral exam (feedback and feedout)

When graduates apply for a paramedic position, it is common practice within many ambulance services to use a clinical interview, or oral exam, to evaluate a potential employee’s clinical knowledge and reasoning. If the graduate fails to perform at this stage there are clear consequences for their employability. Previously, no support had been offered to prepare students for this critical milestone. An oral exam was introduced as the final assessment event in response to this need. In an attempt to provide authenticity, student responses are judged by industry partners, with the standard set to their expectations of their paramedic peers. The content examined in the oral exam is again linked to the individual learning requirements of each student, as indicated by the diagnostic exam earlier in the semester. Following the MCQ exam, each student is given a list of topics

that directly relate to the area of the exam in which they performed least well. Students have around six weeks to focus their study preparation towards approximately 40 topics on the list, with the knowledge that they will be asked to convince a panel of assessors of their understanding of three topics randomly selected from the list on the day. While students are exposed to the high-pressure environment created through simulated interview conditions, there is complete transparency on how they will be assessed, and on exactly what topics. This is the final summative event in the teaching program; however, the addition of a one-on-one student “exit interview” immediately after the exam gives students formative feedback on their performance and advice for ongoing development beyond the degree.

Transforming assessment relationships

The capstone design is centred around transforming assessment relationships. We have endeavored to transform the role of assessment of learning within the subject with a series of bridges connecting each assessment event to another; for example, the PBL informs the wiki, which informs the exam, which in turn informs the oral exam (Figure 1). Assessment events provide both formative and summative information. The design shifts the student relationship with assessment from engaging with a single test to immersion in an ongoing assessment as a learning dialogue interwoven with all programmed learning. Further, we have empowered the students to help inform aspects of their own assessment.

Student perceptions of the assessment design

In late 2015 the design was formally evaluated. Students undertaking the subject were informed of the study via email, and invited to participate in the evaluation. They were advised that participation in the study was entirely voluntary and that they were free to withdraw at any time. Of the class of 92 students, 90 participated. A paper-based survey was administered following the completion of the subject’s final assessment event. Participants were asked to rate their level of agreement with a series of statements that were linked to each teaching and assessment item in the subject. The response categories – strongly disagree, disagree, neither agree nor disagree, agree and strongly agree – were consistent with standardised student evaluation tools used in the university, and therefore familiar to the participants. Table 1 summarises the results as percentage responses to each category for each statement.

Table 1. Student responses to the design components.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Diagnostic pre-test					
It encouraged me to review my existing knowledge and understanding	1.1	6.7	23.3	55.6	13.3
PBL – Wiki					
I felt my contributions were valued	1.1	4.5	12.4	58.4	23.6
My knowledge and understanding improved as a result of PBL activities	1.1	4.5	14.6	53.9	25.8
The PBL cases helped to improve my critical thinking	0	2.3	11.4	56.8	29.5
I became more confident with talking in front of my peers	1.1	10.0	18.9	45.6	24.4
Collaborating with other students on the wiki was effective for my learning	1.1	11.1	22.2	47.8	17.8
Reporting on the wiki helped extend my learning outside of the classroom	1.1	6.7	12.2	57.8	22.2
Practical assessments (student-tutor consensus)					
The scenarios effectively combined my knowledge, reasoning and practical skills	0	0	3.3	53.3	43.3
I learned through observing my peers being assessed	0	1.1	4.4	42.2	52.2
Self-assessment is an important skill for paramedics	0	1.1	2.2	34.4	62.2
I found the student-tutor consensus marking format:					
• Was effective for my learning	0	2.2	6.7	57.8	33.3
• Improved my ability to critically analyse my practice	0	1.1	4.4	61.1	33.3
• Helped me to develop skills I can use in my future profession	0	1.1	11.4	51.1	36.4
Diagnostic exam					
The exam content effectively represented the PBL and wiki material	1.1	5.6	27.0	50.0	15.7
The exam mid-way in the semester encouraged me to further develop from the feedback/results	0	2.2	18.0	43.8	36.0
Oral exam					
Preparing for the viva was an intense self-directed learning experience	0	1.1	10.2	42.0	46.6
Encouraging me to focus my learning upon an identified area of learning need was valuable	0	0	9.1	37.5	53.4
This form of assessment encouraged me to improve my understanding of topics	0	1.1	6.8	36.4	55.7
The viva was a useful experience in my preparation for future recruitment events	0	1.1	5.6	40.4	52.8

About 70% of participants agreed (combined “agree” and “strongly agree” responses) that the diagnostic pre-test encouraged them to review their existing knowledge. While a substantial group were neutral about its impact, only 8% disagreed that it achieved its purpose. Respondents viewed this part of the experience least positively, perhaps reflecting its very early placement in the subject, before students had been briefed on the subject design and intent. It is noteworthy that the levels of participant agreement with statements about the intended learning benefits of the assessment events increased for every subsequent component, culminating in over 90% agreement that the oral exam encouraged focused learning (92%) and was useful in preparation for future recruitment events (93%).

Other notable results showed that for 86% of respondents the PBLs helped improve critical thinking, and 80% agreed that the wikis extended their learning beyond the classroom. This response validated the decision to blend PBL and wiki formats. (It is noteworthy that after the subject concluded, participants reported verbally that they were still using the wikis for self-directed study even as graduates attempting work-based exams. This is an indication of the sustainability of this assessment practice.)

Most participants (87%) agreed that the practical assessments served an integrative function. Students recognised the importance of the self-assessment as a valuable skill for

paramedics (96% agreement). They also agreed that consensus grading was effective for learning (91%) and fair (94%), and that it helped develop skills for their future profession (87%).

The results paint a comprehensive picture that many participants viewed the delivered and experienced curriculum characterised by rich assessment conversations positively. Summative and formative differences became blurred in this approach. The student relationship with assessment was redefined, with assessment unable to be separated from any of the conventional learning activities: all assessment events were learning opportunities and most learning interactions were assessment events. Most assessments contributed to student credentials and aggregate grades; all assessments also provided feedback on student performance and guided improvement.

Students' engagement is directly influenced by their ability to readily identify a purpose or relevance to their learning tasks. For those students studying paramedicine, the direct feature of being able to see the need for the learning, and to receive both judgement and feedback about both their levels of understanding and ability to perform the tasks, proved a powerful incentive. With our model, each student was always identifiable, and was valued for their contributions towards learning collaborations as they negotiated their own unique study journey through the subject. As all students produced different work in response to different challenges and ultimately sat a unique oral exam, engagement was palpable.

The design offers efficiency to teaching and learning. Students' energies were put to use only upon the areas of greatest need.

Conclusion

Debates about assessment generally concern the learning purpose, process and tools and their relationships to students' actual learning. Some argue that formative and summative assessment are different and separate, and require different tools. The case presented here illustrates that formative and summative assessment are interlinked and interdependent: it is not the tools that differentiate summative from formative assessment, but rather the way that information and judgements generated by applying the tools are used.

Taras (2005) presents the argument that formative assessment cannot occur except as a consequence of summative assessment: summative assessment that generates feedback becomes formative assessment. This characterisation of the relationship presents formative and summative assessment as interdependent, rather than independent. Summative assessment looks back, while formative looks forward. Taras equates judgement with

summative assessment. However, her argument seems to discount one aspect of the summative: formative relationship fundamental to the seminal work of Scriven and Bloom: timing. For them, although both types generate judgements, formative assessment occurs during the learning process, while summative assessment occurs at the end of it. Consequently, the presence of judgement is not a useful characteristic for differentiating formative and summative assessment.

We argue, as does Knight (2002), that what fundamentally differentiates formative from summative assessment is the use that is made of assessment-based judgements and information in subsequent communication processes. In our case almost every assessment event contributed to two streams of communication. The first was the ongoing dialogue between teachers and students about student learning throughout the subject. This central dialog shaped the personalised learning pathway for each student, noted achievement and sign-posted future learning needs. It began with almost the first learning experience of the subject – the diagnostic exam – and concluded after the final oral assessment event and exit interview. This communication process closely integrated learning experiences, assessment events and detailed information about the ongoing interplay between them. From beginning to end, assessment information fed forward into student learning: the communication was essentially formative.

The second communication process honoured the obligation to the industry, potential employers and others interested in student achievement to provide meaningful representations of student learning. Most assessment events produced an indicator of student achievement – information that contributed to the student's final grade for the subject. Staff involved in teaching and assessing students both before and since the redesign strongly expressed the opinion that the final grade from the redesigned approach provided a usable (and far more valid) verification of student learning as input into communication with others outside the particular learning environment.

Virtually all the assessment events contributed to summative judgements and certification of student learning.

Our argument differs from Taras's in one further way: she asserts that "the *process* [italics in original] of formative assessment can only be said to have taken place when feedback has been used to improve the work" (Taras 2005, p.3021). We argue that the process of formative assessment can only be said to be complete when the student has used the feedback to improve multiple aspects of themselves, not just "the work": these aspects include their performance, their ability to judge the quality of their own performance and their

ability to regulate their own future learning. The assessment design introduced into the subject seems to have effectively communicated with students to encourage these forms of learning, as well as with others about students' achievement: the artificial dichotomy between summative and formative assessment essentially disappeared, replaced by real interdependence between them.

References

Bearman, M, Dawson, P, Boud, D, Bennett, S, Hall, M & Molloy, E 2016. Support for assessment practice: developing the Assessment Design Decisions Framework. *Teaching in Higher Education*, 21(5), pp. 545-556.

Boud, D 1998. Assessment and learning – unlearning bad habits of assessment. Paper presented at the Effective Assessment at University Conference, University of Queensland, Brisbane, 4-5 November.

Boud, D & Soler, R 2016. Sustainable assessment revisited. *Assessment & Evaluation in Higher Education*, 41(33), pp. 400-413.

Broadbent, J, Panadero, E & Boud, D 2017. Implementing summative assessment with a formative flavour: a case study in a large class. *Assessment & Evaluation in Higher Education*, pp. 1-16. doi:10.1080/02602938.2017.1343455.

Carter, H & Thompson, J 2015. Defining the paramedic process. *Australian Journal of Primary Health,* 21(1), pp. 22-26.

Dann, R 2014. Assessment as learning: blurring the boundaries of assessment and learning for theory, policy and practice. *Assessment in Education: Principles, Policy & Practice*, 21(2), pp. 149-166.

Durel, R 1993. The capstone course: A rite of passage. *Teaching Sociology*, 21(3), pp. 223-225.

Elton, L & Johnston, B 2002. *Assessment in universities: A critical review of research*. Learning and Teaching Support Network Generic Centre, York, UK.

Elton, L 2004. A Challenge to Established Assessment Practice. *Higher Education Quarterly*, 58(1), pp. 43-62

Johnson, D W & Johnson, F P 1991. *Joining together: Group theory and group skills* (5th ed.), Prentice Hall, Englewood Cliffs, NJ

Kennedy, S, Kenny, A & O'Meara, P 2015. Student paramedic experience of transition into the workforce: A scoping review. *Nurse Education Today*, 35(10), pp. 1037-1043.

Knight, P T 2002. Summative assessment in higher education: Practices in disarray. *Studies in Higher Education*, 27(3), pp. 275-286.

Lau, A M S 2016. “Formative good, summative bad?” – A review of the dichotomy in assessment literature. *Journal of Further and Higher Education*, 40(4), pp. 509-525.

Lee, N & Loton D J 2013. *Capstone curriculum across disciplines: Synthesising theory, practice and policy to provide practical tools for curriculum design*. Office for Learning and Teaching, Sydney.

Nicol, D J & Macfarlane-Dick D 2006. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*, 31(2), pp. 199-218.

Taras, M 2005. Assessment – summative and formative – some theoretical reflections.*British Journal of Educational Studies*, 53(4), pp. 466-478.

Thompson, J, Grantham, H & Houston D 2015. Paramedic capstone education model: Building work-ready graduates. *Australasian Journal of Paramedicine,* 12(3).

Thompson, J, Houston, D, Dansie, K, Rayner, T, Pointon, T, Pope, S, Cayetano, A, Mitchell, B & Grantham, H 2017. Student & tutor consensus: a partnership in assessment for learning. *Assessment & Evaluation in Higher Education*, 42(6), pp. 942-952

Tyler, R W, Gagné, R M & Scriven, M 1967. *Perspectives of curriculum evaluation*. Rand McNally.

van der Vleuten, C, Sluijsmans D & Joosten-ten Brinke D 2017. Competence Assessment as Learner Support in Education. In Mulder, M (ed.), *Competence-based Vocational and Professional Education*, Springer, Cham, Switzerland.

William, D 2000. Integrating summative and formative functions of assessment. Keynote address, First Annual Conference of the European Association for Educational Assessment, Prague.

Winstone, N E, Nash, R A, Parker, M & Rowntree J 2017. Supporting learners’ agentic engagement with feedback: A systematic review and a taxonomy of recipience processes. *Educational Psychologist*, 52(1), pp. 17-37.

4.4 Paper 4. A Bridge to Being a Practitioner

This section contains the publication *A bridge to being a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject* (Houston & Thompson, 2017b).

4.4.1 Background to the publication

While the previous publication (Section 4.3) presented and discussed the capstone study findings in relation to integrated assessment practices, this publication reported and discussed the findings in relation to authenticity of the teaching design and graduate perceptions of preparedness to start work as a paramedic. I was responsible for the project conception, research design and data collection. Dr Don Houston and I equally contributed to the writing and editing of the publication, which was produced primarily for presentation at the 2017 HERDSA conference. The order of the authorship reflects my inability to attend the conference due to other commitments and of Dr Houston's presentation of the project. This publication featured at the 2017 HERDSA conference and was later published in the HERDSA journal.

An authorship declaration is included in Appendix 4.

This publication was awarded the conference prize for *Best Paper on an Authentic Learning Environment.*

A copy of the questionnaire instrument used for the data collect presented in this publication is attached in Appendix 10.

The publication is included in the following pages. This is reproduced with journal permission.

4.4.2 Citation

Houston, D., & Thompson, J. (2017). A bridge to 'being' a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject. *Publications, Conference Proceedings, Research and Development in Higher education: Curriculum Transformation, 40*, 175-185. Higher Education Research and Development Society of Australasia, Sydney, Australia

A bridge to ‘being’ a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject

Issues of ‘pulling the course together’ for students and facilitating the transition to worklife beyond study concern many disciplines. Paramedicine is a particularly challenging environment for curriculum design and implementation given the complexities of being a paramedic and the consequent challenges of providing authentic, contextualised learning experiences for students. Capstone experiences help students to both look back over their course and look forward to life beyond study. Our project to design, implement and evaluate a paramedic capstone subject contributes to thinking about key factors in capstone design. The design is heavily influenced by staff experiences of ‘being a paramedic’. It fundamentally repositions the student from learning about paramedicine, into immersion in lived experiences of the profession. A traditional learning focus on ‘content’ is replaced by ‘practice-in-context’. Students experience messy, complex situations. They are required to interrogate, extend and apply their knowledge and understanding. Student performance, and judgements about their own performance are calibrated against industry expectations through conversations with practicing paramedics.

Data on student perceptions of the experience indicate that the subject achieved two key objectives: enhancing preparedness for the paramedic role and calibrating students’ learning against industry expectations.

This experience draws on designers’ and teachers’ own lived experience of ‘being’ a practitioner in the discipline. Their ability to help students learn about ‘being’ relies on what we have named pedagogical practice-in-context knowledge. Our evaluation of the curriculum points to the central role of pedagogic practice-in-context knowledge in creating an immersive experience in which students learn to be, by being.

Keywords: capstone experience, design, pedagogical practice-in-context knowledge

Bridging to practice: the role of capstone experiences

Addressing issues of transitioning out of higher education study and into work or other environments has long been of concern to many disciplines. The graduate employability agenda dominating contemporary debates around higher education in Australia and elsewhere has brought even greater attention to these issues. One mechanism that has

been gaining increasing attention is the use of capstone experiences in their many guises. Culminating experiences such as final year practical projects in the engineering disciplines, honours theses and work placements and practicums are well established in higher education in Australia. In recent years the term ‘capstone experience’ has been adopted from the US as a generic label for learning experiences that are designed to assist students to bridge from study to life beyond study. Such experiences have a long history in USA with some tracing capstone-like culminating learning experiences back to the late 18th century (Alstete and Beutell, 2016) but with significant expansion from the late-20th century (Kinzie, 2013).

The unifying concept behind capstone experiences is the intention to help students to both look back and look forward as a bridge between theory and practice. Durel (1993, p. 223) describes a capstone as:

> coming at the end of a sequence of courses with the specific objective of integrating a body of relatively fragmented knowledge into a unified whole. As a rite of passage, this course provides an experience through which undergraduate students both look back over their undergraduate curriculum in an effort to make sense of that experience, and look forward to a life by building on that experience.

Capstones have been situated as a significant personal and professional transitional experience for students as they prepare for their post-graduation lives (Lee & Loton 2015). While there is a large literature on capstone courses (e.g. Lee and Loton (2015) identified 500 reference sources), much of the literature describes particular examples with until recently, little research to theorise or model capstone experiences or evaluate their effects on student learning (Kinzie, 2013; Lee and Loton, 2015). Beyond general agreement on intent, capstone experiences seem to be characterised by variety. Rowles et al. (2004) identify three ‘organizing models’ – mountaintops, magnets and mandates - that influenced the development of capstone experiences at their university: Mountaintops cross disciplines; magnets draw together learning within a single discipline; mandates are organised to meet external requirements such as professional registration. While the three models shared common underlying design principles, the principles were enacted through a range of designs. Alstete and Beutell (2015) similarly identify a diversity of capstone designs in business schools across the USA.

Recently efforts have been made to develop frameworks to help to systematically compare and differentiate capstone designs. Healey et al. (2013) propose that capstones can be characterised according to their position in relation to five key dimensions: conception – the overarching structure of the capstone; function - the emphasis on particular goals;

organisation - the ways in which students go about their work as a class; location - the primary place of learning; outputs – the types of artefacts produced for assessment or in the course of the capstone experience. Following Healy et al. (2013) and others, Lee and Loton (2015) identify the key features of capstone curriculum as:

- integration and extension of prior learning;
- authentic and contextualised experiences;
- challenging and complex problems;
- student independence and agency;
- a concern with critical inquiry and creativity, and;
- active dissemination and celebration.

These efforts to identify key features of effective capstone experiences begin to provide a basis to systematically describe, analyse and evaluate particular projects to design and implement such experiences. Without such frameworks, it is difficult to identify and share what works, for whom and in what circumstances and contexts.

Recent reviews of the literature (French et al., 2015; Lee and Loton, 2015) note, specifically in relation to degrees in Australia, a distinct shortage of information about designing for quality and about the experiences of students undertaking capstones. In the American context, Kinzie (2013) makes the observation that capstone experiences have a long history ‘yet we know little about the nature of the experience for student learning’: Kinzie’s analysis of data collected through the National Survey of Student Experience in the USA over multiple years indicates broad perceived benefits from capstone experiences however the data does not provide any clear pointers to what works for which students, how or why. Similarly, van Acker et al. (2014, 1060) note “data on the experiences of students undertaking capstones, [and] the views of lecturers teaching them … provide untapped areas for further research”.

In our investigations we were unable to find any research on the deliberate use of transition pedagogies in paramedicine to help students to bridge the theory-practice gap by looking back to consolidate learning from their degree and looking forward to ‘road readiness’.

Our work adds to the body of research by: first describing the process we followed to develop and implement a capstone experiences in the specific context of paramedic

education; secondly, analysing quantitative data from participating students on their perceptions of the value of the experience in helping them to look back and look forward; and third, reflecting on the implications for others engaging with capstone pedagogy of our experience as the designers, teachers and evaluators of the capstone subject. We propose that a key feature of the subject that contributed to its effectiveness is the expertise of the design and teaching team. This capstone 'bridging to being' experience shifts well beyond teaching and learning disciplinary knowledge and skills drawing on designers' and teachers' own lived experiences of 'being' a practitioner in the discipline. Their ability to help students learn about 'being' relies on what we have named pedagogical practice-in-context knowledge. Our reflections on and formal evaluation of the designed, implemented and experienced curriculum points to the central role of pedagogic practice-in-context knowledge in creating an immersive capstone subject in which students learn to be, by being.

Capstone experience: an answer to issues in paramedic education?

Paramedic education is a developing discipline with a relatively short history and limited research on teaching and learning in the discipline (Hou, Rego and Service, 2013). Previously paramedics were taught through the vocational education and training system with substantial 'on the job' training but since the mid-1990s there has been a shift towards university-based education for the role. This shift has brought with it numerous challenges to the higher education system, including to determine how best to train students so that they will be 'work ready', having the skills necessary to perform in what can be a dynamic, unpredictable and intense role in environments characterised by variety. Currently some uncertainty surrounds the preparedness of graduating paramedic students from Australian universities (O'Brien et al., 2014).

Paramedicine is a particularly challenging case for curriculum design and implementation given: the developing nature of the discipline; the demanding nature of the paramedic process (Carter and Thompson, 2013) and 'road ready' requirements; the often physically and emotionally demanding characteristics of the work environment; and the consequent challenges of providing authentic and contextualised educational experiences for students. Through their structured review of the literature, Kennedy et al. (2015) identify four key themes in the experience of university educated paramedics transitioning to practice: "I'm out of my depth", the discrepancy between theory and practice, 'ability to fit in', and 'the expectation to control emotions'. They note the limited research about enhancing the transition, echoing Hou et al.'s (2013) observations about the literature on paramedic education more broadly. Both studies however indicate the need to provide better preparation for the transition from student to beginning practitioner. Learning to become a

paramedic involves more than simply being able to demonstrate practical task competence: it also requires the development of judgement and the capacity to self-reflect on performance.

The impetus to explore the potential of capstone experiences in Flinders University's Bachelor of Paramedic Science degree developed in response to student and industry criticism of the previous version of the program. Students criticised quality of teaching and relevance to future professional roles. Industry criticised the program whenever graduates were seen not to be 'road ready'.

The need to respond to criticisms presented a unique opportunity to redesign a final year subject within the degree. A broad literature search focused on terms including graduate readiness identified a capstone model as an appropriate solution to the complexities of issues affecting the student completing their final study requirements. The capstone label and principles offered considerable flexibility to mold an approach to the specific needs of the student cohort. As students were already engaged in on-road clinical placements, we sought an approach which specifically addressed the gap existing between their on-road practice and the classroom curriculum: the theory-practice gap. The culminating experience needed to target the holistic features linked to the paramedic role.

The Paramedic capstone: the planned, implemented and experienced curriculum

The final semester subject 'Applied Paramedic Practice' was redesigned as a capstone experience. Over five years, significant investment has been made into the design and refinement of the approach: refinements to the design have built on feedback from staff about delivering the designed curriculum and from students about their experience of what has been delivered. The design sought to consolidate the knowledge and learning experiences presented from the broad curriculum within the degree by using a mixture of learning experiences which are closely aligned with authentic 'real-world' paramedic events. The data and analysis presented later focuses on the students' perceptions of the impact of the curriculum as they experienced it.

The following description and analysis of the capstone experience follows Prideaux's (2003) model of the curriculum as comprising three stages: the planned curriculum, the delivered curriculum and the experienced curriculum. For the purposes of this paper, Healy et al.'s (2013) framework provides a means to broadly describe the defining characteristics of the intended curriculum experience to provide context for subsequent discussion of the student perceptions of the experienced curriculum.

At the macro-level the subject design has the following characteristics.

Conception–the overarching structure of the capstone

The official subject description states that the subject

> *is aimed at providing the student with an integration of all the paramedic related skills, knowledge and attitudes, in order to enable them to graduate with confidence and a thorough grounding in paramedic practice …. (course website)*

Although the subject is not formally labelled as a capstone experience, the aims clearly articulate the characteristics of one: it is designed to consolidate and integrate previous learning (to look back) and to prepare the students for practice as a paramedic (to look forward to beyond study). The design encompasses interconnected theoretical and practical experiences linked by a variety of assessment tasks which contribute to the mapping of an individualised, differentiated pathway for each student through the experience.

Function–the emphasis on particular goals

The intended learning outcomes in subject documentation state:

At the completion of this topic it is intended that the participants will be able to:

1. Demonstrate the recommended qualities and attributes associated with the paramedic degree graduate

2. Demonstrate comprehensive skills in the evaluation of; the environment, the setting and the patient

3. Demonstrate the safe and proficient execution of appropriate clinical skills

4. Incorporate the knowledge from all pre-requisite curriculums and apply to the clinical decision

5. Critically evaluate the existing evidence that underpins current paramedic practice

The outcomes encompass the three curriculum domains of knowledge, action and self identified by Barnett et al. (2001). The ‘knowledge’ domain refers to those components that build discipline-specific competences towards creating a competent practitioner in the discipline. The ‘action’ domain includes the broad generic skill ‘of doing’ identified as graduate attributes: communication, presentation and similar. The domain of ‘self’ develops a thoughtful, critical disposition in relation to the discipline: a critically reflective practitioner.

While the aims seem to address the domains separately the organisational aspects of the design focus on drawing together and integrating these areas.

Organisation

Broadly the curriculum is organised as interconnected group and individual components covering both theoretical/conceptual and practical areas of paramedic practice. Specific elements are designed and presented to as far as possible replicate for students the complex challenging and uncertain contexts in which paramedics apply their vocational expertise as 'knowing in practice' (Billett, 2001).

Lee and Loton's (2015) key features of capstone curriculum provide a useful framework for presenting the organizational detail of the planned and delivered curriculum.

Integration and extension of prior learning

This is achieved through a sequence of interconnected assessment activities and individualised learning paths (see Figure 1 below). All students undertake an initial diagnostic assessment which highlights gaps in their retained knowledge from earlier parts of the degree: these become the focus for individualised learning activities for each student.

All of the learning experiences including assessment activities intentionally link both forward and back to consolidate and extend student learning. Assessment culminates with an oral examination specific to each individual student. Student performance within the mid-year exam is used to profile knowledge strengths and ongoing learning opportunities. Used as a diagnostic tool, each student has a curriculum area highlighted as the focus for their personal learning investment. Students are advised well ahead of the final exam of the potential areas in which they are required to demonstrate their knowledge and learning achieved. The oral is designed to enable each student to demonstrate the growth and consolidation of their knowledge.

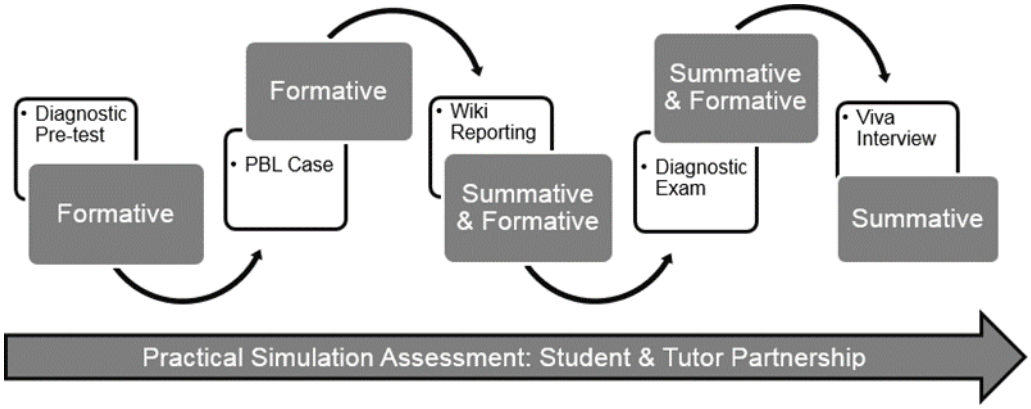


Figure 1: elements and linkages in the capstone experience

Authentic and contextualised experiences

The subject features a series of staggered intensive full days, each divided into both theory and practical components addressing selected themes. No advanced warning of content is provided to students, forcing them to arrive at class without specific preparation. This strategy of withholding preparatory learning material, and concealing the education themes of the day, was designed to serve several key purposes. Firstly, it echoes the spontaneous pre- hospital setting, where the paramedic has no knowledge of what their next case will be or what knowledge of skills they will be required to call upon in order to effectively respond to it. Secondly, it means that the knowledge or skills the student brings to the classroom, are an authentic representation of their current ability, instead of being a rehearsed response to a specific scenario.

Challenging and complex problems

Problem based learning (PBL) sessions encourage the students to unravel authentic patient cases. Students apply their knowledge, while becoming self-aware of the key understanding they need to solve the clinical case mysteries. In a shift from conventional PBL practice, the subsequent student reporting of self-identified knowledge gaps, are made through a wiki platform. This strategy offers every student a reporting voice while continuing the learning conversation well beyond the classroom. At this stage the learning pathway for each individual student becomes further differentiated.

Student independence and agency

Students are individually required to find and evaluate supportive learning material or resources unique to each learning need, which replaces traditional generic pre-reading provisions. Once established, the wikis remain the property of the student cohort, free from academic judgement or interference. The quality control of the information presented on this platform is solely the responsibility of the student. Rigour of student learning is achieved when the subjects which are identified and presented by students, are incorporated into a mid-year exam. In effect, students have discovered their own knowledge deficiencies, collaborated with their peers to produce a dynamic collection of study notes, and in doing so contributed to writing their own class exam.

A concern with critical inquiry and creativity

Throughout the subject students engage in critical enquiry and critical reflection. In the practical simulations, students are assessed on not only their practical performance but also

their ability to reflect critically on their own performance–including the quality of their professional judgements in situ.

Active dissemination and celebration

Throughout the experience students actively share their learning particularly through the wiki and through observation, critique and acknowledgement of achievements in simulations. Extending peer-to-peer collaborative student learning opportunities from the PBL classroom to the wiki forum was intended to foster student reliance upon each other for the co-construction of learning responding to earlier issues associated with adverse impact of graduate competitiveness upon the learning.

Location

Multiple sites are provided for student learning. Large parts of the course occur on campus with face-to-face experiences in lecture rooms, simulation laboratories and similar spaces but the subject also has an on-line environment for students to work individually and collectively on learning tasks. Other components occur in the field with simulated scenarios. All learning sites are designed to promote independence, interdependence and agency.

Outputs

The new design, delivery and experience explicitly links the development and consolidation of knowledge, action and self for each individual student through an individualised experience that helps the individual student to both look back and look forward. Students are given multiple opportunities to demonstrate their developing knowledge, the application of their knowledge in practice and to demonstrate their ability to judge the quality of their own performances. The intended key outputs are not artefacts of assessment but rather, students who emerge from immersive experiences as beginning practitioners with vocational expertise built through knowing in practice.

The result is a student-centric design for teaching, learning and assessment intended to help students.

Student perceptions of the experienced curriculum

Students enrolled in the subject in Semester 2, 2015 were invited to complete two questionnaires, one prior to commencing and another after completing all of the teaching and assessment requirements of the subject. 90 of the 94 enrolled students completed the questionnaires. Response patterns for key questions are presented below (see figures 2 and 3).

Students reported that the capstone subject helped them feel well prepared for the paramedic role with 84.0% either agreeing or strongly agreeing with this statement (Figure 2). All students felt that they agreed, strongly agreed or were neutral with the statement that they recognise the expected standards of local industry paramedics. 88.8% of students felt more confident in their knowledge and practice after undertaking the capstone subject and 89.9% believed that the subject helped to consolidate previous curricula in the undergraduate degree.

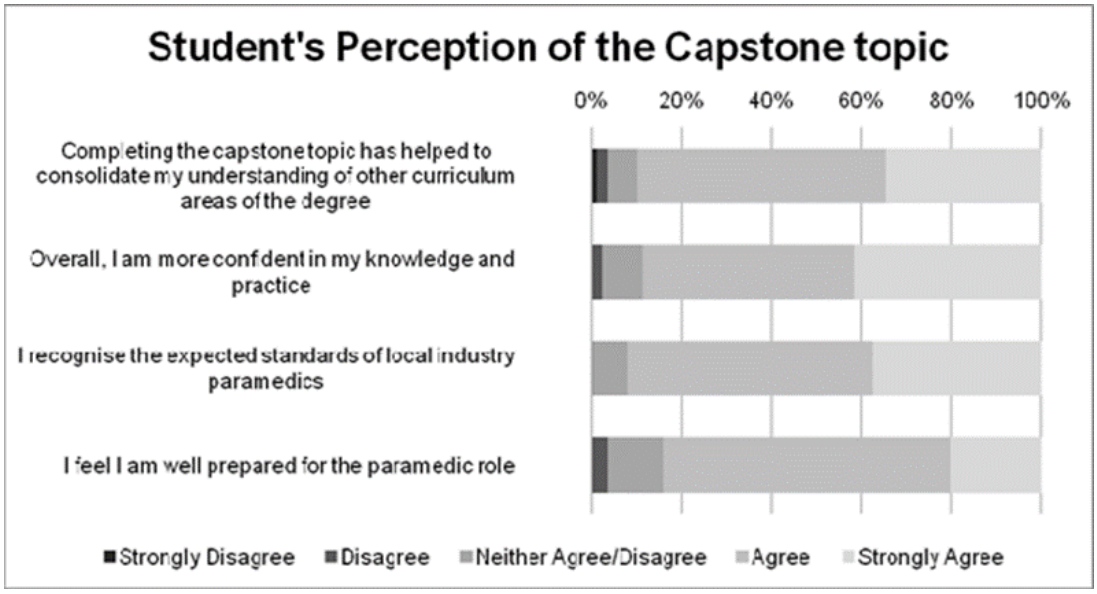
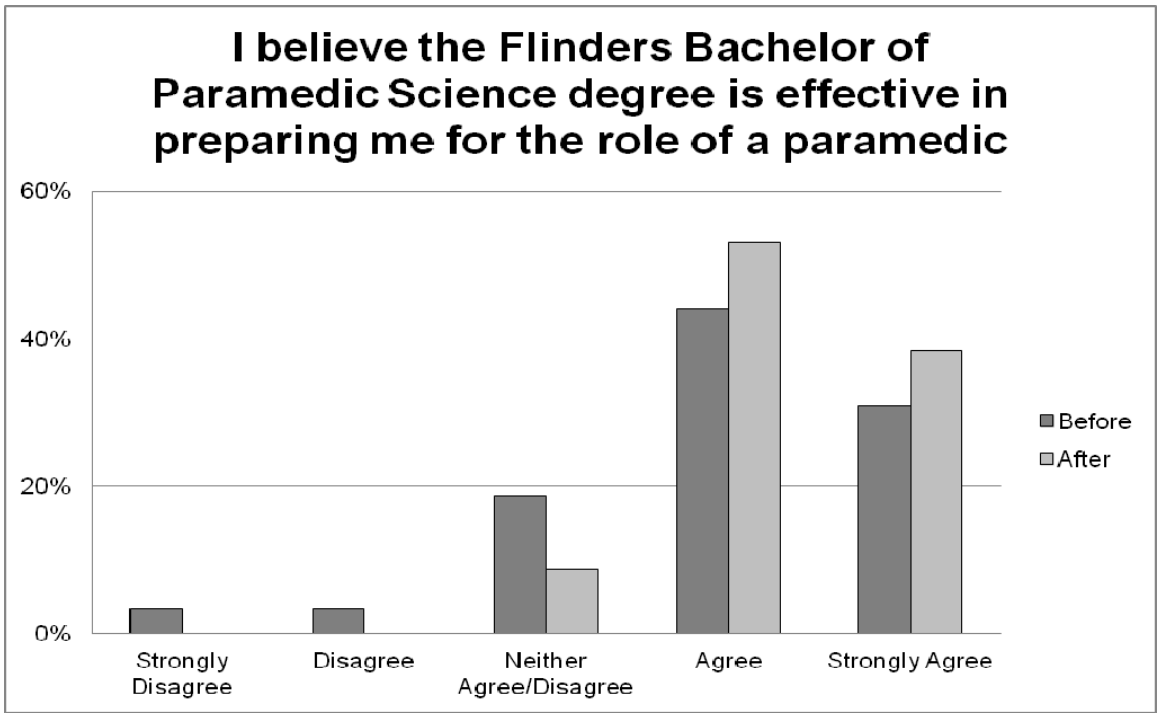


Figure 2: Overall student perceptions

Before subject commencement 74.8% of students either agreed or strongly agreed that the degree was effective in preparing them for the role of a paramedic. This increased to 91.4% after completion. Commencing the capstone subject 6.6% of students either disagreed or strongly disagreed that the Paramedic degree was effective in preparing them for the role of a paramedic (Figure 3). This reduced to 0% of students feeling this way after completion of the capstone subject.

Figure 3: Perceptions of preparation for the role of a paramedic



Before commencing the subject 4.4% disagreed or strongly disagreed with the statement that they valued their degree qualification: this reduced to 0% after completion of the capstone (Figure 4). Whereas overall agreement (strongly agree and agreed) with this statement increased from 86.9% before commencing the subject to 91.4% after completion.

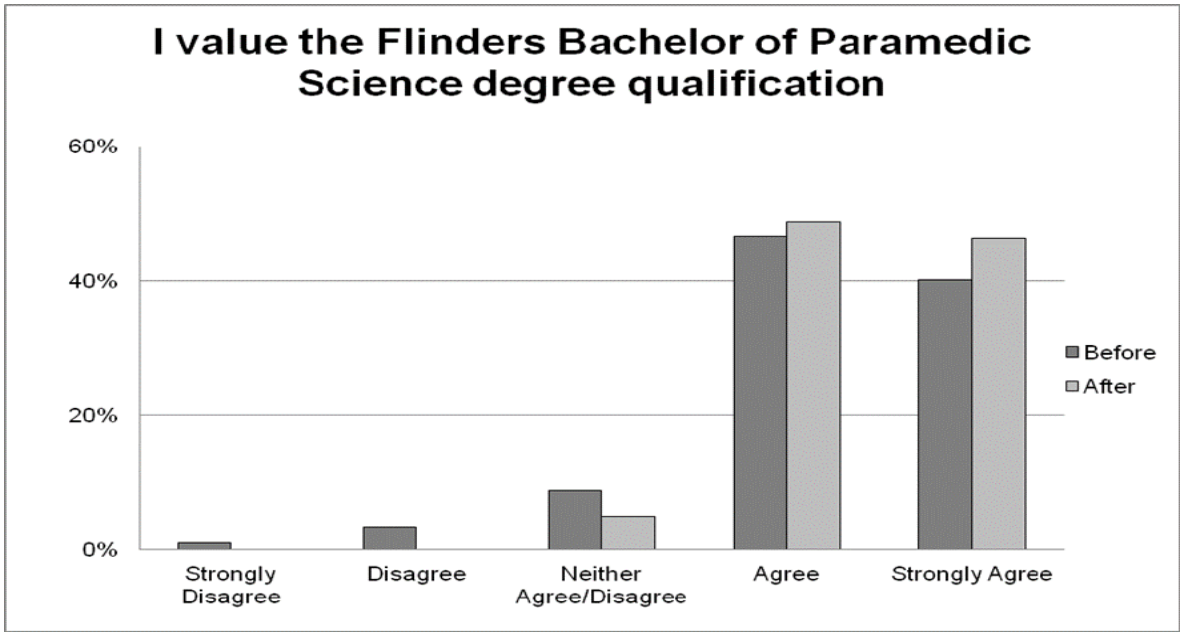


Figure 4: Perceptions of value placed on the degree

Reflections on success

Student responses show that from their perspective, the capstone experience achieved its intended outcomes of consolidating previous learning, increasing student confidence and providing a more effective bridge for students into industry. In the judgement of staff, the experience was much more effective than previous versions of the subject. We suggest that the success of the experience has been largely dependent on the capacity of the designers and teachers to bring together pedagogical expertise and discipline expertise defined in a particular way.

Shulman (1987), acknowledging the importance of disciplinary difference in education, coined the term 'pedagogical content knowledge' to highlight the particular expertise required to teach disciplinary knowledge (theory and skills) in the best or most appropriate ways. However as criticisms of previous designs of the paramedic course indicated, neither students nor industry partners were satisfied with content-focused but context-free teaching and learning, even when taught well. It seems that pedagogical content knowledge is necessary but not sufficient for developing beginning practitioners: it does not necessarily bridge the theory-practice gap. While students experienced 'on-road' placements as part of the course, there was no guarantee that 'hours served' on the road provided an effective way to bridge the gap either.

Billett's (2001) conception of vocational expertise as 'knowing in practice' provides some insights into the limitations of the previous approach. He proposes that 'knowledge in practice' is relational, embedded, comprises competence, is reciprocal and requires pertinence. Knowledge in practice is socially and culturally positioned. The previous manifestation of the topic emphasised learning about knowing, while placements emphasised practice. Explicit strategies to develop 'knowing in practice' were missing.

In the redesign, the designers brought to bear a particular combination of expertise developed as paramedics as educators: their pedagogical knowledge developed through experience and training as educators; their paramedic 'knowing in practice' developed through being practicing paramedics; and the third element in the mix, their experience of the complexity of practice and the variety of contexts in which paramedic practice occurs, that is experience of practice-in-context. This expertise enabled the capstone to be designed to expose students to experience of being paramedics applying 'knowing in practice'. We have labelled this complex expertise as 'pedagogical practice-in-context knowledge'.

Moreover, the delivered curriculum deliberately incorporated additional 'practice-in-context' expertise by using currently practicing paramedics as sessional tutors and assessors. These

practitioners are involved in assessing students' 'knowing in practice' demonstrated through complex simulations and also in 'calibrating conversations' with students. These conversations provide opportunities for students to reflect on their own performance and make judgements about their own performance against industry norms and expectations as well as academic outcomes and standards.

The design built on pedagogical practice-in-context knowledge provided a learning environment that was relation, provided practice, clearly identified competence, created opportunities for reciprocity in learning and was pertinent to performance in the discipline. The environment provided students with the opportunity to develop into being paramedics, through experiencing paramedic knowing in practice.

Conclusions and implications

As Alstete and Beutell (2015) observe 'There is no singular path that leads to capstone nirvana'. Nevertheless, Lee & Loton (2015, p 19) identify and group fundamental 'how to' concerns into seven short guidelines for capstone design and delivery, which encourage academics to:

- start with the end in mind;
- choose a model that works for the particular context;
- provide an underpinning structure;
- explicitly give students ownership;
- build in regular feedback from a range of sources;
- recognise the benefit of uncertainty and creativity, and;
- link to the future.

We believe that our paramedic capstone experience showcases the enactment of these guidelines. Providing the best possible experience requires an iterative process of refinement to enhance the alignment between the curriculum, industry expectations and the 'knowing in practice' requirements of a beginning paramedic practitioner. In our case, the ability to build and refine such an experience draws on designers' and teachers' own lived experience of good pedagogical practice and also of 'being' a practitioner in the discipline. The capstone subject as designed, implemented and experienced reflects what we have named the pedagogical practice-in-context knowledge of the paramedic educators

responsible for the subject: this is arguably the key to its success. The ability to align and refine teaching and the educational experience to the particular knowledge, skills and professional attitudes and orientations of paramedic practice has been crucial.

The student response to their experience of this capstone model strongly suggests that it achieves the broad outcomes for capstone experiences generally and the specific outcomes intended in this case. The role of a paramedic requires critical thinking and self-reflective practices. We have introduced an innovation which develops student judgement and critical thinking. The real pre-hospital world is often unpredictable, requiring a paramedic to constantly judge their practices. The large majority of students valued the opportunities both to look back and consolidate their learning from the degree and to look forward to the context of paramedic practice to more fully appreciate the expectations and challenges of being a 'road ready' paramedic. The designed, implemented and experienced curriculum now better complements the 'on-road' experience gained through industry/clinical placement to more effectively bridge the 'theory-practice gap' identified in recent literature (Kennedy, Kenny & O'Meara (2015). The capstone helps students to learn to be paramedics, by being paramedics.

References

Alstete, J. W., & Beutell, N. J., (2016). Balancing instructional techniques and delivery formats in capstone business strategy courses. *Quality Assurance in Education*, 24, (2), pp173-93

Barnett, R., Parry, G., & Coate, K., (2001). Conceptualising Curriculum Change. *Teaching in Higher Education*, 6, (4), 435-449

Billett, S., (2001). Knowing in practice: re-conceptualising vocational expertise. *Learning and Instruction*. 11 (6), 431-452

Carter, H., & Thompson, J., (2013). Defining the paramedic process. *Australian Journal of Primary Health*. 21, 22-26

Durel, R., (1993). The capstone course: A rite of passage. *Teaching Sociology*, 21(3), 223–225.

Firn, J., (2015). 'Capping off' the development of graduate capabilities in the final semester unit for biological science students: review and recommendations. *Journal of University Teaching & Learning Practice*. 12(3) Available at: http://ro.uow.edu.au/jutlp/vol12/iss3/3

French, E., Bailey, J., van Acker, E., & Wood, L., (2015). From mountaintop to corporate ladder – what new professionals really really want in a capstone experience!. *Teaching in Higher Education*. 20 (8), 767-782

Healey, M., Lannin, L., Stibbe, A., & Derounian, J. (2013*). Developing and enhancing undergraduate final-year projects and dissertations*. York: The Higher Education Academy

Hou, X., Rego, J., & Service, M., (2013). Paramedic education opportunities and challenges in Australia. *Emergency Medicine Australia*. 25, 114-119

Kennedy, S., Kenny, A., & O'Meara, P., (2015). Student paramedic experience of transition into the workforce: A scoping review. *Nurse Education Today*. 35, 1037-1043

Kinzie, J., (2013). Taking stock of capstones and integrative learning. *Peer Review* 15, (4), 27-30. Accessed on line at https://www.aacu.org/peerreview/2013/fall/kinzie

Lee, N., & Loton, D.J., (2015). *Capstone curriculum across disciplines: Synthesising theory, practice and policy to provide practical tools for curriculum design: Final Report* OLT, Sydney

O'Brien, K., Moore, A., Dawson, D., & Hartley, P. (2014). An Australian story: paramedic education and practice in transition. *Australasian Journal of Paramedicine* 11(3), 1–13.

Prideaux, D., (2003). Curriculum design. *British Medical Journal*. 326, 268-270

Rowles, C., Koch, D., Hundley, S., & Hamilton, S., (2004). Toward a model for capstone experiences: Mountaintops, magnets, and mandates. *Assessment Update*. 16 (1), 1–16

Shulman, L., (1987). Knowledge and Teaching: Foundations of the New Reform. *Harvard Educational Review*57 (1), 1-23.

Thompson, J., Grantham, H., & Houston, D., (2015). Paramedic capstone education model: Building work ready graduates. *Australasian Journal of Paramedicine*.12 (3). 1-8

van Acker, L., Bailey, J., Wilson, K., & French, E., (2014). Capping them off! Exploring and explaining the patterns in undergraduate capstone subjects in Australian business schools. *Higher Education Research & Development.* 33(5), 1049-1062.

4.5 Paper 5. Student and Tutor Consensus

This section contains the publication *Student and tutor consensus: a partnership in assessment for learning* (Thompson et al., 2016).

4.5.1 Background to the publication

This publication provided a concentrated analysis of the student-tutor assessment event I developed and researched within the broader capstone study. This innovation had drawn on the earlier work of the paramedic process framework and an aim to enhance student learning behaviours in relation to assessment, particularly the receipt and use of critical feedback. I was responsible for the conception and development of the student-tutor consensus method, its introduction to teaching delivery, its research and evaluation. I was the principal author of the publication, along with critical contributions from Dr Don Houston to literature and discussion sections. Kathryn Dansie contributed to data collection, and the interpretation and presentation of research findings. The author listings of Rayner, Pointon, Pope, Cayetano and Mitchell reflect their valued contributions towards consultation during the development of the model and publication and their shared interest in the tool for their own teaching within the team. These authors also provided editorial roles for the publication. Inclusion of Dr Grantham on the publication reflected local insistence that the educational research output within the paramedic unit required his endorsement. This publication features in the journal Assessment & Evaluation in Higher Education.

An authorship declaration is included in Appendix 5.

A copy of the questionnaire used to collect the data which is reported in this publication is attached in Appendix 11.

The publication is included in the following pages. This is reproduced with journal permission.

4.5.2 Citation

Thompson, J., Houston, D., Dansie, K., Rayner, T., Pointon, T., Pope, S., Cayetano, A., Mitchell, B., & Grantham, H. (2016). Student & tutor consensus: a partnership in assessment for learning. *Assessment & Evaluation in Higher Education*,*42*(6), 942-952. https://doi.org/10.1080/02602938.2016.1211988

Student & Tutor Consensus: A Partnership in Assessment for Learning

Abstract

The mistakes made when attempting tasks often prove to be some of the most invaluable learning experiences. Despite this, outcome and results driven assessment formats largely penalise student performance errors or reward students who succeed by chance. Consequences of this paradigm are visible effects on student relationships with assessment. The “Student-Tutor Consensus” approach to assessment was introduced to capture student learning achieved ‘from’ assessment to complement the measurement of performance outcomes. This approach parallels student and tutor judgement in a grade negotiation affording the student an opportunity to share with their assessor what they have learned from the assessment activity. This student self-awareness was then considered alongside the traditional outcome based score awarded by the tutor to generate a final grade for the assessed activity. Our study evaluated the perceptions of 90 undergraduate students enrolled in the bachelor of paramedic studies who participated in this novel assessment approach as part of a final year capstone topic. The results comprehensively indicated value for all aspects of the assessment approach, as well as a recognition that the skills will be useful in their future professional roles.

Keywords:

Consensus Marking, Self-reflection, Co-Assessment, Self-regulated Learning, Paramedic Education

Introduction

Assessments in higher education serve two principal purposes; promoting current and future learning, and recognition and certification of student achievement (Boud and Falchikov, 2006). These purposes may be complementary. The existence of perceived or real expectations of prospective employers combines with the higher education system’s emphases on grades, graduate employability and employment outcomes to perpetuate an emphasis on assessment of learning rather than assessment for learning. Tensions between these purposes are amplified in vocationally oriented courses, such as medicine, nursing and paramedicine, where graduate capabilities to perform as a beginning practitioner are an expectation (O’Brien et al., 2014). Overcoming the perceived tensions between these purposes is challenging as it requires a fundamental rethink of the network links between teaching/learning interactions, assessment events, feedback and feed-forward cycles, and

processes of grading that are central to the student learning experience. This assessment and feedback linkage also influences students' approaches to and thinking about assessment and learning.

Ingrained patterns of assessment of learning combined with students' focus upon the attainment of qualifications and future employment has meant that 'learning' as a result of assessment events is seldom prioritised or valued by students. For the graduate who is required to evidence academic performance during their recruitment into professional roles, this focus on grades as symbols of achievement may be understandable. The impact of this on learning, however, cannot be understated. Exclusive emphasis on results, to the detriment of meaningful learning experiences, raises concerns about the acquisition of learning over the long term. Boud and Soler (2015) have called for greater focus on aligning assessment with long term learning through 'sustainable assessment' that helps students to develop the capability to make judgements about the quality of their own performance and learning needs. The process of equipping learners to face a set of future challenges is the foundation of sustainable assessment practice (Boud and Soler, 2015).

A focus on sustainable assessment is consistent with theory and institutional claims and rhetoric about developing reflective practitioners and self-regulated learners (Nicol and McFarlane-Dick, 2006). Notably both reflective practice and self-regulated learning are built around the ability of the individual to make judgements about their own capability and quality of performance. As Boud (2007) notes, both share the perspective that 'the key to learning in complex settings is to be able to 'look again', to monitor one's own performance, to see one's own learning in the context in which it is deployed and to respond to the exigencies of the tasks in which one is engaged' (p21). While the value to the individual of self-assessment skills has been widely advocated, there is little evidence in the literature of efforts to redesign assessment practices to develop, encourage, value and, in particular reward student insight and capability to make such informed judgements.

The vast majority of assessment of learning (and for learning) places the responsibility for judging and rewarding learning at the time of the assessment event with the 'expert' academic, who grades the student performance. Grading by the expert excludes the student from high stakes decisions about their own performance even at the end of their course. While advocating reflective practice and self-regulation, most assessment regimes fail to acknowledge the student as more than a passive recipient of summative assessment judgements: 'students are seen to have no role other than to subject themselves to the assessment acts of others, to be measured and classified' (Boud, 2007,p17). This perpetuates student dependence on academic staff for judgements.

Such ongoing dependence on the judgement of others is a potentially significant issue for a student who is about to transition into the role of a beginning professional where they will be expected to judge the quality of their work relative to industry standards in often high stakes/high risk situations. This is particularly relevant in health professions and especially in the context of paramedicine and out-of-hospital care where the paramedic's performance and their ability to make judgements about performance, their ability to recognise errors and their capacity to recover from them have potentially life threatening implications. As such, the need to develop and reward students' capacity to independently judge and reflect on their own performance in this context is critical. Boud (2007) suggests that assessment discourse could be usefully reframed around the theme of informing judgement linked closely to learning focused on developing students' capacity to make informed judgements. He notes that such a reframing of learning and assessment "gives prominence to students making judgements about their own learning as a normal part of assessment activities" (Boud, 2007, p20).

This paper presents and reflects on one component of an action research project intended to improve a final year paramedic practice capstone subjects' effectiveness in helping students transition to paramedic practice. Specifically, this paper reports the introduction of 'student-tutor consensus grading' of simulation-based practical skills assessments that form a key component of the subject. This assessment innovation was introduced as a strategy to promote students to re-prioritise learning and judgement, and to integrate and reward student judgement through the assessment, feedback/feed-forward and grading cycle. The design sought to recognise learning obtained through student reflection on their own individual successes and errors and in so doing, alter some negative features of a competitive student culture.

We provide a description of the context and genesis of the intervention. This is followed by a detailed description of the innovation and the research process used to gather student perceptions of the impact of the reconfigured practical assessment cycle on their learning and preparation to practice. We then discuss the implications of the results as well as our reflections on this new approach to the integration of assessment for learning and assessment of learning through making students' judgements of their own learning a normal part of assessment. This new approach integrates the student's skill performance and their personal reflection on their learning from their own performance together with the expert judgement of an industry-based assessor to create a grade based on 'student-tutor consensus'.

The context of the study

The focus of the study was a final year capstone paramedic practice subject offered in the three year bachelor of paramedic science degree at a university in southern Australia. The program attracts a diverse cohort of Australian and international students who bring very mixed educational, pre-hospital and other healthcare experiences to their studies.

Over the past six years the subject has been systematically redesigned to provide a more realistic transition experience for students about to move into the unpredictable and complex realm of out-of-hospital paramedic practice. While a number of these reforms to teaching and learning have been shown to enhance the student learning experience (Thompson et al. 2015), the highly competitive employment prospects facing paramedic graduates continued to influence students towards 'grade-seeking' behaviours. Despite the introduction of a range of teaching strategies promoting cooperative learning, learning from collaborations with peers was frequently threatened by student competitiveness. This was particularly noticeable to the teaching team when students were required to participate in practical assessment activities observed and assessed by industry-based practicing paramedics. Anecdotally, the level of contribution and engagement by the students was influenced by fear of showing knowledge deficits or delivering a lesser performance than their peers. This behaviour seemed to contribute to a difficult learning culture within the classroom and limit the learning opportunities from the simulations and debriefing on performance.

Simulation-based education and assessment are established parts of education in the health professions and debriefing is seen as an essential element of both (Dreifuerst, 2009), providing students with the opportunity to develop self-regulated learning (Brydges et al., 2015) and reflective practice (Husebo et al., 2015). There is, however, no universal view on which debriefing practices generate the greatest benefit to students (Maestre and Rudolph, 2015). Much of the literature places simulation and debriefing within the confines of formative assessment, leaving summative judgements to the academic/industry-based tutor (see Barr et al. 2014 for an example an approach from paramedicine). As such, an unequal power relationship continues to constrain the student to await the exclusive verdict linked to tutor judgement. Previous use of simulations for assessment in the capstone subject followed this pattern: students completed the simulation while being observed by staff and each student's grade was based exclusively on staff members' judgements of quality of the student's practical skills application.

Introducing the innovation: prompts and challenges to (re)design

One feature, which can confound the effectiveness of seemingly innovative assessment, is the failure to understand what motivates the students. Student motivations are not always positively focused on learning: career success and future pay prospects can drive the need for success in assessment over the thirst for learning and knowledge (Bevitt 2015)**.** Our past experience with student approaches to assessment and learning in this subject concurred with this view and highlighted how imperfect classroom results were directly aligned with recruitment or career consequences in the students' view. As such, new innovations to teaching would need to mitigate these concerns and allow the student to participate in the process of learning without a perceived pressure to appear immediately 'job ready'.

Simulation-based assessments have been an integral part of the subject's design for close to a decade. Within the subject experience each student participated in six simulation-based scenarios. These were routinely observed and assessed by currently practicing paramedics who provide a key element of currency to the teaching team. Amongst the more effective assessment practices was an approach whereby the tutor would invite the student to reflect on the case, prior to the tutor delivering their critique of the student's efforts. This reinforced the concept of "reflection" which is a well-recognised element within pre-hospital practice and encouraged the student to methodically, and often chronologically, critique aspects of their performance (Carter and Thompson 2013). Frequently the student was able to effectively self-identify the mistakes they had made and their own opportunities for development. Tutor responses would acknowledge and reinforce to the student the areas where they had appropriately critiqued their practice, while highlighting areas where the student had not recognised the limitations of their own performance. Despite not being reflected in the tutor's formal assessment records, there was evident merit for the individual student and wider group of peers being achieved through student self-evaluation and debriefing after the scenario, thus creating a rich learning event. It was clearly a valuable learning event, but was not a formal part of the assessment.

A number of limitations were identified with the exclusively case outcome focus of the existing simulation-based assessment approach. A student could receive a good grade for a marginal performance with limited understanding of the key elements, providing the case outcomes were satisfactory. Conversely, the student who made a judgement error but was able to comprehensively analyse their performance, identify the mistake, suggest more appropriate paths of action and effectively demonstrate their learning was not rewarded. So despite the value of student engagement within their own assessment activities being well established (Nicol and Macfarlane-Dick 2006) and the importance of the 'debriefing' phase

being identified as critical to effective simulation based learning and assessment (Dreifuerst, 2009), there was no benefit to the student of engaging in these practices. In addition, students who were given feedback by the tutors were not required to do anything with it. Without reflection or follow-up, there was little compulsion for students to act on the feedback to prevent them repeating their errors. Moreover, while some tutors engaged in debriefing it was not universal practice, leading to discontinuity in approach for the students depending on the tutor allocation for the sessions they attended.

While reflective assessments were not new to the teaching team, this variable uptake by the teaching staff appeared to be linked to reservations originating from their own prior experiences as students of reflective assessments.

Despite the teaching rhetoric about the value for students attaining self-assessment skills that could be applied to all aspects of their graduate lives, the tutor's personal experiences suggested reflection-based assessments were indeed sporadic events often disconnected from other teaching practices. This experiential perspective was at odds with recommendations in the literature that students be provided opportunities for reflection that are not just once-off, isolated experiences but rather form an ongoing integrated component of the learning and assessment process (Boud and Soler 2015). This approach would facilitate students becoming better equipped to make judgements on their own performance with practice, something that was found particularly lacking in previous offerings of the subject. For example, student responses to isolated reflective tasks using tools such as Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis, appeared to be significantly influenced by their prior results. Rather than being self-reflective, students would routinely default to echoing prior tutor judgments or assessment results: "I received a low score for last year's [curriculum area] exam.... that must be a weakness of mine". So not only was this type of response not a meaningful self-reflection, but it also failed to consider learning that may have been achieved subsequently as a result of an assessment event.

Student-Tutor Consensus–The New Design

The new design was intended to enable student reflection on the learning achieved through assessment to become a central and regular element of key assessment processes. It sought to encourage students to judge their own performance, consciously reflect on feedback, and to identify learning from the assessment experience that could be applied beyond the assessment event. A key element of this approach was to reward the ability to identify mistakes and learn from them and to provide multiple opportunities for students and tutors to engage in calibrating conversations. The capacity to hold these conversations was considered important to help students hone their judgements against both the written criteria

for tasks and the industry expectations reflected in tutor grading as well as to respond to studies that indicate students become “calibrated” to marking within a subject (Boud and Soler 2015). Boud, Lawson and Thompson (2013) showed that the accuracy of student judgements varied depending on student level and type of course and that student and tutor grades were found to become more closely matched over time.

This inclusion of critical dialogue as an integral part of each case scenario was also important to help the new design echo real-world practices of the discipline and align it with the literature describing the development of sustainable assessment (Mavin and Roth 2014, Boud and Soler 2015). To respond to previous challenges for students associated with reflective practice including a lack of guidance on how to do such tasks, a basic guide to common performance criteria (or rubric) was produced for all scenarios which outlined a simple evaluation of demonstrated competence across five areas common to the practicing paramedic. These key competency domains were identified as: *1) Scene Assessment, 2) Understanding, 3) Skills, 4) Communication, 5) Teamwork and Leadership.*

The incorporation of these competency domains is consistent with recommendations around the delivery and use of feedback. That is, feedback needs to address a range of criteria in order to be effective and close the theory-practice gap and feedback needs to be clear and unambiguous (O’Donovan et al. 2015). The defined domains allow students and tutors to clearly identify where mistakes have been made and provide a foundation for effective feedback which can be incorporated into the grading of their learning. They also allow tutors to clearly certify achievement and provide a score for student performance and case outcome as part of their total grade, thus aligning with the critical nature of paramedic practice. So overall, the design sought to encompass learning and the development of reflective skills across a range of domains deemed useable throughout the students’ future careers.

The new process

The key enabler for capturing the benefits of student involvement and reflection in their own assessment (Bevitt 2015), was the development of a performance/consensus rubric (Figure 1). The fundamental difference between this and standard assessment rubrics is that it mandates input from both the student and their assessor and cannot be completed without these two essential participants. Figure 2 shows key parts of the student-tutor consensus process with its application described as follows.

After having observed a student attempt a practical simulation assessment, the tutor records their scores based on the case performance and outcome (Figure 1, Part A). A score of

between 0-5 reflects the tutor's overall judgement of the student's performance across the five competency domains. This tutor observation provides the first half of the student's overall grade and provides the 'real world' context by acknowledging the significant consequences often linked to clinical actions. Before learning the tutor's score, the student is invited to apply the same criteria to their own performance across the key domains (Figure 1, Part B). All of the conversation around the event is conducted in the presence of student peers. The student appraises their own performance and is provided with the opportunity to explain their reasoning. The student's reflection provides the tutor with an opportunity to confirm or even reconsider their initial thoughts and judgements based upon the student's arguments and explanations. The student and tutor criteria-based responses are then discussed and completed by both the student and tutor together. Each time the student and tutor are in consensus about performance in relation to a criterion, it attracts a mark for that competency domain. Notably, a mark can be awarded if a mistake has been made during the scenario that is correctly identified and rationalised by the student and achieves tutor consensus. Conversely, the student who does not recognise errors, or who cannot justify their apparently correct actions, or even who is excessively self-critical will not be rewarded. This interchange ensures the awarding of marks is supported by detailed and extensive feedback and discussion within the classroom. This ultimately contributes to the development of the tutor-student relationship which enables feedback information to be decoded and processed by students more effectively (Nicol and Macfarlane-Dick 2006, Boud et al. 2013, Ajjawi and Boud 2015).

To determine a balanced total score, case outcome marks determined by the tutor are added to the consensus marks thus representing both student performance within an assessment task and the recognised learning achieved from the task.

Evaluating student responses to the change

Evaluation of student responses to the student-tutor consensus innovation was included as a component of a wider study evaluating student perceptions about the subject's influence on their preparedness for the paramedic role, and the perceived value of each teaching and learning strategy employed within the final capstone subject. Participants were recruited from students enrolled in the subject in 2015. Ethics approval was obtained from the University's Social and Behavioural Research Ethics Committee.

All potential participants were advised of the project via web-based advertisement and were invited to complete a voluntary questionnaire. The questionnaire comprised a series of statements related to: the teaching and assessment methods employed within the topic, perceptions about preparedness to undertake the paramedic role, and perceptions of value for their degree experience.

The questionnaire was distributed directly following the final session of the subject, and administered by a non-academic staff colleague, who had no connection to student teaching, assessment or progression decisions. Completed questionnaires were reviewed independently to ensure that no participant had submitted any responses which might identify them.

The questions set relevant to this component of the study is:

- The scenarios effectively combined my knowledge, reasoning and practical skills
- Self-assessment is an important skill for paramedics
- I found the student-tutor consensus marking format:

    a. fair
    b. effective for my learning
    c. improved my ability to critically analyse my practice
    d. helped me to develop skills I can use in my future profession

Student perceptions: results and implications

90 of the 94 eligible participants enrolled in the subject responded to the survey: a 96% response rate. The responses to the questions exploring the student-tutor consensus innovation are presented in Table 1.

In response to the broad questions about the practical scenarios, 96.6% of respondents agreed or strongly agreed that scenarios effectively combined knowledge, reasoning and practical skills, and 96.6% agreed or strongly agreed that self-assessment is an important skill for paramedics.

Four of the survey questions addressed the student's perceptions of the student-tutor consensus marking component. 87.8% of respondents found the student-tutor consensus marking format fair (strongly agreed or agreed with this statement), 91.1% found it effective for their learning, 94.4% found it improved their ability to critically analyse their practice and 85.6% found it helped them to develop skills for their future profession.

Across these six questions no more than two students disagreed with any of the statements and no students strongly disagreed with any of the statements. These results show that students were largely positive about the assessment design.

Core to the innovation was the goal of imparting appreciation of the importance of self-assessment skills to the students through a system all considered fair. The student responses indicate that they recognise the importance of self-assessment as a skill for their career beyond graduation and also that they recognised the fairness of the approach introduced to develop and assess those skills. Learning has been identified as being at the core of the purpose of assessment and we have discussed the need to re-adjust student focus from being exclusively results driven. The responses relating to learning effects and critical thinking development clearly demonstrate that students consider they have made significant achievements in learning.

When considered alongside the 96.6% broad agreement about the holistic integration of paramedic practice skills, there appears to be a widespread belief that students had acquired a set of effective skills for use within their profession beyond graduation. This offers evidence of achieving a sustainable assessment process.

The consensus grading innovation was the first time within the students' studies that they had been introduced to any form of 'co-assessment' (Dochy et al.,1999) which contributed to their grade for a subject. As we employed the method from the first day of the subject, limited opportunity was available to invest in developing student understanding of the assessment process and purpose. Regardless of this, the student responses suggest that if an assessment innovation is simple and intuitive, it can still be readily embraced.

Early in the subject questions were raised about the fairness of the process, with several students expressing concern that if they had achieved a 'good' case outcome by chance, and not deliberate intent, they may be penalised during grading if they were unable to demonstrate understanding behind their actions. Rather than presenting an issue, this highlighted an opportunity, in that we were able to identify false positives, or 'accidental competence' in student performances. It prompted to us to identify four possible assessment

outcomes for students (see Table 2). Optimally, a student (Student A) could perform the scenario well, demonstrate sound understanding and intent, and their score would reflect this. A student (Student B) who may have inadvertently achieved a successful scenario outcome as the result of a chance performance, was now identified through the student-tutor dialogue. Their scores were now more aligned with their development needs and opportunities, which were now also identified through the dialogue. Students in group C who did not perform well, who were not conscious of their errors and required extensive tutor guidance, would receive grades aligned with their performance and understanding and be guided to improve their performance. The fourth group (D in Table 2) were of particular interest to this innovation. These were students who made errors during their practical performance, but were able to critique themselves effectively, demonstrating that they had learned from the experience. While these students did not attract the highest scores, they were appropriately rewarded for their insight, self-reflection and learning from the assessment activity.

Although there was 87.8% broad agreement from the participants that the marking process was fair, a small number of students indicated they felt they preferred to not be penalised for a chance performance. These students seemed not to have appreciated that 'good marks' based on guesses or luck were not an appropriate basis for work in the high stakes and high risk area of paramedicine and pre-hospital care. This view reflected a focus on achieving high grades for their own sake rather than achieving high grades as a consequence of deeper learning.

In a supplement to the participant survey responses, qualitative responses were provided at the end of the subject through an automated, university-mandated ‘Student Evaluation of Topic’ (SET) survey. While this instrument sought student responses beyond our current focus on consensus marking, many responses referred explicitly to it. Student responses relating to practical teaching and assessment included;

> *“The delivery style pushed me to want to challenge myself with my understanding of clinical concepts, and was conducted in a way that made learning easier and in ways that I suspect will be retained. It has set me up well to continue learning throughout my career.”*

Discussion

From our search of the literature we were able to identify very few examples of what Dochy et al. (1999) describe as co-assessment: “a way of providing an opportunity for students to assess themselves whilst allowing the staff to maintain the necessary control over the final assessment”(p 342). We found two cases: Deeley (2013) describes a case study of

summative co-assessment of employability skills in an elective subject with eight students, while Cooper (2015) describes a small scale intervention in placement subject in a Youth and Community Work program: both cases include student participation in the negotiation of a component of their summative grade. Both studies acknowledge the dearth of research reporting on the development of co-assessment.

Our study complements these. We were unable to find any studies where co-assessment had been introduced into a core capstone subject focused on developing and consolidating core disciplinary skills and thinking of students about to transition to beginning practitioners. Similarly we were unable to identify any examples of co-assessment where student learning from assessment tasks (assessment as learning) was acknowledged in the creation of student grades. While in our case staff retain 'necessary control', they do not retain total control over the determination of final grades: students contribute to reaching consensus with the assessors on the final judgement of practical performance as well as the thinking and understanding underpinning that performance. This is a significant movement from most self-assessment and reflection during debriefing on simulations, with these embedded in formative assessment where they contributes to student learning, but do not 'count' in formal recognition of learning, that is, grading. As such, student-tutor consensus grading develops an explicit association between student judgement and grading, as reported here for the first time.

All features of the assessment practice occur in 'real time'. The experience is repeated at intervals throughout the subject to enable students to develop their capacity to self-assess and make judgements that contribute to not only their learning but also their grade. As timing is a key feature of effective feedback (Nicol & Macfarlane-Dick 2006, O'Donovan 2015), the synchronous tutor and student consideration of performance in our approach provides students with relevant and immediate feedback, thus enhancing for their growth and learning. Discussion, negotiation and reflection are other key elements to self-assessment (Ajjawi and Boud 2015) which are enabled within the guided discussions between students and tutors. This is not only highly beneficial to students as they experience real-time critique and conversation from industry paramedics but unsolicited responses from tutors also highlighted that the tutors themselves also found the process useful. Another feature of the assessments is that students get a chance to put their case and reasoning forward before tutor judgement, facilitating negotiation and engaging students in the assessment process.

Throughout the redesign process we focused on the need to better prepare students for the workforce by formalising effective practice and clarifying criteria and standards as the benchmark for student judgement on performance in complex clinical situations/simulations.

We discovered that consensus marking provided the basis for calibrated conversations between students and industry practitioners as tutors providing students with ‘real time’, synchronous reflection on their performance. These additions to assessment complement and extend the value gained from skill development in simulations and provide a potentially more holistic and advanced form of assessment for students.

Conclusion

A student’s relationship with assessment is crucial to their learning. Student mistakes made while participating in assessments usually result in grade penalties which can have implications for student progress. A key message to students from our innovative practices is that making mistakes in the learning process is acceptable. Many students are self-aware when they have made errors during assessments and can demonstrate instantly the learning that has been achieved from reflecting on such errors. Their judgement about the quality of their own performance rarely is recognised in, let alone incorporated into, grading processes certifying achievement. We have designed, implemented and evaluated an approach to learning which imbeds ‘real-time’ student reflection including recognising and learning from mistakes within practical scenario assessment and summative grading.

The innovation effectively balances performance outcomes while fostering an environment where students can recognise the value of learning from their mistakes, supporting the notion that a mistake from which we learn is very valuable education. The discussion-centric assessment technique which followed practical scenarios afforded opportunity for the student who appropriately identified their errors and learning achieved, to improve their grades. For the student who performed well by chance, but who demonstrates limited understanding, their grade now reflects this. It has contributed to a change in learning culture within the topic.

The change provides an example of co-assessment that extends the collaborative element to the determination of student grades, thus bridging across formative and summative assessment by giving student reflection on their own performance a place in the certification of learning. In 2007, Boud proposed a reframing of assessment discourse around the theme of informing judgement and focusing on the influences of assessment beyond the course. He also noted that “the building of skills for reflexivity and self-regulation through assessment is not currently a strong feature of courses” (2007, p22). The student-tutor consensus model attempts to normalise student judgement and self-regulation as integral to summative assessment and to enhance the influence of assessment beyond the course.

Reference List

Ajjawi, R. and Boud, D. 2015. “Researching feedback dialogue: an interactional analysis approach.” *Assessment & Evaluation in Higher Education*:1-14.

Barr, N., Readman, K. and Dunn, P. 2014. “Simulation-based clinical assessment: Redesigning a signature assessment into a teaching strategy.” *Australasian Journal of Paramedicine* 11 (6).

Bevitt, S. 2015. “Assessment innovation and student experience: a new assessment challenge and call for a multi-perspective approach to assessment research.” *Assessment & Evaluation in Higher Education* 40 (1):103-19.

Boud, D. 2007. “Reframing assessment as if learning were important.” Review of*. Rethinking assessment in higher education: Learning for the longer term*:14-25.

Boud,D. and Falchikov, N. 2006. “Aligning assessment with long-term learning.” *Assessment & Evaluation in Higher Education* 31 (4):399-413.

Boud, D., Lawson, R. and Thompson, D.G. 2013. “Does student engagement in self-assessment calibrate their judgement over time?” *Assessment & Evaluation in Higher Education* 38 (8):941-56.

Boud, D. and Soler, R. 2015. “Sustainable assessment revisited.” *Assessment & Evaluation in Higher Education*:1-14.

Brydges, R., Manzone, J., Shanks, D., Hatala, R.,Hamstra, S.J., Benjamin Zendejas, B. and Cook, D.A. 2015. “Self-regulated learning in simulation-based training: a systematic review and meta-analysis.” *Medical education* 49 (4):368-78.

Carter, H., and Thompson, J. 2015. “Defining the paramedic process.” *Australian journal of primary health* 21 (1):22-6.

Cooper, S. 2015. “A collaborative assessment of students’ placement learning.” *Assessment & Evaluation in Higher Education*:1-16.

Deeley, S.J. 2013. “Summative co-assessment: A deep learning approach to enhancing employability skills and attributes.” *Active Learning in Higher Education*:1469787413514649.

Dochy, F., Segers, M. and Sluijsmans, D. 1999. “The use of self-, peer and co-assessment in higher education: A review.” *Studies in Higher education* 24 (3):331-50.

Dreifuerst, K.T. 2009. “The essentials of debriefing in simulation learning: A Concept Analysis.” *Nursing education perspectives* 30 (2):109-14.

Husebø, S.E., O'Regan, S. and Nestel, D. 2015. “Reflective practice and its role in simulation.” *Clinical Simulation in Nursing* 11 (8):368-75.

Maestre, J.M. and Rudolph, J.W. 2015. “Theories and Styles of Debriefing: the Good Judgment Method as a Tool for Formative Assessment in Healthcare.” *Revista Española de Cardiología* 68 (04):282-5.

Mavin, T. J, and Roth, M.W. 2014. “Between reflection on practice and the practice of reflection: a case study from aviation.” *Reflective Practice* 15 (5):651-65.

Nicol, D.J, and Macfarlane-Dick, D. 2006. “Formative assessment and self-regulated learning: A model and seven principles of good feedback practice.” *Studies in Higher education* 31 (2):199-218.

O'Brien, K., Moore, A.,Dawson, D.A. and Hartley, P.R. 2014. “An Australian story: paramedic education and practice in transition.” *Australasian Journal of Paramedicine* 11 (3):4.

O’Donovan, B., Rust, C. and Price, M. 2015. “A scholarly approach to solving the feedback dilemma in practice.” *Assessment & Evaluation in Higher Education*:1-12.

Thompson, J., Grantham, H. and Houston. D. 2015. “Paramedic capstone education model: Building work ready graduates.” *Australasian Journal of Paramedicine* 12 (3).

4.6 Paper 6. Teaching Students to Think Like a Paramedic

This section contains the publication *Teaching students to think like a paramedic: Improving professional judgement through assessment conversations* (Thompson et al., 2017).

4.6.1 Background to the publication

The publication was created for the purpose of communicating the student-tutor consensus method using a narrative that was considered appropriate to industry paramedics who were the target audience. As a result, the publication presented a case study that, in part, inspired the design of and which illustrates the assessment dilemma considered common to many paramedic assessors, using inflexible competency based rubric tools. I was responsible for the production and composition of the publication with design and editorial assistance from Houston and Dansie. This publication features in the Australasian Journal of Paramedicine.

An authorship declaration is included in Appendix 6.

The publication is included in the following pages. This is reproduced with journal permission.

A copy of the questionnaire used to collect the data which is reported in this publication is attached in Appendix 11.

4.6.2 Citation

Thompson, J., Houston, D., & Dansie, K. (2017). Teaching students to think like a paramedic: Improving professional judgement through assessment conversations. *Australasian Journal of Paramedicine, 14*(4),1-5. https://doi.org/10.33151/ajp.14.4.543

Teaching students to think like a Paramedic: Improving Professional Judgement through Assessment conversations

Abstract:

The ability to self-assess is essential to the practitioner who often works independently, and reflective practice is entrenched within the paramedic process of care. In order to develop these practices a paramedic student must be able to self-identify mistakes and learn from their errors. However, student assessment has traditionally focused heavily upon outcomes, with errors being penalised. Justification for these customary approaches towards the assessment of paramedic students acknowledges the potentially catastrophic consequences associated with mistakes being repeated in the real pre-hospital setting. Responding to the challenge of balancing the reflective practice skills set with 'real world' implications of case outcomes, an assessment process was re-designed. The 'Student-Tutor Consensus Assessment' (STCA) was created to rebalance assessment weighting from being exclusively outcomes-focussed, and encourage students to apply a similar critical lens to events as the paramedics assessing them. Parallel tutor and student self-assessments are applied to simulated scenarios, with scores only awarded to criteria where consensus has been reached. METHOD: Final year undergraduate Batchelor of Paramedic Science students enrolled in a capstone topic were invited to complete a paper based questionnaire at the end of their studies. Questions sought student perceptions about the STCA features and effectiveness. RESULTS: n=90 responded. Responses to the 6 different questions showed a range of between 85.6-95.6% broad agreement regarding the value, effectiveness and suitability of the method. CONCLUSION: The pilot of the STCA approach proved highly successful, with student endorsement for the continued and expanded application for this teaching approach.

Key Words

student consensus, paramedic education, self-regulated learning, sustainable assessment, learning partnerships, formative assessment

Introduction:

Learning to become a paramedic involves more than simply being able to demonstrate practical task competence: it also requires the development of judgement and the capacity to reflect on performance. Mistakes when attempting tasks often provide some of the most valuable learning experiences. Despite this, most established assessment focuses on

assessment of learning to certify achievement with less emphasis placed on assessment for learning to feed forward into future practice. This balance of attention can have significant unintended consequences. Accidental performance may be rewarded over understanding: learning from mistakes is excluded from the assessment process. The two case studies below illustrate the dilemma.

Jeff and June are both paramedic students attempting practical assessments. A tutor is assessing them in accordance with a prescriptive rubric, which sees marks deducted for clinical errors or omissions.

Case 1:

Jeff attempts a chest pain scenario. His history taking and patient examination are both limited and consequently, several patient findings are not discovered. He manages to execute a suitable path of treatment, which results in an improvement to the patient's condition. During a debrief discussion with his assessor, it is apparent that Jeff was unaware of his practice omissions, and demonstrates a poor understanding of the underlying disease features. Jeff satisfies a majority of the assessment criteria which have an emphasis on critical outcomes and passes his exam.

Case 2:

June responds to a case of patient breathlessness. She arrives at the decision that several of the patient's features (including an extensive history of asthma) suggest that asthma was a probable diagnosis. June commits to asthma management pathway. With no patient improvement following her initial actions, she methodically critiqued the case asking herself "what was she missing?" Realising that she had forgotten to record a blood glucose level, she immediately reviews her approach. Sharing her understanding of the sequela of increased respiratory rates associated with ketoacidosis, she suggests that her initial diagnosis was probably incorrect, and modifies her management appropriately. June fails the assessment due to her initial incorrect reasoning and critical errors.

It can be argued that Jeff's actions were risk adverse, which would surely be a virtue to future paramedic practice. However with key patient data overlooked, whether his actions were based on sound reasoning or chance is unclear. Jeff is dependent on the tutor to indicate his performance and knowledge errors. For Jeff, a large amount of the learning took place during the debrief with the tutor, yet as much of the discussions fell outside the rigid grading design, little of the paramedic tutor's critique was represented on the report.

During June's debrief, she confidently led the discussion with her tutor. She identified all key case features, highlighting her errors and suggesting how she will adapt her future practice. The assessor had very little additional guidance to offer. June has clearly demonstrated her learning from the assessment. Once again, the report fails to capture this.

The focus upon clinical skills performance and outcome has resulted in assessments being 'of learning' as opposed to being 'for learning'. The essence of this narrow marking approach is the deduction of points for each student fault, as opposed to rewarding student learning.

These cases illustrate one of the concerns faced in our capstone subject: the approach to practical assessment marking–focused on skills performance–was potentially sending the wrong signals to students about what was important in practicing as a paramedic and what constituted 'good' performance. Concerns about students' approaches to study and grade seeking behaviours were one prompt to subject redesign including changes to practical assessment components to refocus student attention on learning rather than just performing to achieve good grades (Thompson, Grantham et al. 2015).

Some assessment literature over the last decade has focused on reframing assessment to integrate students' judgements about their own learning as a normal part of assessment activities'. Boud (2007) argued 'the key to learning in complex settings is to be able to 'look again', to monitor one's own performance, to see one's own learning in the context in which it is deployed'. Themes within this thread emphasise: the importance of practice to enable students to calibrate their judgements over time (Boud, Lawson et al. 2013); and aligning assessment with long term learning through 'sustainable assessment' (Mavin and Roth 2014, Boud and Soler 2015). Assessment that helps students to develop the capability to make judgements about their own performance and learning needs can be used using to develop reflective practitioners and self-regulated learners (Nicol and Macfarlane-Dick 2006). Existing challenges are noted in when it comes to the 'readiness' of graduates to undertake the role of a beginning paramedic (O'Brien, Moore et al. 2014), yet it is common place for educators to exclude students from the assessment process (Boud 2007). The practice of placing all of the responsibility for assessment in the hands of an assessor maintains a student dependence on others for judgement. This is considered at odds with the goals of training professionals who work mostly unsupervised (Kennedy, Kenny et al. 2015). These ideas heavily influenced our assessment redesign.

Method: Evaluating Assessment Re-design

This paper presents the paramedic specific context of the research findings obtained from a student-tutor consensus assessment component of a broader paramedic action research

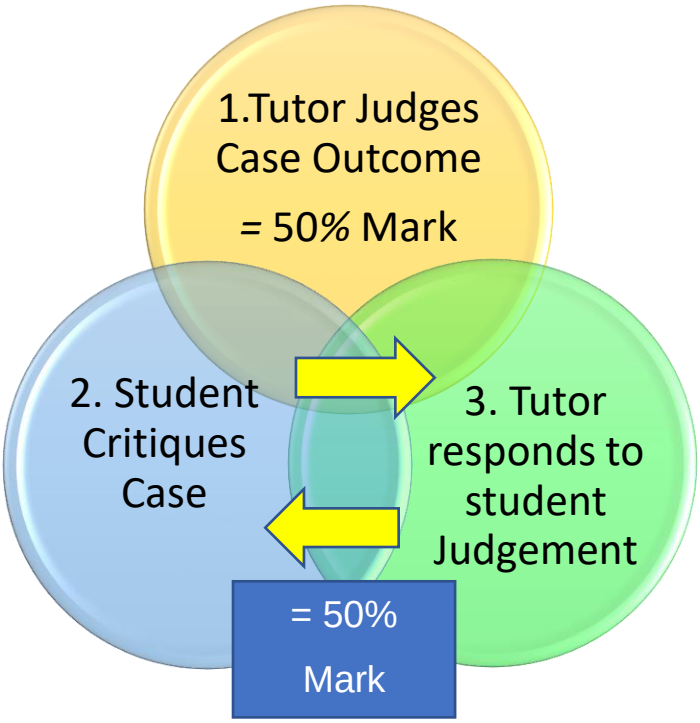
project (Thompson, Houston et al. 2016). This broader study focused on the evaluation of the effectiveness of a capstone paramedic practice subject in preparing students for the transition to the paramedic role. Carr and Kemmis (1983) explain action research as inquiry undertaken by participants to improve their own practices and their understanding of these practices and their context. Action research involves a cycle of identifying a local 'real life' problem situation, taking action to improve that situation and evaluating the effect of the actions to contribute to future improvement and learning. It contributes to the body of knowledge through sharing learning from the process and outcomes with the wider community. In our case the problem situation was the capstone topic and its connection to real life paramedic practice, which had been subject to some criticism. The action taken was to redesign the subject with particular attention to assessment components and their influence on developing students as critical reflective pre-hospital practitioners (Thompson, Houston et al. 2016). One part of the change, analysed in this paper, was the redesign of the practical clinical simulation assessment to incorporate and value students' clinical reasoning and their judgement about their practical performance.

Borrowing directly from on-road customs, the assessment re-design was deliberately based around the paramedic process of care (Carter and Thompson 2013), with criteria acknowledging recognised practice features of the paramedic role. Grading of clinical outcomes was retained, but reduced to now only represent 50% of the overall score. The total grade now also reflects student-tutor calibrated judgement of performance (50% of the score).

Implementing the student-tutor consensus method:

Students attempt the practical scenarios while being observed by their paramedic assessors. The tutors first grade the student in isolation. The case outcome and performance are scored (50%), then each paramedic process-of-care criterion is considered in turn, as either satisfactory or unsatisfactory. Before delivering their judgements to the student, tutors seek and report the student appraisal of the scenario. Students also evaluate whether they have satisfied each of the criteria. Consensus achieved between the paramedic tutor and student is rewarded (see Diagram 1).

Diagram 1. Student-Tutor Consensus Grading Model



Data collection methods:

A questionnaire investigating student experiences and perceptions of the assessment innovation, and its effectiveness for learning was administered to participants recruited from students enrolled in the capstone undergraduate paramedic topic in 2015. (This was the first cohort to experience the assessment methodology.) Ethics approval was obtained from the university's human research ethics committee. The questions relevant to this component of the study asked participants to rate their agreement with statements as; Strongly Disagree (SD), Disagree (D), Neither Agree or Disagree (N), Agree (A) or, Strongly Agree (SA).

The statements included;

1. The scenarios effectively combined my knowledge, reasoning and practical skills
2. Self-assessment is an important skill for paramedics
3. I found the student-tutor consensus marking format:
    a. Fair
    b. Effective for my learning
    c. Improved my ability to critically analyse my practice
    d. Helped me to develop skills I can use in my future profession

Results:

90 of the 94 eligible participants responded to the survey. In summary, 96.6% agreed or strongly agreed that scenarios effectively combined knowledge, reasoning and practical skills; 96.6% of students either agreed or strongly agreed that self-assessment is an important skill for paramedics. 87.8% of students found the student-tutor consensus marking format fair (strongly agreed or agreed with this statement), 91.1% found it effective for their learning, 94.4% found it improved their ability to critically analyse their practice and 85.6% found it helped them to develop skills for their future profession.

Discussion:

The assessment re-design witnesses a dramatic shift, moving from long traditions of penalising student mistakes. Tutor judgements have been extended to acknowledge learning occurring as a result of an assessment practice, instead of being solely performance driven. It was noteworthy how readily students both embraced the new assessment method. Borrowing heavily from recognised industry practices is considered to be central to the successful introduction to both paramedic tutors and student cohorts. All of the results demonstrate overwhelming broad student agreement across all domains of the questionnaire. At an early stage in the semester a small group of students did express their dissatisfaction with no longer being able to achieve ‘chance’ outcome scores. This validated the academic intent of eliminating ‘false positives’ from student results and ensuring grades were a true reflection of student capability. Sustainability in assessment practices (Boud and Soler 2015), is indicated through broad student agreement about the value for the approach to their practice beyond graduation.

Conclusions:

The role of a paramedic requires critical thinking and self-reflective practices. However, traditionally university education has placed greater emphasis on assessing students’ content knowledge and less on assessing their ability to self-reflect. We have introduced an innovation which develops student judgement and critical thinking. It actively positions the student voice in the assessment process, a domain usually reserved for the tutor. Students are often very aware when they have made errors, but are typically denied an opportunity to express this. This approach is not only well embraced by students, but offers a capacity to improve student judgement which has been industry calibrated through conversations with practicing paramedics. The real pre-hospital world is often unpredictable, requiring a paramedic to constantly re-evaluate and question their practices. The student-tutor consensus model offers an approach to assess how well a student can ‘think like a paramedic’.

Acknowledgements:

We wish to thank the academic staff and students of the Flinders University Bachelor of Paramedic Science degree for their contributions to the project.

Competing Interest:

We acknowledge there to be no competing interests related to the body of work being presented.

References:

1. Thompson J, Grantham H, Houston D. Paramedic capstone education model: Building work ready graduates. Australasian Journal of Paramedicine. 2015;12(3).

2. Boud D. Reframing assessment as if learning were important. Rethinking assessment in higher education: Learning for the longer term. 2007:14-25.

3. Boud D, Lawson R, Thompson DG. Does student engagement in self-assessment calibrate their judgement over time? Assessment & Evaluation in Higher Education. 2013;38(8):941-56.

4. Boud D, Soler R. Sustainable assessment revisited. Assessment & Evaluation in Higher Education. 2015:1-14.

5. Mavin TJ, Roth M-W. Between reflection on practice and the practice of reflection: a case study from aviation. Reflective Practice. 2014;15(5):651-65.

6. Nicol DJ, Macfarlane-Dick D. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. Studies in higher education. 2006;31(2):199-218.

7. O'Brien K, Moore A, Dawson DA, Hartley PR. An Australian story: paramedic education and practice in transition. Australasian Journal of Paramedicine. 2014;11(3):4.

8. Kennedy S, Kenny A, O'Meara P. Student paramedic experience of transition into the workforce: A scoping review. Nurse education today. 2015;35(10):1037-43.

9. Thompson J, Houston D, Dansie K, Rayner T, Pointon T, Pope S, et al. Student & tutor consensus: a partnership in assessment for learning. Assessment & Evaluation in Higher Education. 2016:1-11.

10. Carr W, Kemmis S. Becoming critical: Knowing through action research: Deakin University; 1983.

11. Carter H, Thompson J. Defining the paramedic process. Australian journal of primary health. 2013.

4.7 Paper 7. Programmatic Assessment Condensed

This section contains the publication *Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject* (Thompson & Houston, 2020).

4.7.1 Background to the publication

This publication reflects ongoing refinements of the final year capstone paramedic education experience, which were inspired by the programmatic assessment approaches applied to entire degree programs in medicine. I was responsible for the research and development of the project idea and led the development of the test and the research design. I was the principal contributor to the authorship of the publication. Dr Don Houston provided critical design advice for the project, research and publication, as well as an editorial role. This publication features in the Journal of University Teaching and Learning Practice.

An authorship declaration is included in Appendix 7.

A copy of the questionnaire used to collect the data which is reported in this publication is attached in Appendix 12.

The publication is included in the following pages. This is reproduced with journal permission.

4.7.2 Citation

Thompson, J., & Houston, D. (2020). Programmatic Assessment Condensed: Introducing Progress Testing Approaches to a Single Semester Paramedic Subject. *Journal of University Teaching and Learning Practice*, *17*(3), 1-16.

Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject

Abstract

The paramedic profession is rapidly evolving and has witnessed significant expansion in the scope of practice and the public expectations of the paramedic role in recent years. Increasing demands for greater knowledge and skills for paramedics has implications for the university programs tasked with their pre-employment training. The certification of paramedic student knowledge typically occurs incrementally across degree programs with aggregate results used to determine student qualification. There are concerns regarding learning sustainability of this approach. The narrowed focus of assessment practices within siloed subjects often neglects the more holistic and integrated paramedic knowledge requirements. Programmatic assessment is becoming increasingly common within medical education, offering more comprehensive, longitudinal information about student knowledge, ability and progress, obtained across an entire program of study. A common instrument of programmatic assessment is the progress test, which evaluates student understanding in line with the full broad expectations of the discipline, and is administered frequently across an entire curriculum, regardless of student year level. Our project explores the development, implementation and evaluation of modified progress testing approaches within a single semester capstone undergraduate paramedic topic. We describe the first reported approaches to interpret the breadth of knowledge requirements for the discipline and prepare and validate this as a multiple-choice test instrument. We examined students at three points across the semester, twice with an identical MCQ test spaced 10 weeks apart, and finally with an oral assessment informed by student's individual results on the second test. The changes in student performance between two MCQ tests were evaluated, as were the results of the final oral assessment. We also analysed student feedback relating to their perceptions and experiences. Mean student correct response increased by 65% between test 1 and 2, with substantial declines in numbers of "incorrect" and "don't know" responses. Our results demonstrate a substantial increase in correct responses between the two tests, a high mean score in the viva, and broad agreement about the significant impact the approaches have had on learning growth.

Key Words

Progress Test, Programmatic Assessment, Paramedic Education, Capstone

Background

Since the start of university-based paramedic education in Australia two decades ago, educators have faced challenges in preparing graduates for the highly specified paramedic role when using traditional teaching approaches (O'Brien, Moore et al. 2014). The ultimate target of graduate work-readiness within this discipline is measured by a yardstick which is both difficult to quantify and subject to differing interpretations (Thompson, Grantham et al. 2015). At the time of this study the Council of Ambulance Authorities (CAA) assumed responsibility as the regulator of the professional standards for the discipline as well as the accreditation of the national university programs, requiring universities to evidence student attainment of knowledge and skills which were seen to align with their set of broad paramedic core competency statements (CAA 2013). Since this study the Allied Health Professionals Regulator of Australia (AHPRA) has replaced the CAA as regulator, with these competencies replaced by an interim document of Professional Capabilities for Registered Paramedics (AHPRA 2019). Ambulance services coordinate their practice and policies to reflect interpretations of these standards, and similarly the specific detail required to inform these broad statements is left to the discretion of local university curriculum designers.

Paramedic curriculum distributed across subjects is also assessed within these compartmentalised increments of learning, with graduate credentials constructed from the aggregated sum of subject achievements. Assumptions made about student competence which are solely formed by the accumulation of incremental milestones are however challenged within medical education, as the atomised testing fails to reflect the more complex and interconnectedness of the content (Schuwirth and Ash 2013). These concerns are relevant to paramedicine also, notable as undergraduate studies draw towards completion with expectations that students have obtained and retained knowledge from all prior curriculum and are capable of applying it on demand. The consequences of graduate paramedic deficits surfacing in the field of emergency care are clearly potentially devastating. Despite this, it remains usual for university paramedic curriculums to teach and assess separate subject components, before moving to the next, seldom revisiting or reassessing student knowledge foundations. Rarely are students assessed on the comprehensive, integrated knowledge required of the discipline, the breadth of an entire curriculum, or through assessments designed in context of the discipline (Thompson, Grantham et al. 2015, Houston and Thompson 2017). In addition, there are concerns for the validity and reliability many exiting testing practices. In the cases where there are no marking deterrents imposed for incorrect responses, it is not clear the extent to which student scores faithfully reflect knowledge and not chance (Schuwirth and van der Vleuten 2012). Similar

concerns relate to the effectiveness of assessments in contributing to sustainable student learning (Boud 2000, Boud and Soler 2016). Our capstone program was originally introduced to enhance graduate standards through authentic discipline-based and personalised student learning approaches (Thompson, Grantham et al. 2015). Coordinated use of assessment 'for' learning has been central to all changes to the subject. While many improvements had been made within the subject design, it was evident that there was a significant gap in the expectations of student knowledge between the start of the single semester subject and their graduation. It was also apparent no clear representation of the full integrated knowledge expectations of the discipline existed to guide students.

Programmatic assessment for learning (PAL), a design commonplace in medical education, features assessment of student knowledge across an entire broad body of curriculum representative of expectations of the field of study (Heeneman, Schut et al. 2017). One tool used to achieve this is the progress test; a comprehensive exam designed to evaluate student mastery of knowledge, administered at regular intervals across all the years of their study (Wrigley, Van Der Vleuten et al. 2012). We sought to explore whether progress testing could be effectively introduced to paramedicine, and if an approach which is typified by repeated testing over a whole course, could be effectively applied within a single semester subject. This current project marks a shift in content, delivery and assessment rigour within our capstone paramedic subject. This paper describes the context for our innovation and the collaborative process we used to develop the instrument. We explain how we integrated our progress test into the student learning experience, and our various approaches to evaluate and analyse of our findings and their implications.

Capstone paramedic developments

For a decade we have been developing and evaluating teaching, learning and assessment innovations in a final year, single semester capstone topic of a Paramedic degree in an Australian university. The focus has been on 'bringing it all together' for student learning and making sense of all the material previously covered in the degree in preparation for the transition to paramedic practice (Thompson, Grantham et al. 2015, Houston and Thompson 2017). Previous cycles of action research have resulted in multiple modifications to the subject's pedagogy, principally responding to issues relating to the student relationships with assessment and its impacts on learning. Examination-related stress, grade seeking behaviour, student reluctance to accept critical feedback, and poor engagement with learning, had proved constant challenges for teaching staff (Thompson, Houston et al. 2016). The incremental changes since the initial redesign have placed much greater emphasis on formative learning, feedback to students and far deeper levels of student

understanding (Houston and Thompson 2017). We had previously introduced a formative pre-test to the start of the subject, sampling questions from subject material students had previously satisfied, before a mid-way summative multiple-choice exam (MCQ) then explored student knowledge of the content delivered, prior to a final viva interview. While these reforms marked considerable advances to the approaches to student learning, there remained a considerable leap in the content complexity and expectations confronting the students between the pre and midway tests. Additionally, the content and design of the midway multiple-choice test had yet to be widely validated, and principally reflected student driven leaning gaps from within the semester. We made a decision to explore the introduction of a progress testing approach as a means to enhance the quality of the existing suite of assessments within the capstone subject, and trial the suitability and effectiveness of the approach within a single subject ahead of broader program-wide consideration.

Progress Testing (PT)

An established feature of medical degrees in the Netherlands for over thirty years (Vleuten, Verwijnen et al. 1996), the test enhanced learning approach is now a global phenomenon (Howe, Campion et al. 2004). Initially introduced in response to the effects that examinations were having on driving rote learning among students, the progress test (PT) seeks to develop deeper student understanding (Van Berkel, Nuy et al. 1994). It also answered a call for a suitable assessment strategy to respond to self-directed PBL based curriculum models (Vleuten, Verwijnen et al. 1996) (Tio, Schutte et al. 2016). With PTs, conventional single summative tests are replaced by a series of similar repeated tests dispersed across an entire program of study with every enrolled student across all year levels sitting the same test simultaneously (Coombes, Ricketts et al. 2010). Students' broad understanding is tested and retested (Muijtjens, Schuwirth et al. 2008). This acknowledges that the outcomes of a single test are likely to be a less reliable indicator of student ability than multiple samples of testing dispersed over time (Schuwirth and van der Vleuten 2012). A carefully choreographed suite of low stakes assessments providing maximal feedback, enable the student to be self-aware of their ability levels and development (Muijtjens, Schuwirth et al. 2008, Hauff, Hopson et al. 2014). Where traditional assessment programs offer insight into student incremental learning steps, they are unable to validate student mastery of the full, inter-related curriculum (Verhoeven, Verwijnen et al. 2002).

Progress tests are designed to represent the full breadth of functional knowledge required for the discipline, are not aligned to any one subject or student year level, and commonly involve large samples of questions drawn from large question pools (Heeneman, Schut et al. 2017, McHarg, Bradley et al. 2005). Sampling the whole breadth of curriculum, it is

considered near impossible for a student to cram or binge learn as preparation for the test: instead learning is more evenly regulated across a full program (Muijtjens, Hoogenboom et al. 1998, Van Berkel, Nuy et al. 1994). This type of test-directed learning is linked to learning enhancement as well as offering educators more reliable indicators of student knowledge retention (Schuwirth and van der Vleuten 2012). Replacing simple passive measurement of student knowledge with a tool which is an active driver for learning has led many to re-think how they regard assessment (Freeman, Van Der Vleuten et al. 2010). Commonly multiple-choice exam formats are used for testing (Ricketts, Freeman et al. 2009), however, examples of alternative assessment styles such as objective structured clinical examinations (OSCEs) in medicine have been recently emerging (Pugh, Touchie et al. 2014). The merits of PTs have also seen their broader application to disciplines beyond medicine such as dentistry, although we found no reported instances of PT use within paramedic education (Bennett, Freeman et al. 2010). Despite our subject comprising only a single semester of a three year teaching program, we felt that a comprehensive test series which could provide students with rounds of feedback set against the discipline's knowledge requirements, matched the ethos of our capstone approach. Our initial steps were to establish and validate the knowledge expectations of the discipline.

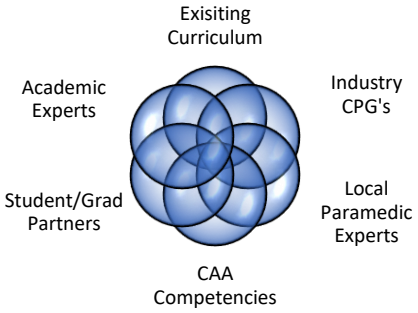
Methods

Determining Paramedic Knowledge: Paramedic learning list

Australian universities offering paramedic education have been guided by the 'Paramedic Professional Competency Standards' produced by the Council of Ambulance Authorities (CAA) (CAA 2013). This has since this been replaced by AHPRA, with a current interim set of Professional Capabilities for Registered Paramedics (AHPRA 2019). The CAA document broadly specifies the expectations for paramedic practice within industry, which by inference determines the goals of any underpinning education and training (O'Brien, Moore et al. 2014). Broad statements are presented under the headings of 'Professional Expectations of a Paramedic' and 'Knowledge, understanding and skills required for Practice'. These are neither an exhaustive list of knowledge or skill components, nor specific instructions, but represent an equivocal set of points which can be translated for the vastly differing dialects of Australia's ambulance services and education providers. In the absence of definitive detail to inform specific graduate knowledge, we set about compiling these elements. Starting with the existing undergraduate curriculum, each learning outcome and all teaching and assessment artefacts were reviewed, itemised and paired alongside the clinical practice guidelines (CPGs) which represent instructions for practicing local paramedics. A decision was made to restrict the parameters of content to the core paramedic science and practice

topics, reflecting the more qualitative nature of much of the professional stream subjects and consideration of the suitability of an MCQ to effectively assess this knowledge. Academic staff responsible for teaching design and delivery reviewed the lists in relation to their own teaching and curriculum priorities. In addition, several senior paramedic clinicians from the local industry were invited to review items, offering opinion regarding the significance of items to the practice of paramedics. We also included several recent graduates within the item review process. The process of identifying the elements for the list is illustrated in Figure 1. The approach represented a modified Delphi method of building consensus around the inclusion of items through repeated phases of expert item review (Gordon 1994).

Figure1. Learning list item contributions



The next phase involved mapping and linking each of these items through a process which drew together concepts normally the domain of a single subject with those from others and with features of practice requirements drawn from the CPGs. This scaffolding process integrated concept themes such as anatomy, pathophysiology, pharmacology, clinical skills and field instructions. Despite these broad subject areas usually representing pre-requisite requirements, student knowledge usually had been evaluated in isolation. An exhaustive process of itemising, accounting and organising key items of learning and paramedic practice enabled us to produce a template comprising primary items and four connected subsidiary items. Mapping, distilling and aligning concepts generated a framework which underpinned our progress test. This was again considered by our review team for legitimacy and perceived relevance to both university curriculum and paramedic practice. The product which resulted was a prioritised and validated list of 100 primary concepts, each aligned to 4 sub-concepts (400 in total).

The test design: TEST QUESTIONS

Once the list had been established and validated, constructing test questions commenced, with the list providing the framework for both question and four potential responses (one correct and three distractors). Throughout the design process a goal was to ensure that assessments represented a faithful measurement of student knowledge. We deliberately sought to reduce student results which were obtained through chance or through only partial topic knowledge used to eliminate obvious incorrect distractors. We aimed to create items which a student ‘who knows’ would be able to get correct but a student ‘who doesn’t know’ would be unlikely to get correct. Consequently, test outcomes would be less likely to reflect false positive or false negative performances (Schuwirth 2004). Literature and resources on

optimal assessment design were consulted, and the revised taxonomy of multiple-choice item writing guidelines tool was applied as a filter during question composition and editing phases (Haladyna, Downing et al. 2002). Consistency in response item length and opening wording were carefully considered to ensure that item structure was unlikely to be a factor influencing the student response decision. Our group of academic staff, recent graduates and senior paramedics then participated in a series of question review sessions to ensure relevance, non-ambiguity, fairness and balance, as a final validation of the question set with particular attention to content, format, style and writing. The result was a set of questions with validated discriminators which correlated directly to a learning list of items which integrated broad curriculum and industry expectations and represented consensus between all contributors. An example of the learning list items and MCQ question relationship is presented in table 1.

Table 1. Learning list and MCQ relationship example

Learning list item: *Myocardial Infarction*	**Subject Domains**
• Hospital referral criteria for code STEMI	Clinical Practice Guidelines
• Identify coronary arteries and the regions they perfuse	Anatomy
• Explain pharmacodynamics of aspirin	Pharmacology
• Describe the ECG changes consistent with MI	Assessment skills
MCQ Question: *Which one of the following statements regarding Myocardial Infarctions is correct?* a) The patient must be experiencing moderate to severe chest pain in order to satisfy code STEMI criteria b) The left anterior descending artery supplies blood to the AV node and posterior myocardium c) Aspirin promotes prostaglandin release to create less clot formation d) ST segment elevation in leads II, III and aVF is suggestive of an inferior MI e) Don't know	

Marking & Grading Decisions

Considerable disagreement exists on optimal test marking approaches. Central to the debate is the capacity of differing approaches to provide a true account of student knowledge (Lesage, Valcke et al. 2013, Burton 2005). In the case of simple 'marks for correct answer' approach, criticism relates to assessors being unaware of the extent a final score is achieved from chance (Burton 2001). Alternatively, negative marking approaches which seek to discourage students guessing through penalising incorrect answers attract criticism for the additional test-related anxiety these create for some students, while others

suggest that it is infrequent that students entirely guess a response, but instead use deduction informed by some knowledge (Lesage, Valcke et al. 2013). One point of consensus is that there is no one optimal measure, but instead a need for assessment design to consider local need and context (Burton 2004). The specific context of our discipline ultimately informed our grading decisions. Paramount to the practice of paramedics is the requirement that all clinical decisions are founded on effective knowledge for practice, with a high degree of risk aversion and clinician recognition of their own limitations (CAA 2013). We wanted test practices to echo this philosophy. Conscious of the critical negative marking rhetoric it was still felt that reducing chance results and encouraging students to self-identify material they had not yet mastered was consistent with our wider learning intentions. The construct of our test distractors involving differing domain knowledge was intended to counter deductive elimination based on partial knowledge guesses. In the case of a student who was unsure of the correct answer, our preference was that they choose the 'don't know' option and received the structured learning support featured within our subject pedagogy. Our final student test scores were designed to reflect a summary of correct minus incorrect responses.

Test Implementation

Progress Test 1

Progress test 1 was administered on the first day of the semester. Typically progress testing is introduced with no prior exposure to material being examined. By contrast our students had previously covered most of the content across two and a half years of the teaching program. While they had previously satisfied the assessment milestones, their knowledge had been examined solely within the boundaries of individual subjects and not the broader context of the pre-hospital setting requirements.

Students were required to select a single correct answer from four possible options or 'don't know', with three options being distractors. The first test was entirely formative introducing students to the PT experience and offering early performance benchmarking and self-reflection opportunities. Negative marking applied to incorrect answers and students received a zero mark for each unanswered or declared unknown answer. As each question shared a direct relationship to knowledge expectations for practice, we wanted incorrect answers to show that there would be foreseeable consequences associated with judgement or practice errors, while also considering areas of strengths and weaknesses in their understanding of the curriculum.

A common practice with PTs is to provide students with a copy of their exam questions, to encourage students to continue to reflect beyond the test, noting problems encountered when tests feedback is withheld (Wade, Harrison et al. 2012). We decided to deviate from this and provided students access to their results and a copy of the learning list which corresponded directly with each individual question. This directed student learning towards identified knowledge gaps (incorrect questions) with a corresponding learning list, supporting learning while also preserving the question set for subsequent test use and enabling us to make direct comparisons on the two tests. Replacing the exam questions with the learning list was intended to encourage the development of broader student understanding and discourage students from being distracted by debating question semantics rather than investing effort in learning. We offered students the opportunity to seek additional clarification in a face to face meeting with staff, where additional feedback or concerns could be explored.

Learning List in Teaching

In addition to providing the framework for exam questions the learning list permeated all other areas of teaching. Classroom problem-based learning (PBL) sessions constructed around authentic cases steered students through selections of items from the learning list presented in context of actual patient cases and reasoning challenges. The PBL encourages students to recognise the context and deeper understanding around material through collaborative problem solving (Vleuten, Verwijnen et al. 1996, Wood 2003). At the close of each class, students were required to self-nominate a list item to research before reporting back to a group shared wiki platform. Like the collaborative peer learning experience of the PBL, the wiki offers students a vehicle to continue co-constructing understanding (Notari 2006, Parker and Chao 2007, Cole 2009). Students assembled a collective body of information and sourced links supporting the learning of the group. Over the semester each group compiled entries for all items on the learning list producing a comprehensive database of shared study resources which corresponded to the PT content.

Practical classes were also mapped to the learning list to encourage a hands-on application of required knowledge. Simulated scenarios mimicking ‘on-road’ events, required students to work through a defined discipline-specific paramedic process of care (Carter and Thompson 2013). Student responses, performance and judgement formed the basis of these events, which were calibrated against the guidance of their paramedic tutors in a consensus-based assessment approach, a largely self-regulated approach to learning requiring student self-critiques of their efforts (Thompson, Houston et al. 2016). This format of alternating PBL,

practical classes and online wikis connected through the learning list was used for a ten-week cycle prior to students repeating the identical progress test for the second time.

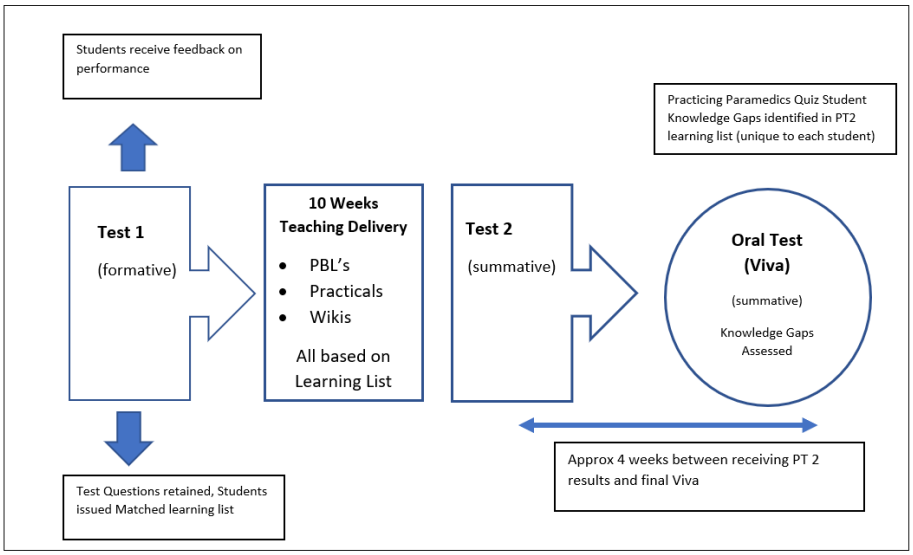
Progress Test 2

The identical test was re-administered at week 11 with student marks this time contributing to their final grade for the subject. Questions were again retained by staff at the close of the exam and feedback on performance was channelled through the learning list. This time the test was also used as a diagnostic tool with results informing a personalised oral exam, unique to the gaps identified for each student.

Viva/Oral Exam (Test 3)

Ambulance industries routinely use a viva approach to determine knowledge or competence particularly during recruitment (Guss and Posluszny 1984, Thompson, Grantham et al. 2015). Despite the importance placed on a graduate's ability to respond well, students had previously not been exposed to these within their study program, meaning they were unprepared for these events prior to recruitment, which influenced our inclusion of vivas within our assessment strategies. Vivas are noted for enabling face to face judgements of student competence beyond what is achievable within a written exam (Torke, Abraham et al. 2010). For many of our graduates these also represent one of the next major hurdles they will encounter–potentially with high stakes attached to their performance (Thompson, Grantham et al. 2015). Students were made aware from the start they were to sit the two identical progress tests and that the question items they had been unable to answer correctly in PT 2 would contribute to a pool of list items they could potentially be asked to discuss during the viva. Students had approximately four weeks following the PT2 to target remaining gaps in their knowledge. The strategy intended to direct maximal learning efforts towards students' weakest areas of understanding. Each viva was assessed by two tutors who were also practicing paramedics in a deliberate effort to calibrate the quality of student responses against the expectations of local industry. Many of these paramedic tutors were already familiar with the academic motives of the capstone subject. Assessors selected 3 items from the student's unique results profile and during a 15-minute interview the student shared their understanding of these items. Summative scores were awarded for accuracy, depth and breadth of information provided. The viva marked the final step of the interrelated test-driven learning experience illustrated in Figure 2.

Figure 2. Summary of the assessment design



Evaluation of the innovation

We analysed student performance in the identical tests administered 10 weeks apart as well as performance in the final viva. Additionally, a questionnaire was administered to participants recruited from the student cohort. (Ethics Approval was obtained through the Social and Behavioural Research Ethics Committee project approval: 8034.) Students were notified of the study by email prior to commencing the subject and advised their participation was entirely voluntary and assured their responses would not be identifiable. Participant responses were obtained via a paper questionnaire administered to students during the last contact day of the subject. Students were required to rate their level of agreement with statements as well as being provided an option for free text to provide additional comment. All responses were de-identified, and responses entered to a spreadsheet for analysis.

All 103 students (101 internal and 2 distance education) attempted both progress tests. Item response analysis was conducted on the progress test questions using RASCH modelling. The statistical parameters for difficulty and discrimination had previously been established and validated for use with the University's medical degree and are presented alongside the two test results in Table 2.

Calculation of discrimination was calculated using percentile for discrimination of 25.

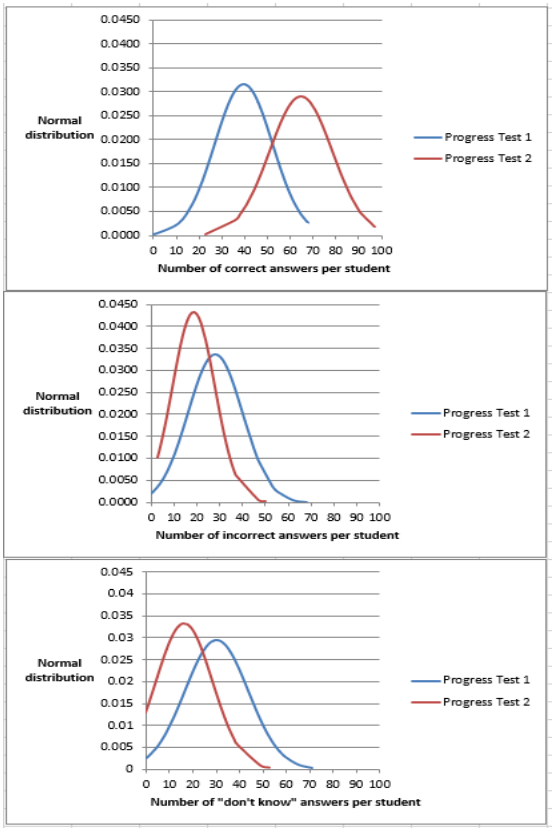
$$D = \left(\frac{item\ count\ (upper)}{number\ students\ (upper)}\right) - \left(\frac{item\ count\ (lower)}{number\ students\ (lower)}\right)$$

Table 2. Statistical parameters for question difficulty and discrimination

	Difficulty				Discrimination		
	>=80 Easy	>=50 Good	>=30 Hard	<30 V Hard	>=0.19 Good	>=0.1 Moderate/OK	< 0.1 Non Discrim
PT 1	4	34	32	30	66	15	19
PT 2	26	53	18	3	79	15	6

Initial measures considered the differences in student responses over the 2 tests (correct, incorrect and don't know responses) were analysed using a paired t-test analysis in order to establish the statistical significance of the variance between the two tests using SPSS version 25. The eta squared statistic was calculated to ascertain the effect size and interpreted using the guidelines proposed by Cohen (2013). Our results showed a highly statistically significant increase in the number of correct responses from progress test 1 (M=40.15, SD=12.11) to progress test 2 (M=64.39, SD=13.46), t(102)=-16.67, p≤.001 (two tailed). The mean increase in number of correct responses per student was -24.24 (95% CI=-27.13 to -21.36). The eta squared statistic (.73) indicated a large effect size. There was a highly statistically significant decrease in the number of incorrect responses between progress test 1 (M=28.17, SD=11.68) and progress test 2 (M=19.15, SD=9.12), t(102)=6.92, p≤.001 (two tailed). The mean decrease in incorrect responses per student was 9.03 (95% CI=6.44 to 11.62). The eta squared statistic (.32) indicated a large effect size. There was a highly statistically significant decrease in the number of "don't know" responses between progress test 1 (M=31.69, SD=15.16) and progress test 2 (M=16.47, SD=11.88), t(102)=8.56, p≤.001 (two tailed). The mean decrease in "don't know" responses per student was 15.22 (95% CI=11.69 to 18.75). The eta squared statistic (.42) indicated a large effect size. The mean scores of students' correct, incorrect and don't know responses between the two test intervals are presented in Figure 3.

Figure 3. Distribution Curves Student Responses for Progress Tests 1 & 2



Final Viva Results:

103 students participated in oral viva assessments in week 15 of the semester. Based on the second progress test results, the mean number of potential viva themes was 35, each with 4 sub-theme items (based on incorrect or don't know responses). The cohort's performance within this final assessment item produces a mean student score of 71% with the range: 23-100%. More than 10% of the class achieved 100%.

Student Perceptions:

88 students (91%) voluntarily completed the survey directly following the final viva. The table below illustrates the level of broad agreement obtained from the survey. Survey questions were designed to capture student perceptions relating to their experiences with the test, its effects upon their learning, and value of the approaches.

Free text responses proved additionally informative. We used thematic analysis to analyse the student comment across the written responses. The recognised themes emerging from the student feedback could mostly be organised within a small number of different classifications. Themes were most commonly reflected; *1. Challenging Experience Good, 2. Challenging Experience Bad, or 3. Personal Development/ Achievement*. When these were

considered in parallel with the quantitative responses it appeared consistent that students found the test to reflect the breadth of curriculum and effective at identifying knowledge gaps and challenging them to learn, however students appeared divided over how well they received and responded to this.

Comments included:

"forced me out of my comfort zone", "it was terrifying but very helpful in the end", "Stressful but effective", "challenging….definitely learned a lot" ….."more confident"

Similarly critical reviews *"felt discouraged from choosing (when didn't know answers)", "A lot of content to cover in a short time which made me feel pressured & stressed" , "difficult if you are not comfortable being scrutinised", "stressful to get my abilities to expected standards"*

Student comments also reflected on the learning process.

"Made to learn in a comprehensive manner", "good preparation for the future" "very useful - Broad study was required ...exactly what we need…" "learning to self-learn is more valuable than being spoon-fed information"

The 2 test scores, quantitative ratings and qualitative reports appear to support a similar conclusion: the subject was challenging but highly effective at generating learning and engaging students.

Table 3. Survey Question Response Ratings

Questions	% Broad Agreement
Test content effectively reflect the breadth of the undergraduate curriculum	89.7%
Questions challenged my understanding	95.5%
Test 1 was effective identifying gaps in my knowledge & understanding	95%
Re-sitting the identical test was an effective way to measure personal development	86.4%
I was satisfied with the amount I learned between the 2 tests	76.1%
Negative marking discouraged me from guessing answers	85.2%
I normally guess answers in exams	55.7%
The viva encouraged me to effectively target personal knowledge development	93.2%
Explaining my answers verbally enabled me to demonstrate my understanding	83%
It was beneficial to include this type of industry assessment approach to university teaching	89.7%

Discussion

Development of our learning list in collaboration with members from industry was critical to the identification, interpretation and validation of specific content detail. This reflects the general importance of the industry stakeholder relationship within curriculum design (Orrell 2011, Jackson 2015). Previously university curriculum and industry-based practice guidelines had been considered and developed by each group in isolation, or with ad hoc opinions sought. Our collaborative test building approach advanced a mutual appreciation and addressed assumptions from each group. The decision to include several recent graduates to the review committee provided invaluable insight to student reactions and test strategies during design and aligns with the benefits espoused for the engagement of students as partners (Healey 2014, Matthews 2017).

Capstone subjects and progress tests may appear incompatible at first glance. PTs offer longitudinal student performance data, encouraging paced learning across a whole program and discouraging intensive bursts of isolated study, where capstones represent a final learning push (Houston and Thompson , Kinzie 2013). PT avoidance of cramming and binge learning (Schuwirth and van der Vleuten 2012) is challenged in intensive single semester delivery. They do however share some important common ground. Both aim to facilitate learning through immersing students into a full experience of the discipline, its practices, knowledge and expectations. We accept that the confines of a single semester period mean we forgo the beneficial longitudinal performance data. However, data from 3 tests (2 MCQ and 1 viva) is a marked improvement on student data achieved from the former single summative test. A conventional PT philosophy discourages student focus on test preparation as a strategy to avoid superficial and less sustainable rote learning (Van Berkel, Nuy et al. 1994, Dijksterhuis, Scheele et al. 2009). In contrast we repeatedly promoted our learning list, openly advertising the 400 items (relating to 100 questions). Essentially these represented an extensive set of mini learning outcomes which students were to be measured against on 3 occasions during the single semester. Where PTs direct student focus to the wider curriculum instead of a test, we potentially met this ideal part way with our design.

Comparing PT1 and PT2 results the 64% increase in total correct student responses and reductions in incorrect (33.5%) and “don’t know” responses (47%) with the student reported experiences, and the observed paramedic assessor feedback suggest considerable learning growth. Improvements to student test scores in an examination they had previously attempted, following 10 weeks of focussed teaching and learning design may seem unremarkable and likely a predictable result, but this does not represent the complete picture. This was by far the most comprehensive test the students had encountered in the

history of our degree and represented knowledge critical to their future work as paramedics. Mastery of 400 learning items deemed essential to on-road practice places greater stakes beyond a simple test score result, with foreseeable consequences linked to knowledge gaps or poor decisions. The value of using such a comprehensive test is also reflected in the literature as a means to address the practice of student strategic revision ahead of deeper sustained learning, with the importance of 'whole discipline knowledge' emphasised (Van Berkel, Nuy et al. 1994, Norman, Neville et al. 2010). Until now paramedic students had not been measured on their 'whole knowledge' and the broader expectations of the paramedic role. Nor had they been previously exposed to a correct minus incorrect scoring approach. This is considered important to the reliability of making test-based decisions about students, with the justifications posed in medicine that it is unacceptable practice for doctors to be forced to guess responses when they are unsure (Schuwirth and van der Vleuten 2012). This same argument is appropriate for the paramedic.

To the cohort of previously high achieving students embarking on their final academic phase, many already with conditional offers of employment, an adjusted class mean score of 14% on PT 1 close to the end was extremely confronting. We were very interested to explore the effect our first use of negative marking had upon student test behaviour and posed a survey question about what amount of negative weighting it would take to deter students from guessing an answer in a test. While the responses varied, -1 was the most common response with 35% supporting this. Remarkably 8.3% indicated that no weighting amount would stop them from guessing to potentially optimise their scores. More than half of the respondents (55%) indicated it was normal for them to guess answers in exams. With the PT reflecting curriculum students had previously satisfied, these responses coupled with a PT1 correct score of only 40%, compelled us to question the role chance had played with inflating previous student grades.

While the numbers of correct, incorrect and don't know responses all showed pleasing shifts between the tests, student attitude towards the PT1 result proved pivotal to their success. Students more willing to accept the critical PT1 results proved far quicker to engage with the learning structure of the subject and respond to knowledge gaps. The free text feedback results echoed this with the identified 'challenging experience good' and 'challenging experience bad' themes, suggesting that while many students felt they were challenged by the testing process, individual 'like' or 'dislike' for of being challenged influenced student decisions about the value of the approach. Many embraced the testing format and opportunities to target knowledge gaps, while others struggled with receiving such extensive critical feedback and vehemently defending a right to chance test results. The perceived

impacts on GPA close to their course completion outweighed any learning benefit of the innovation for these few.

PT claims to being linked to a reduction in test-related anxiety (Heeneman, Schut et al. 2017) was certainly different to our own experience when applied to a single semester topic and for the first time for our students. Regardless of the purely formative nature of PT1, the results were clearly inconsistent with the expectations for many students. Student awareness that the next time they would face a summative test on the same instrument which had left much knowledge very exposed proved a source of some nervousness for much of the semester. While it was not feasible in this study to compare results and experiences across previous cohorts given the changes to content and approaches, anecdotally exam related stress was not reported to be higher than in previous years. By retaining and re-using the same test questions for PT 1 and PT 2 we attempted to address concerns of students memorising questions ahead of prioritising substantive learning through frequent requirements of students to demonstrate their knowledge in PBL and practical exercises. The inclusion of an oral viva further encouraged deeper student understanding. We have no way of establishing if students did or did not memorise any of the questions, however during a subject exit interview, students shared how unfamiliar they felt with the specific questions wording after having been so focussed on the learning list, with several conveying their genuine surprise that the 2 tests were identical despite being made aware this was to be the case from the start of the subject.

Our decision to include a viva to the PT offered a variation on the versatility of PTs. Although there are examples in the literature of alternatives to MCQ PTs, such as OSCEs (Pugh, Touchie et al. 2014), we were unable to find reports of the use of PT content across several linked assessment formats. We had introduced the viva assessment in an earlier iteration of the subject and have found it continues to be well received by students.

Regardless of whether they liked or disliked the test-driven design, there was clear consensus the method had been highly effective at contributing to relatively rapid learning growth.

Conclusion

Consensus was reached between 100 core themes and 400 related essential concepts which can offer an illustration of the core knowledge requirements for the Australian paramedic, and a comprehensive guide for the expectations of graduates. We have been able to construct a test which we feel to be a valid instrument for measuring knowledge of

this content. The approach we have used to imbed the testing within a single subject offers students a transparent guide of the expectations of the discipline, and support to respond to these. We are confident that the integrated nature of content within the test design and the rigour used to ensure student results more accurately reflect student understanding.

We found clear student admissions of chance score contributions in the past and the need for a significant penalty requirement in order to influence any change to student test behaviour. While the use of negative marking may remain up for debate, discouraging student paramedics from making practice decisions when they are unsure, continues to be a position supported by our expert group. An effect on other behaviour like cramming, is difficult for us to measure directly, however we have been able to demonstrate regular student engagement with the test material across a semester. We recognise the limitation of the data being constrained to student performance measures and student perceptions, however these remain two fundamental measures of the success of any teaching innovations.

Our design and evaluation offer a model for others considering introducing a programmatic assessment approach to a teaching program, who may first require a test of the viability of the process prior to a wholesale course wide commitment and undertaking.

We have ambitions to transition the full paramedic program to programmatic assessment, which will require far broader acceptance and approval from internal and external interest groups.

References

Australian Health Practitioner Regulation Agency 2019, *Professional capabilities for registered paramedics,* viewed 30/10/2019,https://www.paramedicineboard.gov.au/Professional-standards/Professional-capabilities-for-registered-paramedics.aspx

Bennett, J, Freeman, A, Coombes, L, Kay, L & Ricketts, C 2010, 'Adaptation of medical progress testing to a dental setting', *Medical teacher,* vol.32**,** no.6, pp.500-502.

Boud, D 2000,'Sustainable assessment: rethinking assessment for the learning society', *Studies in continuing education,* vol.22**,** no.2, pp.151-167.

Boud, D & Soler, R 2016, 'Sustainable assessment revisited'. *Assessment & Evaluation in Higher Education,* vol.41, no.3, pp.400-413.

Burton, RF 2001, 'Quantifying the effects of chance in multiple choice and true/false tests: question selection and guessing of answers', *Assessment & Evaluation in Higher Education,* vol.26**,** no.1, pp.41-50.

Burton, RF 2004, 'Multiple choice and true/false tests: reliability measures and some implications of negative marking', *Assessment & Evaluation in Higher Education,* vol.29**,** no.5, pp.585-595.

Burton, RF 2005, 'Multiple-choice and true/false tests: myths and misapprehensions', *Assessment & Evaluation in Higher Education,* vol.30**,** no.1, pp.65-72.

Council of Ambulance Authorities 2013, Paramedic Professional Competency Standards Version 2.2., viewed 30/10/2019, https://www.caa.net.au/images/documents/resources_for_universities/Paramedic_Professional_Competency_Standards_V2.2_February_2013_PEPAS.pdf

Carter, H & Thompson, J 2015, 'Defining the paramedic process', *Australian journal of primary health*, vol.21, no.1, pp.22-26.

Cohen, J 2013, '*Statistical power analysis for the behavioral sciences'*, Routledge.

Cole, M 2009, 'Using Wiki technology to support student engagement: Lessons from the trenches',*Computers & education,* vol.52**,** no.1, pp.141-146.

Coombes, L, Ricketts, C, Freeman, A & Stratford, J 2010, 'Beyond assessment: feedback for individuals and institutions based on the progress test', *Medical teacher,* vol.32**,** no.6, pp.486-490.

Dijksterhuis, M, Scheele, F, Schuwirth, L, Essed, G, Nijhuis, J & Braat, D 2009, 'Progress testing in postgraduate medical education', *Medical teacher,* vol.31**,** no.10, pp.e464-e468.

Freeman, A, van der Vleuten, C, Nouns, Z & Ricketts, C 2010, 'Progress testing internationally', *Medical teacher,* vol.32, no.6, pp.451-455.

Gordon, TJ 1994, 'The delphi method',*Futures research methodology,* vol.2**,** no.4, pp.1-30.

Guss, DA & Posluszny, M1984, 'Paramedic orotracheal intubation: a feasibility study' *The American journal of emergency medicine,* vol.2**,** no.5, pp.399-401.

Haladyna, TM, Downing, SM & Rodriguez, MC 2002,'A review of multiple-choice item-writing guidelines for classroom assessment', *Applied measurement in education,* vol.15**,** no.3, pp.309-333.

Hauff, SR, Hopson, LR, Losman, E, Perry, MA, Lypson, ML, Fischer, J & Santen, SA 2014, 'Programmatic assessment of level 1 milestones in incoming interns', *Academic Emergency Medicine,* vol.21**,** no.6, pp.694-698.

Healey, M 2014, 'Students as partners in learning and teaching in higher education' Workshop Presented at University College Cork, vol.12, pp.15.

Heeneman, S, Schut, S, Donkers, J, van der Vleuten, C & Muijtjens, A 2017, 'Embedding of the progress test in an assessment program designed according to the principles of programmatic assessment', *Medical teacher,* vol.39, no.1, pp. 44-52.

Houston, D & Thompson, J 2017, 'A bridge to 'being'a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject'*, Research and Development in Higher Education: Curriculum Transformation,* vol.40, pp.175-185.

Houston, D & Thompson, J N 2017, 'Blending Formative and Summative Assessment in a Capstone Subject:'It's not your tools, it's how you use them', *Journal of University Teaching & Learning Practice,* vol.14, no.3

Howe, A, Campion, P, Searle, J & Smith, H 2004, 'New perspectives—approaches to medical education at four new UK medical schools' *Bmj,* vol.329**,** no.7461, pp.327-331.

Jackson, D 2015, 'Employability skill development in work-integrated learning: Barriers and best practice', *Studies in Higher Education,* vol.40**,** no.3, pp.350-367.

Kinzie, J 2013, 'Taking stock of capstones and integrative learning', *Peer review,* vol.15**,** no.4, pp.27.

Lesage, E, Valcke, M & Sabbe, E 2013, 'Scoring methods for multiple choice assessment in higher education–Is it still a matter of number right scoring or negative marking?', *Studies in Educational Evaluation,* vol.39, no.3, pp**.**188-193.

Matthews, KE 2017, 'Five propositions for genuine students as partners practice', *International Journal for Students as Partners,* vol.1, no.2

McHarg, J, Bradley, P, Chamberlain, S, Ricketts, C, Searle, J & McLachlan, JC 2005,'Assessment of progress tests', *Medical education,* vol.39**,** no.2, pp.221-227.

Muijtjens, A, Hoogenboom, R, Verwijnen, G & van der Vleuten, C 1998, 'Relative or absolute standards in assessing medical knowledge using progress tests', *Advances in Health Sciences Education,* vol.3**,** no.2, pp.81-87.

Muijtjens, AM, Schuwirth, LW, Cohen-Schotanus, J & van der Vleuten, CP 2008,'Differences in knowledge development exposed by multi-curricular progress test data', *Advances in Health Sciences Education,* vol.13**,** no.5, pp.593-605.
Norman, G, Neville, A, Blake, JM & Mueller, B 2010, 'Assessment steers learning down the right road: impact of progress testing on licensing examination performance', *Medical teacher,* vol.32**,** no.6, pp.496-499.
Notari, M 2006, 'How to use a Wiki in education:Wiki based effective constructive learning', Proceedings of the 2006 international symposium on Wikis, 2006 ACM, pp.131-132.
O'Brien, K, Moore, A, Dawson, D & Hartley, P 2014, 'An Australian story: paramedic education and practice in transition', *Australasian Journal of Paramedicine,* vol.11, no.3
Orrell, J 2011, 'Good practice report: Work-integrated learning', *ALTC: Strawberry Hills*.
Parker, K & Chao, J 2007, 'Wiki as a teaching tool' *Interdisciplinary Journal of e-learning and Learning Objects,* vol.3**,** no.1, pp.57-72.
Pugh, D, Touchie, C, Wood, TJ & Humphrey-Murto, S, 2014, 'Progress testing: is there a role for the OSCE?', *Medical education,* vol.48**,** no.6, pp.623-631.
Ricketts, C, Freeman, AC & Coombes, LR 2009, 'Standard setting for progress tests: combining external and internal standards' *Medical education,* vol.43**,** no.6, pp.589-593.
Schuwirth, L & Ash, J 2013, 'Assessing tomorrow's learners: in competency-based education only a radically different holistic method of assessment will work. Six things we could forget', *Medical teacher,* vol.35**,** no.7, pp.555-559.
Schuwirth, LW 2004, 'Assessing medical competence: finding the right answers', *The clinical teacher,* vol.1**,** no.1, pp.14-18.
Schuwirth, LW & van der Vleuten, CP 2012, 'The use of progress testing,'*Perspectives on medical education,* vol.1**,** no.1, pp.24-30.
Thompson, J, Grantham, H & Houston, D 2015, 'Paramedic capstone education model: Building work ready graduates', *Australasian Journal of Paramedicine,* vol.12, no.3
Thompson, J, Houston, D, Dansie, K, Rayner, T, Pointon, T, Pope, S, Cayetano, A, Mitchell, B & Grantham, H 2017, 'Student & tutor consensus: a partnership in assessment for learning'. *Assessment & Evaluation in Higher Education***,** vol.42, no.6, pp.942-952.
Tio, R A, Schutte, B, Meiboom, AA, Greidanus, J, Dubois, EA & Bremer, AJ 2016, 'The progress test of medicine: the Dutch experience', *Perspectives on medical education,* vol.5**,** no.1, pp.51-55.
Torke, S, Abraham, RR, Ramnarayan, K & Asha, K 2010, 'The impact of viva-voce examination on students performance in theory component of the final summative examination in physiology', *Journal of Physiology and Pathophysiology,* vol.1**,** no.1, pp.10-12.
Van Berkel, HJ, Nuy, HJ & Geerlings, T 1994, 'The influence of progress tests and block tests on study behaviour', *Instructional Science,* vol.22**,** no.4, pp.317-333.
Verhoeven, B, Verwijnen, G, Scherpbier, A & van der Vleuten, C 2002, 'Growth of medical knowledge', *Medical education,* vol.36**,** no.8, pp.711-717.
Vleuten, CVD, Verwijnen, G. & Wijnen, W 1996, 'Fifteen years of experience with progress testing in a problem-based learning curriculum',*Medical Teacher,* vol.18, no.2**,** pp.103-109.
Wade, L, Harrison, C, Hollands, J, Mattick, K, Ricketts, C & Wass, V 2012, 'Student perceptions of the progress test in two settings and the implications for test deployment', *Advances in health sciences education,* vol. 17**,** no.4, pp. 573-583.
Wood, DF 2003,'Problem based learning', *Bmj,* vol.326**,** pp.328-330.
Wrigley, W, van der Vleuten, CP M, Freeman, A & MUIJTJENS, A, 2012,'A systemic framework for the progress test: Strengths, constraints and issues: AMEE Guide No. 71',*Medical Teacher,* vol.34**,** pp.683-697.

4.8 Paper 8. Assessment Partnerships from the Start

This section contains the publication *Assessment partnerships from the start: Building reflective-practice as a beginning paramedic student competency* (Thompson et al., 2020).

4.8.1 Background to the publication

This publication reports on the revisited study of my previously developed student-tutor consensus assessment tool, applied in a new first year student participant population. I was instrumental in the design of the research project and I was the principal contributor towards the production and composition of the publication. Dr Leah Couzner contributed to both data collection, interpretation of findings, critical discussions and editing. Dr Don Houston contributed to critical discussions regarding the literature and the research findings. This publication features in the Australasian Journal of Paramedicine.

An authorship declaration is included in Appendix 8.

A copy of the questionnaire used to collect the data which is reported in this publication is attached in Appendix 13.

The publication is included in the following pages. This is reproduced with journal permission.

4.8.2 Citation

Thompson, J., Couzner, L. & Houston, D., (2020). Assessment partnerships from the start: Building reflective practice as a beginning paramedic student competency. *Australasian Journal of Paramedicine, 17*(1),1-8. https://doi.org/10.33151/ajp.17.750

Assessment partnerships from the start: building reflective practice as a beginning paramedic student competency

Abstract

The ability to critically self-evaluate is fundamental to professional health roles. Reflective practice is now a recognised feature of the professional capabilities of registered paramedics in Australia, which has implications for both education and industry when determining competency. Reflective practice currently receives little priority in teaching, often appearing late in curriculum and not usually linked to high stakes assessment. It is argued that sustainable reflective practice skills should appear earlier and include opportunities for active student involvement in decisions regarding their learning. Student-tutor consensus assessment (STCA) is a reflection-in practice technique providing a structured approach for critically appraising practice, while calibrating judgement with assessors. We evaluated the experiences of a cohort of newly commencing undergraduates within a fundamentals of paramedic practice subject. **Methods** Students were invited to complete a questionnaire relating to their perceptions and experiences after participating in the student-tutor consensus assessment approach. **Results** 88 responses were collected which indicated broad agreement regarding the value to learning and recognition for the importance of reflective practice skills to future professional roles. **Conclusion** Students readily embraced the principles of reflective practice and were able to effectively contribute to high level decisions regarding their work despite having only recently commenced the program. In addition, the high levels of broad agreement for the value of the STCA approach, suggest reflective practice and critical thinking-based assessments have a more important role to play in paramedic education.

Key Words

Reflective practice, students as partners, paramedic competency, paramedic education

Introduction

The recent launch of national registration for paramedics in Australia coincided with the publication of a set of professional capabilities, setting out the minimum expectations of knowledge and skills for practice under the paramedic title. The Australian Health Practitioner Regulation Agency (AHPRA) document identifies critical thinking and reflective

practice as key components of the evidence based practice requirements for registered paramedics (AHPRA 2018). These skills are fundamental to a role which is characterised by unpredictable clinical variables. They, however, are often underrepresented when assessing competency (Epstein and Hundert 2002, Schuwirth and Van Der Vleuten 2019), or restricted to the later stages of university programs. Similar to other health disciplines, Australian university paramedic courses traditionally start with foundation knowledge for practice, before layering disease conditions, then clinical management principles. From our experience as paramedic educators, once foundational knowledge is established clinical reasoning and reflective practice skills start to become more prominent in teaching. However, in paramedic education students embark on placements from the outset of their studies, immediately exposing them to a complex case-mix of patients and a myriad of conditions. Consequently, their learning does not always follow the curriculum map, but is more reactive to varied and unpredictable learning encounters. It is also perplexing that when assessing the effectiveness of critical thinking and reflective practice skills, high stakes decisions are restricted to the tutor, excluding the student judgement. Van Der Vleuten and Schuwirth (2019) note the contradiction of requiring the learners to self-regulate their learning, while also being required to successfully pass teacher lead test approaches. An argument exists to embed reflective practice much earlier and to include students in decision-making about the quality of their own work (Cowan 2010, Boud and Falchikov 2007, Tai, Ajjawi et al. 2018), if they are to develop the sustainable skills needed to critically appraise their future practice. Reflective practice is a mechanism which supports the growth of knowledge and skills through critical evaluation of events (Brookfield 1998, Russell 2005, Thompson and Pascal 2012). Limiting student exposure to these essential skills is a lost learning opportunity. Student assessment and determinations of competence remain contentious topics (Clinton, Murrells et al. 2005, van Der Vleuten and Schuwirth 2005).

Reflection and Reflective-Practice

Reflection skills now feature as mandated competency requirements of most recognised professions (Argyris and Schon 1974, Mann, Gordon et al. 2009, Boud, Keogh et al. 2013). However, the liberal use of a variety of terms interchangeably shows that understanding and application of reflection within disciplines is not homogenous (Vince and Reynolds 2009). The terms reflection and reflective practice are examples of code which can hold unique meaning in different contexts. Differentiating these terms, reflection can be simply viewed as the act of looking back (Mann, Gordon et al. 2009). Building on reflection as a single act, Schön's seminal work on 'the reflective practitioner' identifies reflective practice as a tool by which to apply reflection (Schön 1987). This enables reflection to be considered in terms of

reflection-on-action and reflection-in-action, separating outcome and process (Yanow and Tsoukas 2009). Expanding on these concepts further are the numerous research contributions towards the principles of evaluative judgement and self-regulated learning. Evaluative judgement concerns the evaluation of one's own or others' work (Panadero et al. 2018). Self-regulated learning looks to the development of the self which comes from using these processes (Pintrich and De Groot 1990). In the context for contemporary paramedic practice, the APHRA paramedic professional capabilities now emphasise the requirements for logical problem solving, critical and reflective thinking about the effectiveness of a paramedic's actions (AHPRA 2019). As university education is tasked with contributing to the development of paramedics who require these skills for practice, it is appropriate for students to receive training and opportunity to exercise reflection in action and reflection on action to help build their capacity for effective evaluative judgement about their own performance.

Challenges with assessing paramedic competence

The early phases of paramedic education emphasise the foundation skills required for safe and competent entry level practice. A discipline with military origins, the legacy of regimented approaches towards determining competent practice are still evident, such as the guidelines and protocols which govern the actions of employees. The influence of these standing orders extends to teaching and assessment within the classroom, with students instructed that when they encounter a patient who satisfies criteria "x", then treatment "y" is indicated. Predicted responses and key points are collated into rubrics, which underpin the credentialing of student competency, with tutors able to check off whether the rules for practice have been met. Usually starting with a small number of steps associated with simple psychometric tasks, rubrics become increasingly complex as teachers try to accommodate additional elements. The limitations of competency focused rubrics are exposed when they fail to predict significant variables, when multiple acceptable responses exist, or when a binary check-box approach tries to faithfully capture qualitative data (Meier, Williams et al. 2000, Tavares, Boet et al. 2013). Assigning competency from single-faceted assessments remains contentious, as simply delivering automated reactions when triggered by a clinical indicator fails to represent the complete picture of competence (Nicol and Macfarlane-Dick 2006). Non-technical attributes, such as communication and reflection, are essential requirements for a practitioner who's primary focus is human agency (Regehr et al. 1998), Wilkinson, Frampton et al. 2003) and deeming a student competent infers they have demonstrated adequate knowledge, skills, and judgement (Miller 1990, Govaerts, van der Vleuten et al. 2007), which cannot be demonstrated through simple task-based exercises.

Competency demands assessment be multifaceted and acknowledge the importance of the domain and integration of the task (Tavares, Boet et al. 2013). Domain–the authenticity of the context for assessment–is cited as one of the most significant contributors to the reliability of assessing for student competence (van Der Vleuten and Schuwirth 2005). The importance of the environmental context has implications for tutors attempting to assess student competence. Additionally, the problem-solving approaches demonstrated by students can often be more telling than the actual outcomes they arrive at (Schuwirth, Southgate et al. 2002). While the absence of a critical error may satisfy a rubric, it is how a student works through problems and applies knowledge and skills, which offers much greater insight to their true abilities. This data is seldom captured in competency-based assessment. Typically, the assessment of paramedic practice within university settings involves the student performing tasks, and the observing assessor awarding their summative evaluation. All judgement decisions reside with the tutor, with the student passive. This can contribute to power tensions between students and those judging them, or lead to students regarding the process of assessment as punitive (Thompson, Houston et al. 2016), a perception which is perpetuated when the focus of assessment is primarily finding student deficiencies (Schuwirth and Ash 2013). This has fuelled growing criticism for models which do not allow for student input or restricts the options for students to challenge tutor decisions (Bond and Spurritt 1999).

Summative assessment has long been the mainstay of paramedic education, where credentialing practices provide assurance that the standards and expectations of stakeholders have been met (Brookhart 2001). Assessment is a widely recognised driver for learning (Brown 2005, Wiliam 2011) and the desire to perform well in summative tests can be a powerful motivator for students. When it comes to learning impact however, feedback has been identified as the single most influential factor (Hattie and Timperley 2007). Feedback is not normally a prominent feature in summative assessment. Simply issuing test results is no substitute for high quality feedback (Biggs 1998) with check box approaches regarded as the poorest form of feedback (Hattie and Timperley 2007). Conventional competency rubrics relay a tutor's judgements usually in the form of a score, but high-quality feedback requires a discourse between student and assessor (Hodges, McNaughton et al. 1999). Feedback enables students to be guided in further development of knowledge, skills or attitude (Holmboe, Sherbino et al. 2010). It is reasonable to expect assessment which is used to determine paramedic competency to consider the unique domain of the discipline, be multifaceted and be learner centric.

Taking teaching inspiration from on-road practice

The Australian Health Practitioner regulation Agency (AHPRA) Professional Paramedic Capabilities explicitly include reflective practice as a competency for paramedic practice (AHPRA 2019). Paramedics in the field often exercise reflective practice. Based on student reports and observed practices of paramedics, crews commonly unpack the events following the completion of a case, critiquing effectiveness of their management, identifying opportunities to improve practice and highlighting knowledge gaps. In the case of junior and developing paramedics this ritual is a learning event, with the novice encouraged to present their understanding prior to receiving their senior colleagues' appraisal. Joining the discussion only once the developing paramedic has declared their own case reflection, senior input is able to provide clarification, endorsement, or advice. This active two-way exchange is characterised by comprehensive explanations and often underpinned with teaching concepts. Discussion around challenges as well as successes is equally encouraged in a process designed to calibrate staff judgement. It is through analysing events and auditing the efficacy of their practices, that clinicians can gain valuable experiential learning and self-improve (Mann, Gordon et al. 2009, Paterson and Chapman 2013). Despite varying definitions of reflective practice, the literature identifies these consistent features of revisiting experiences in order to progress learning into the future (Husebø, O'Regan et al. 2015).

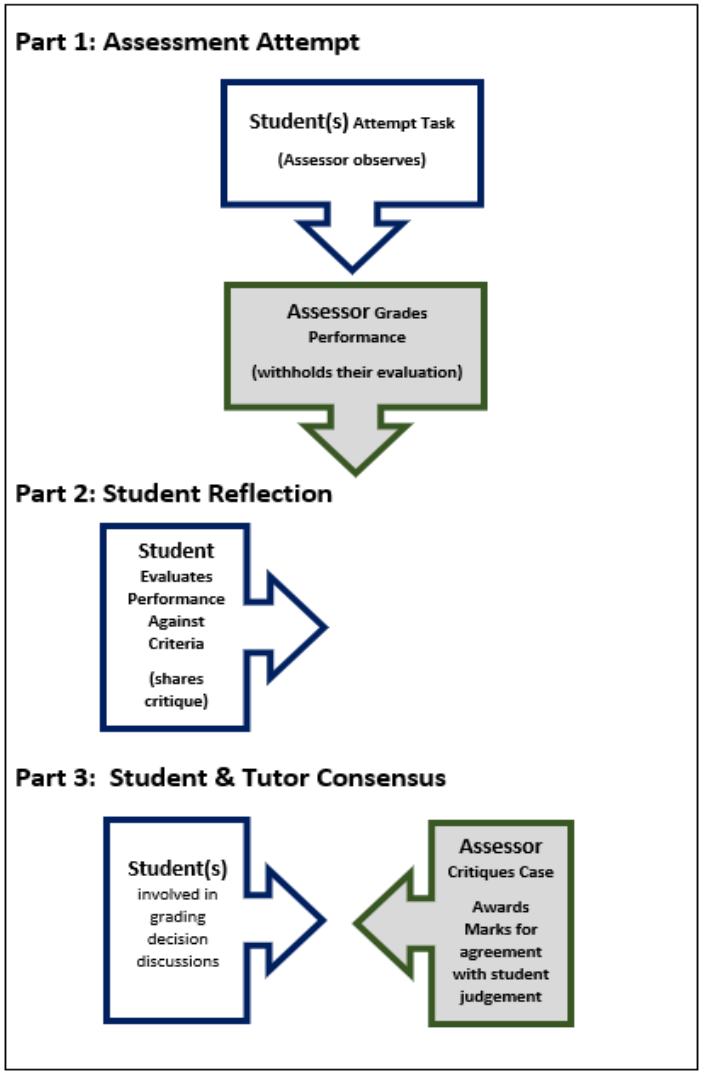
The Student-Tutor Consensus Assessment (STCA) Design

The Student-Tutor Consensus Assessment (STCA) design, which echoes the on-road discourse, was developed after efforts to incorporate other reflective practice approaches into learning experiences proved unsuccessful. Our response was to develop a reflective practice assessment shaped by the on-road practices of paramedics. We considered incorporating paramedic reflective practice principles into the classroom would enhance the validity of our assessments, increasing the breadth of features required to be considered for determining competency. The STCA was first developed and trialled with a final year cohort undertaking a paramedic capstone subject in 2015 (Thompson, Houston et al. 2016, Thompson, Houston et al. 2017). For some time, this subject had been plagued by competitive student behaviours which prioritised grade-seeking ahead of learning acquisition. These competitive behaviours derailed collaborative learning designs, and it was common for students to attempt to conceal mistakes, an action with potentially catastrophic consequences if carried into the real-world. Any educational goals relating to quality patient care or optimal health outcomes, were sidelined by students prioritising their individual results (Thompson, Grantham et al. 2015). It became evident that these frustrating

behaviours were symptoms of the teaching and assessment systems which enabled and rewarded them.

The STCA imitates the reflective practices seen in industry. Firstly, students attempt a simulated pre-hospital scenario observed by tutors, who record a score in line with the proficiency of practice and likely effectiveness of case outcomes. However, this judgement is withheld initially, with students being first encouraged to critique each of the components of the case in line with the steps of the paramedic process of care (Carter and Thompson 2013). Optimal patient care is used as the benchmark for all decisions of effectiveness. Detailed discussion is encouraged before students are required to determine whether each individual criterion was satisfied. Only when the student has finished sharing their critique is the tutor judgment shared with the student. Starting with their own rating of the scenario, the tutor declares their original score and expands on their rationale. This step is interactive with students encouraged to question tutors. The tutor simply follows the student's earlier self-critique criteria, with their own appraisal of each criterion, validating or disagreeing with the student judgment by way of a comprehensive explanation and two-way discourse with students. Marks are awarded each time the student and tutor appraisals are in consensus. With scores reflecting consensus, student mistakes or omissions are rewarded instead of being penalised when they are identified by both student and assessor, motivating students to declare their mistakes and suggest improvements. The final score for the assessment represents the overall case performance (the tutor's score based on their observations) and a tally of the consensus score (student reflective judgement calibrated to that of their assessor). A summary of the STCA approach is illustrated in Figure 1.

Figure 1. Student-Tutor Consensus Approach process



Implementation and Evaluation of the Student- Tutor Consensus Approach with 1st Year Paramedic Students

The original STCA was introduced and studied with a cohort of third year paramedic students which explored the use of assessment for learning practices as a means for enhancing the work-ready capabilities of paramedic graduates (Thompson, Houston et al. 2016, Thompson, Houston et al. 2017). The evaluation of the initiative demonstrated that the approach was extremely well received by students and had a positive effect on their learning (Thompson, Houston et al. 2016). This success prompted the decision to trial it with first year students in an attempt to promote the development of critical thinking and self-reflection skills from the outset of the degree. The STCA was therefore introduced as an assessment method within a first year paramedic practice subject. This represented a major change to the assessment expectations for the beginning student who is yet to establish knowledge

and skills foundations. Therefore, we were especially interested to explore student responses to the innovation. The research question for this project was: *what are the perceptions of first year students of the effectiveness and value of the STCA in relation to their learning?* This paper reports on the perceptions of the first year student cohort following their completion of the STCA, and presents key considerations for paramedic student learning, assessment and competencies.

Methods

This component of the research involved student self-rated perceptions and experiences with the STCA. Approval was provided by the Flinders University Social and Behavioural Research Ethics Committee. Students were informed of the project in advance via the topic's online learning platform. Participants were advised all responses would be de-identified, that their participation was anonymous and voluntary, and that their participation was in no way linked to their academic progress. A paper-based questionnaire was administered in class by a non-academic staff member following the completion of all teaching requirements of the subject, which took approximately 15 minutes to complete. The format mirrored standard student feedback questionnaires that routinely accompany university subjects: a document familiar to the student participants. The questions contained in the survey deliberately explored a range of statements which represent a variety of concepts embodying reflective practice within the context of the paramedic discipline.

We presented the same questionnaire to the first year students that was administered to the final year student cohort several years earlier when the STCA was first evaluated. It featured a series of eight statements, to which students were asked to rate their level of agreement on a Likert scale ranging from 1 (strongly disagree) through to 5 (strongly agree).

Analysis

Descriptive statistics were used to explore the education and employment background of the students prior to enrolling in the Bachelor of Paramedic Science degree, and also their responses to the eight questionnaire items relating to the STCA.

In order to measure the students' overall agreement with the concept of the STCA, principal axis factoring was performed. The results indicated that the students' responses to the eight questionnaire items could be combined into a single value for each student representing their overall agreement with the concept of the STCA (one factor with an eigenvalue exceeding 1.0 (4.86), explaining 60.74% of the variance). This "overall agreement" value was calculated for each student by calculating the mean of their responses to each of the

eight questionnaire items, with the resulting value ranging from one (indicating strong disagreement with STCA) to five (indicating strong agreement with STCA). Prior to this Bartlett's Test of Sphericity ($p \leq .000$) and the Kaiser-Myer-Olkin Measure of Sampling Adequacy (KMO=0.89) were conducted to establish that the data was appropriate for principal axis factoring.

To determine whether students' educational and employment background had an influence on their views regarding the STCA, a one-way ANOVA was performed. All analyses were undertaken using version of 25 of IMB SPSS Statistics.

Results

88 (88% of possible responses from the cohort) anonymous questionnaires were completed and returned. The majority of students (n=48, 55%) identified themselves as "school leavers", having commenced their degree immediately following the completion of their secondary schooling. This was followed by students who had transferred from another degree (n=21, 24%) and 18% (n=16) who identified themselves as being a "mature aged student". The remaining students were comprised of one international student and two who selected the response option of "other" but provided no further information. Only one participant, a mature aged student, identified themselves as having prior ambulance industry experience. The responses to the STCA related questionnaire components are presented in Table 1.

Overall, the students demonstrated a positive attitude towards the experience of the STCA. On a scale from 1 (indicating strong disagreement) to 5 (indicating strong agreement), the students had a mean level of agreement of 4.36. The students demonstrated agreement with all of the individual statements that they were asked to consider, although they agreed with some statements more strongly than others. The statement that students demonstrated the highest level of agreement with related to self-assessment being an important skill for paramedics, with 98% (n= 86) of students either agreeing or strongly agreeing with this statement. The statement that students demonstrated the lowest level of agreement with related to their preparedness for a paramedic role, however high levels of agreement were still evident, with 73% (n=64) of students either agreeing or strongly agreeing. This statement having the lowest level of agreement was to be expected given that the students were in their first year of the degree with limited clinical experience. The students' education and employment background prior to entering the degree was found to have no statistically significant impact on their agreement with the overall concept of the STCA ($F(2, 85)=0.78$, $p=.46$). While school leavers demonstrated lower levels of agreement than mature aged

students (mean difference -.07, 95% CI -.36 to .24) and “other” students (tertiary transfer,

	Strongly disagree N	Disagree N	Neither agree / disagree N	Agree N	Strongly agree N	Not answered N	Total N	Mean*
Self-assessment is an important skill for paramedics	1 (1%)	0 (0%)	1 (1%)	28 (32%)	58 (66%)	0 (0%)	88 (100%)	4.61
I learned through observing my peers being assessed	1 (1%)	1 (1%)	0 (0%)	39 (44%)	47 (53%)	0 (0%)	88 (100%)	4.48
I found the student-tutor consensus marking format helped me to develop skills I can use in my future profession	1 (1%)	2 (2%)	1 (1%)	34 (39%)	49 (56%)	1 (1%)	88 (100%)	4.47
I found the student-tutor consensus marking format effective for my learning	1 (1%)	2 (2%)	1 (1%)	35 (40%)	49 (56%)	0 (0%)	88 (100%)	4.47
The scenarios effectively combined my knowledge, reasoning and practical skills	1 (1%)	0 (0%)	0 (0%)	44 (50%)	43 (49%)	0 (0%)	88 (100%)	4.45
Overall I am more confident in my knowledge and practice	1 (1%)	0 (0%)	4 (5%)	46 (52%)	37 (42%)	0 (0%)	88 (100%)	4.34
I found the student-tutor consensus marking format fair	2 (2%)	2 (2%)	7 (8%)	45 (51%)	32 (36%)	0 (0%)	88 (100%)	4.17
I feel I am well prepared for a paramedic role	1 (1%)	2 (2%)	21 (24%)	44 (50%)	20 (23%)	0 (0%)	88 (100%)	3.91

international and students who did not provide details to the question) (mean difference -.17, 95% CI -.43 to .07), it was not to a level of statistical significance.

Table1. Beginning Student response ratings to Student-Tutor Consensus Assessment

Discussion

Unlike participants in the original study, this cohort had limited prior experience with competency-based education. When introduced to the STCA, these students were yet to establish the same knowledge foundations as final year students, however this did not appear to affect their appreciation for reflective practice skills, or willingness to embrace the

approach. Student responses suggested that through the STCA they were able to reflect on their practice performance considering the multiple facets of knowledge, reasoning and skills simultaneously. In determining the competency of a clinician, it is essential not just to consider the components as individual elements, but also the way these parts interact (Schuwirth and Ash 2013). Clinical competence denotes more than a capacity to respond to a known event with a pre-practiced action; it includes holistic skills, attitudes, knowledge and values (Yanhua and Watson 2011). Reflective practice is an integral competency of the current professional capabilities for paramedics (AHPRA 2019). The students' recognition of an interaction between their knowledge, skills, and reasoning, and reflection on their practice, provides a significant advancement on the summative methods traditionally used. This observation was consistent with the views of the paramedic tutors recruited from local industry, who conveyed a preference for the STCA rather than being constrained to traditional rigid grading rubrics during sessional debriefs following each class. Bi-partisan discussions and recognition for the value of subjective assessor input were also reported to be a more authentic approach to critiquing paramedic practice. The questionnaire statements pertaining to student confidence and preparedness were originally designed with the final year student in mind, and particularly their transition from higher education to the workforce. While these may seem poorly placed questions for the beginning student, they do relate to the broader concept of certifying competence. Extending on Millers' original pyramid design for determining the knowledge and performance achievement levels for students, Cruess et al. (2016) identified the pinnacle of student attainment as achieving the level of professional identity labelled as "IS" (Cruess, Cruess et al. 2016). At this level a student had moved beyond the distinctive levels of knowing, and knowing and showing how, and had transcended into a state where they were thinking, acting and behaving as a member of the profession. Considering this as an optimal goal of paramedic education, perceptions of confidence and preparedness for the role seem relevant themes for educators to track across the span of a degree.

Empowering student decision-making is additionally important. By sharing a critical review of their work, students can demonstrate what they have learned 'from' the test, instead of simply how well they have done. Students are often aware when they have made mistakes, particularly when simulated patient scenarios deteriorate based on their decisions or treatment. The STCA promotes the acknowledgement of judgement errors, celebrating their contributions towards learning. For programs seeking to develop critical thinking capacity, building student skills in critically appraising their work represents sustainable learning. Re-configuring the role of students within assessment, the STCA exemplifies the theme of 'students as partners' which is gaining increasing attention within higher education

(Matthews 2016). Where focus for student roles in teaching and assessment is usually directed towards the co-production of learning design (Healey 2014, Matthews 2016), the STCA sees this partnership extended to grade decisions.

A common academic complaint shared by industry partners has historically concerned student reluctance or difficulties in receiving critical feedback. While the variables which may influence this are complex and likely unique to each case, a paramedic grading system which is based principally upon penalising faults certainly a contributing factor. The STCA approach uses assessment as a vehicle to initiate a professional and bi-partisan conversation about competency-based assessment events. When considering the advances to assessment that the STCA achieves, the alternative simple task and student sign off approach seems redundant.

While this research was part of larger project it is a small scale investigation with a single cohort of first year students, therefore care is required in generalising results to wider contexts.

Conclusion

Clinical competency is an essential requirement of the paramedic and a goal which universities strive to have their students attain. Standard skills sign-off grading approaches respond to only a portion of the necessary elements required to effectively credential competency. The STCA empowers students to play active roles within decision making regarding their own work and reprioritises the accountability to patient care ahead of their individual performance scores. It is flexible enough to capture the full breadth of professional considerations required to certify competence. Importantly for educators, the approach chronicles not only how a student performs in a test, but equally a demonstration of the learning they obtain resulting from the assessment event. The introduction of this novel assessment approach to first year students marked a significant re-think of the needs and capabilities of the beginning students. Favourable participant responses and feedback reflected how readily students embraced an approach which is now extensively used throughout all levels of our paramedic teaching. Developing student reflective practice skills previously has been postponed until a foundation of knowledge or skills have first been laid. This project has demonstrated that beginning students are willing to embrace the opportunity to make reflective practice judgments about their work and recognise the importance of being able to do so.

References

1. AHPRA PBoA. Professional Capabilities for Registered Paramedics Australia2018 [10]. Available from: https://www.paramedicineboard.gov.au/Professional-standards/Professional-capabilities-for-registered-paramedics.aspx.
2. Epstein RM, Hundert EM. Defining and assessing professional competence. Jama. 2002;287(2):226-35.
3. Schuwirth LW, Van Der Vleuten CP. Current Assessment in Medical Education: Programmatic Assessment. Journal of Applied Testing Technology. 2019;20(S2):2-10.
4. van Der Vleuten CP, Schuwirth LW. Assessment in the context of problem-based learning. Advances in Health Sciences Education. 2019:1-12.
5. Cowan J. Developing the ability for making evaluative judgements. Teaching in Higher Education. 2010;15(3):323-34.
6. Boud D, Falchikov N. Developing assessment for informing judgement. Rethinking assessment in higher education: Learning for the longer term. 2007:181-97.
7. Tai J, Ajjawi R, Boud D, Dawson P, Panadero E. Developing evaluative judgement: enabling students to make decisions about the quality of work. Higher Education. 2018;76(3):467-81.
8. Brookfield S. Critically reflective practice. Journal of Continuing Education in the Health Professions. 1998;18(4):197-205.
9. Thompson N, Pascal J. Developing critically reflective practice. Reflective practice. 2012;13(2):311-25.
10. Russell* T. Can reflective practice be taught? Reflective practice. 2005;6(2):199-204.
11. Clinton M, Murrells T, Robinson S. Assessing competency in nursing: a comparison of nurses prepared through degree and diploma programmes. Journal of clinical nursing. 2005;14(1):82-94.
12. Van Der Vleuten CP, Schuwirth LW. Assessing professional competence: from methods to programmes. Medical education. 2005;39(3):309-17.
13. Argyris C, Schon DA. Theory in practice: Increasing professional effectiveness: Jossey-bass; 1974.
14. Mann K, Gordon J, MacLeod A. Reflection and reflective practice in health professions education: a systematic review. Advances in health sciences education. 2009;14(4):595.
15. Boud D, Keogh R, Walker D. Reflection: Turning experience into learning: Routledge; 2013.
16. Vince R, Reynolds M. Reflection, reflective practice and organizing reflection. The SAGE handbook of management learning, education and development. 2009:89-103.
17. Schön DA. Educating the reflective practitioner. 1987.
18. Yanow D, Tsoukas H. What is reflection-in-action? A phenomenological account. Journal of management studies. 2009;46(8):1339-64.
19. Panadero1, 2 E, Broadbent J. Developing evaluative judgement: A self-regulated learning perspective. 2018.
20. Pintrich PR, De Groot EV. Motivational and self-regulated learning components of classroom academic performance. Journal of educational psychology. 1990;82(1):33.
21. AHPRA. Professional capabilities for registered paramedics: Paramedicine Borad of Australia 2019 [Available from: https://www.paramedicineboard.gov.au/Professional-standards/Professional-capabilities-for-registered-paramedics.aspx.
22. Tavares W, Boet S, Theriault R, Mallette T, Eva KW. Global rating scale for the assessment of paramedic clinical competence. Prehospital emergency care. 2013;17(1):57-67.
23. Meier RL, Williams MR, Humphreys MA. Refocusing our efforts: Assessing non-technical competency gaps. Journal of Engineering Education. 2000;89(3):377-85.
24. Nicol DJ, Macfarlane-Dick D. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. Studies in higher education. 2006;31(2):199-218.

25. Reronr _'_ R. Comparing the Psychometric Properties of Checklists and Global Rating Scales for Assessing Performance on an GSCE-format Examination. Acad Med. 1998;73:993-7.
26. Wilkinson TJ, Frampton CM, Thompson-Fawcett M, Egan T. Objectivity in objective structured clinical examinations: checklists are no substitute for examiner commitment. Academic Medicine. 2003;78(2):219-23.
27. Miller GE. The assessment of clinical skills/competence/performance. Academic medicine. 1990;65(9):S63-7.
28. Govaerts MJ, Van der Vleuten CP, Schuwirth LW, Muijtjens AM. Broadening perspectives on clinical performance assessment: rethinking the nature of in-training assessment. Advances in health sciences education. 2007;12(2):239-60.
29. Schuwirth L, Southgate L, Page G, Paget N, Lescop J, Lew S, et al. When enough is enough: a conceptual basis for fair and defensible practice performance assessment. Medical education. 2002;36(10):925-30.
30. Thompson J, Houston D, Dansie K, Rayner T, Pointon T, Pope S, et al. Student & tutor consensus: a partnership in assessment for learning. Assessment & Evaluation in Higher Education. 2016:1-11.
31. Schuwirth L, Ash J. Assessing tomorrow's learners: in competency-based education only a radically different holistic method of assessment will work. Six things we could forget. Medical teacher. 2013;35(7):555-9.
32. Bond H, Spurritt D. Challenges of assessment. Educating beginning practitioners: challenges for health professional education Butterworth-Heinemann, Oxford. 1999:228-35.
33. Brookhart SM. Successful students' formative and summative uses of assessment information. Assessment in Education: Principles, Policy & Practice. 2001;8(2):153-69.
34. Brown S. Assessment for learning. Learning and teaching in higher education. 2005(1):81-9.
35. Wiliam D. What is assessment for learning? Studies in educational evaluation. 2011;37(1):3-14.
36. Hattie J, Timperley H. The power of feedback. Review of educational research. 2007;77(1):81-112.
37. Biggs J. Assessment and classroom learning: a role for summative assessment? Assessment in Education: Principles, Policy & Practice. 1998;5(1):103-10.
38. Hodges B, McNaughton N, Tiberius R. OSCE Checklists Do Not Capture Increasing. Acad Med. 1999;74:1129-34.
39. Holmboe ES, Sherbino J, Long DM, Swing SR, Frank JR, Collaborators IC. The role of assessment in competency-based medical education. Medical teacher. 2010;32(8):676-82.
40. Paterson C, Chapman J. Enhancing skills of critical reflection to evidence learning in professional practice. Physical Therapy in Sport. 2013;14(3):133-8.
41. Mann K, Gordon J, MacLeod A. Reflection and reflective practice in health professions education: a systematic review. Advances in health sciences education. 2009;14(4):595-621.
42. Husebø SE, O'Regan S, Nestel D. Reflective practice and its role in simulation. Clinical Simulation in Nursing. 2015;11(8):368-75.
43. Thompson J, Houston D, Dansie K. Teaching students to think like a paramedic: Improving professional judgement through assessment conversations. Australasian Journal of Paramedicine. 2017;14(4).
44. Thompson J, Grantham H, Houston D. Paramedic capstone education model: Building work ready graduates. Australasian Journal of Paramedicine. 2015;12(3).
45. Carter H, Thompson J. Defining the paramedic process. Australian journal of primary health. 2013.
46. Yanhua C, Watson R. A review of clinical competence assessment in nursing. Nurse education today. 2011;31(8):832-6.
47. Cruess RL, Cruess SR, Steinert Y. Amending Miller's pyramid to include professional identity formation. Academic Medicine. 2016;91(2):180-5.

48. Matthews K. Students as partners as the future of student engagement. Student Engagement in Higher Education Journal. 2016;1(1).
49. Healey M, editor Students as partners in learning and teaching in higher education. Workshop Presented at University College Cork; 2014.

Chapter 5. Critical Discussion

The body of work that has been presented in this thesis set out to critically examine and address problems surrounding university paramedic graduates being recognised by the ambulance industry as having achieved suitable work-ready standards. The importance of this research is linked to the essential assurances needed by the community about the quality of graduate paramedics delivering their care. Achieving a shared position between industry and the university of what constitutes graduates' readiness to effectively undertake a demanding and rapidly changing professional role is considered to be critical in the series of studies.

This final chapter returns to the assumptions and research questions (presented in Chapter 3) that originally guided the focus and development of this study. Key findings, cumulative learning and discoveries relating to research problems are summarised in the following sections as propositions that respond to each assumption and related question. These propositions are followed by critical discussions that note the significance of the original contributions made by each of the projects.

5.1 Defining the Role of the Modern Paramedic

Many paramedics are resentful of the growing low acuity patient workloads that now challenge traditional roles and professional identities (Lucas et al., 2019). As a result, there is a difference of opinion regarding priorities concerning the knowledge and skills required by future clinicians when they graduate.

The assumption around the role of the paramedic was outlined in Section 3.4.1 and is: *An improved understanding of the modern paramedic role is central to resolving the work readiness problem*.

This assumption gave rise to the following research questions:

- What are the roles or activities which define the work of a modern paramedic?
- What do graduates need to know and be able to do to perform these roles?

The publications described in this thesis (Chapter 4) suggest the following proposition:

PROPOSITION

- *The paramedic process offers a structure by which to consider the role requirements of the paramedic*

In the discussion contained in the following subsections, responses draw primarily from the contributions of publications:

- *Defining the paramedic process* (Section 4.1).
- *Programmatic assessment condensed* (Section 4.7).

5.1.1 Roles and activities of the modern paramedic

The publication *Defining the paramedic process* (Section 4.1) responds to disagreement surrounding the modern paramedic role by describing and analysing the distinctive practice events which represent the unique process of care in the discipline. The paramedic process provides a framework for considering graduate practice, as well as a common basis for a range of paramedic teaching applications, including guiding the structures of scenarios and assessment. The process is:

1. Dispatch considerations.
2. Scene assessment.
3. First impressions.
4. Patient history.
5. Physical examination.
6. Clinical decision-making.
7. Interventions.
8. Re-evaluation.
9. Transport decisions.
10. Handover and documentation.
11. Reflection.

This framework is built around recognisable stages of practice that can be applied to most pre-hospital events. This shifts the debate away from scopes of clinical practice and the acuity and types of cases to which paramedics respond.

The merits of process modelling have been previously acknowledged for contributing to quality improvement within health (Vanhaecht et al., 2009). Jun et al. (2009) suggested that the use of such models can illustrate roles, responsibilities and event transitions and has benefits that are far reaching. In the case of the paramedic-in-training, this

process has marked out a care pathway to aid not only a sequence for their work, but has also proved a valuable aid for students' reflection on their practice.

These newly defined stages of the paramedic process have been used successfully as a basis for simulated learning design and the critical evaluation of student performance. This application of the paramedic process has been reported in the publications:

- *Student & tutor consensus: A partnership in assessment for learning* (Section 4.3).
- *Teaching students to think like a paramedic: Improving professional judgement through assessment conversations* (Section 4.4).
- *Assessment partnerships from the start: Building reflective-practice as a beginning paramedic student competency* (Section 4.8).

These works demonstrate the utility of the paramedic process and how it can contribute to a wider conversation within the profession relating to the identity associated with the modern paramedic role. The paramedic process offers a methodical approach to aid students' development towards assuming the role of a paramedic, and a framework by which to engage in assessment discourse with regard to their attainment of expected practice standards.

5.1.2 Knowledge and skills integration for practice

Building on the paramedic process (Section 5.1.1), subsequent projects were able to influence curriculum design and content in a way that ensured that graduates attained the necessary paramedic knowledge and understanding. Competency statements, such as those guiding the knowledge requirements provided by the CAA (CAA, 2013) and recently AHPRA (AHPRA, 2019), had provided insufficient detail and led to highly subjective and varying interpretation of standards by different groups.

A common trend within university curriculum has been a tendency to separate knowledge building from skill development. Such curriculum disaggregation is accentuated by the separation of distinct subject areas of curriculum delivery, such as pharmacology and mental health. Learning design in education for practice curricula have been criticised for attempting to demarcate theory from practice, with Stetsenko (2008) emphasising the need for curricula to attend to the essential relationship which exists between knowing and acting. This thesis has generated a response to Stetsenko's claim with the development of the first holistic paramedic knowledge taxonomy and related paramedic practice-in-context exam, which was generated during the "progress test" project. This was validated through a partnership which combined the expertise of university academics, graduates and ambulance industry partners, as

reported in *Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject* (Section 4.7).

Tensions often occur between universities and industries relating to differing expectations for student outcomes (Henderson et al., 2006). An inclusive membership of advisory experts from key stakeholder groups provided an opportunity to formulate outcome standards that achieved wider appreciation and shared acceptance. These outcomes are significant to the success of any industry-university partnership. Shared acceptance by both sectors is intrinsically linked to the perception of success by all (Narayanan, 2009). This shared acceptance was a central goal throughout the local process.

The taxonomy generated integrated theory with practice and enabled the curricula for subjects spanning the breadth of the degree to be framed by best evidence and contemporary paramedic practice expectations. This was presented in the format of a "learning list" that provided the necessary detail to interpret the broad paramedic capabilities or core competencies statements issued by the national regulator. The key characteristic that underpinned the learning list and associated progress test was the focus on integration and interconnectedness of knowledge and skills as opposed to mere recall of unconnected elements. These progress tests became the basis for individual students to focus their learning and monitor their progress towards achieving a work-ready standard. The learning list also prompted a deliberate shift in students' focus from acquiring grades towards prioritising the development and integration of their skills and knowledge for practice.

It is known that simply learning to pass a test is not conducive to longer term learning (Schuwirth & van der Vleuten, 2012). Redirection of students to knowledge items that were sampled to construct the test encouraged them to focus on *building knowledge* as opposed to *memorising questions/answers*. The learning list supported interconnectedness of areas across undergraduate curriculum. Prior to this approach, these items had been assessed largely in isolation from each other.

5.2 Defining a Work-Ready Paramedic Graduate

Interpretation of graduate attainment of work-readiness standards has been confounded by a lack of clarity in definitions of work-readiness. Previous attempts to define paramedic graduate standards have been problematic (see Section 5.1).

The assumption around work readiness of paramedic graduates was outlined in Section 3.4.2 and is: *Improved definitions of work-readiness and decision-making frameworks*

for work-readiness are essential to responding to modern paramedic graduate challenges.

The publications described in this thesis (Chapter 4) suggest the following propositions:

PROPOSITIONS

- *Work-readiness is a point in time where the individual (student, graduate, qualified or, practicing paramedic) is able to demonstrate attained, sustained and maintained minimum accepted proficiency across all recognised capability domains of the paramedic profession.*
- *Decisions made about an individual's work-readiness should be informed by evidence that reflects demonstration across all recognised capability domains, integration of these domains, across multiple events, and consider the students own judgement.*

Propositions regarding new definitions for work-readiness are made on the basis of the incremental and collective contributions of each of the eight publications (Sections 4.1 through 4.8), how their findings are positioned within contemporary literature and theory and through the improved understanding of the issues and limitations, which had been a hindrance to work-ready classifications. These are discussed in the following subsections.

5.2.1 An improved definition for, and understanding of, work-readiness

No standard exists specifically to benchmark the expectations of university paramedic graduates in Australia. As a result, industry decisions about both graduate employability and work-readiness have relied on impressions formed from a limited number of interactions (Thompson et al., 2015).

The findings of Willis and colleagues (2010) have guided much of the narrative regarding university-educated paramedic graduates, arguing for novice beginner labels to be assigned. This argument implies that competency as paramedic clinicians has yet to be achieved at the time of first entering the workforce. However, professional capability statements issued by the national regulator make no concession for expectations of different standards of performance and responsibility across a paramedic's career span, with expectations of the new graduate being the same as for

the most experienced clinician: new graduate or senior member of staff, professional capability expectations apply equally. Ironically, many senior, non-clinical facing staff, operating under the title of registered paramedic, were required to have the same breadth and level of contemporary knowledge and skills proficiency expectations as the modern graduate, and it is expected that such staff be capable of sustaining these. The implications of this on the projects in this thesis were profound, as it promoted a rethinking of the meaning of work-readiness, widening the focus from one solely on the level of knowledge and capabilities that can be attained, to include retaining and maintaining an appropriate level of knowledge and capabilities.

A growing body of literature indicates concerns relating to the decay of knowledge and skill in practicing paramedics, particularly regarding skills that are infrequently practiced (Dyson, 2017; Vaughan et al. 2020; Wik et al, 2005). The notion of work-ready moved from meaning simply “readiness to start work” to more broadly being “ready to work” and, in doing so, shifted the spotlight from this being exclusively a graduate concern to one that implicated all paramedics. Recognition of the change of meaning of work-readiness influenced the projects in this thesis that further contributed components towards the definition and interpretation of work-readiness. Publications 3, 4, 5, 6, 7 and 8 (Sections 4.3 through 4.8) each addressed issues of sustainable assessment practice in context within the paramedic discipline, depicting issues associated with student capacity to retain knowledge and skills across the program. Findings from these six publications support the success of each of the different innovations that were designed to improve sustainable paramedic knowledge and skills, reflecting a tacit expectation that students must sustain any achieved competence far beyond their graduation.

An improved definition was needed to reflect what a paramedic needs to understand and do, as well as his or her capacity to represent the paramedic profession. The publication *Defining the paramedic process* (Section 4.1) defined the paramedic process by using a framework (see Section 5.1.1). In terms of a contribution to an improved work-ready understanding, the paramedic process depicts a range of different tasks that paramedics must be able to complete, recognising that paramedic practice requires not only a breadth of skills and knowledge, but, additionally, the capacity of the clinician to integrate each of these in the process of delivering care.

Within the paramedic process, each of the steps in the framework helps to inform the next, and paramedics are required to make sense of, and respond to, case information within the broad context of the event. A concept of work readiness considered that graduates must possess a paramedic’s capacity to effectively deliver this process of

care, to integrate the steps, and to understand and respond to dynamic case findings. Publications 2, 3, 4 and 7 (Sections 4.2, 4.3, 4.4 and 4.7) present findings that build on the theme of paramedic graduate capabilities to reflect the holistic and integrative knowledge and practice requirements of the discipline.

As knowledge and practice requirements are translated through curriculum, these publications argue that the education of paramedics needs to change its educational structure and approaches. Teaching and assessing students in siloed blocks of different curriculum specialisations must become more authentic and integrated. Similar narratives are emerging within education management, where it is acknowledged that academics who teach theory from a practice perspective are able to challenge assertions of a theory-practice gap (Billsberry & Eichler, 2020). Others argue that true authentic learning experiences cannot be pre-arranged or choreographed and suggest that real-world learning occurs in unpredictable contexts, unlike the typically simulated and regulated experiences in classroom practice (Herrington & Herrington, 2014).

Despite conjecture about what might be true authentic learning, there is evidence to support the impact it has on student engagement and learning attainment across a range of disciplines (Hariri & Said, 2020; Waghid & Davids, 2020). Publications 2, 3, 4 and 7 (Sections 4.2, 4.3, 4.4 and 4.7) discuss attempts to embody authentic learning principles through the use of events that are more representative of the day to day routines of industry. These events immerse students within the complexities and integrated nature of paramedic practice.

Collectively, this body of work contributes to a new definition of work readiness; namely, a point in time in which all required skills, knowledge and capabilities can be demonstrated simultaneously and in an integrated manner. Where previous work-readiness debates within disciplines such as nursing and education frequently concern the attributes or qualities of graduates (Bridgestock, 2009; Litchfield et al, 2008; Oliver & Jorre de St Jorre, 2018), this new definition responds to the dynamic nature of skills and knowledge, something often overlooked. Appreciation for the dynamic nature of features that underscore graduate attributes, such as knowledge, skills and professional dispositions, suggests that without sustainable authentic learning strategies, a students work-ready status is possibly only temporary.

5.2.2 Assessment of work-readiness

The new recommendations for the interpretation of work-readiness have consequences for the methods and instruments used to decide this.

Publications 2, 3, 4, 5, 6, 7 and 8 (Sections 4.2 through 4.8) each presented a critical narrative regarding the dominant use of summative credentialing approaches. The limitations of making reliable decisions regarding paramedic students based upon a single test event has been described and discussed (Section 2.1). As a response, the above publications presented valid alternatives, depicting approaches that offer more reliable indications of a graduate's capabilities. Underscoring these claims are the findings in publications 2, 3, 4 and 7 (Sections 4.2, 4.3, 4.4 and 4.7) that support the use of assessment to integrate the curriculum, while publications 5, 6 and 8 (Sections 4.5, 4.6 and 4.8) support assessment that applies the full paramedic process (Section 5.1.1).

In addition to assessment that reflects a more complete knowledge and practices of the discipline, publications 2 to 8 (Sections 4.2 through 4.8) report on the use of approaches that represent improvements on the reliability of decisions regarding paramedic students' true capabilities. Publications 5, 6 and 8 (Sections 4.5, 4.6 and 4.8) report on the use of the STCA approach, in which tutor decisions are required to consider comprehensive student explanation and justification, ensuring that judgement is informed by more than simple tutor observation. A student and tutor consensus assessment approach can include empowering student decision making, self-assessment, sustainable learning and reflective practice. The educational themes underscoring such approaches are features of contemporary learning literature and synonymous with the assessment for learning ideals (Rodrigues-Gomez & Ibarra-Saiz, 2015). These themes are discussed in more detail in a later part of this chapter.

Negative marking in assessment remains a contested issue within educational literature (Allen-Collinson, 2009; Goldik, 2008). It is claimed that successful acceptance of negative marking is reliant upon the perceived fairness of both reward and penalty (Holt, 2006). The reliability of conventional paramedic assessment results to faithfully represent student capabilities is explored in *Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject* (Section 4.7), which includes the use and impact of negative-marking deterrents to mitigate chance results. This publication offers a new and unique insight into paramedic students' perceptions of penalty weightings and provides a critical discussion of the impact this measure had on student learning.

Publications in this thesis also report on the increased frequency and repetitive assessment practices introduced within a subject. It is now widely accepted that no single assessment event is capable of capturing the data necessary to make an effective decision about a student's capabilities (Govaerts et al., 2007; Miller, 1990;

Schuwirth, 2004; Schuwirth & van der Vleuten, 2012). Publications 2, 3, 4 and 7 (Sections 4.2, 4.3, 4.4 and 4.7) include findings that support the use of more frequent, diverse and authentic assessment practice. These findings argue that the tradition of major, summative, final-barrier tests to determine graduate readiness, offer a far less reliable indicator of student capabilities than multiple data points of student results obtained across an entire subject and through a variety of testing approaches.

Previous models from medical education have presented theory regarding student development in terms of specific tiered levels of capability. The seminal work of Miller (1990) used the illustration of a pyramid to indicate levels of student performance to inform assessment of competence. The pinnacle of student ability in this pyramid, labelled “does”, identified a level of assessment that indicated student's capacity to perform all previous levels of learning, namely, “knows”, “knows how”, “shows how” and “shows”. A feature of this model is the recommendation that reliable decisions about students need to be informed by sufficient data that reflects all complex domains that embody the clinician’s role. Miller (1990) emphasised that it is unrealistic for this complex requirement to be achieved by a single assessment design or a single assessment event. He was critical of an overreliance on examinations, which assess the lowest level of learning (namely, knowing), and checklist-based observations of student performance, which merely sample skills and do so in the absence of a dialogue with students (Miller, 1990). Miller’s principles were integrated into the assessment approaches put in place in the projects in this thesis in order to improve the decisions made about graduates. The most notable of these were replacement of a single summative assessment with an extensive range of varied assessment items and replacement of observational performance checklist assessment items with Student-Tutor Consensus Assessment (STCA), which captures student discourse. Together, these assessments offer much more reliable indications of a paramedic graduate’s capabilities.

Cruess and colleagues (2016) suggested that a further level – “Is” – should be included above Miller’s top level (“Does”) to indicate the attainment of a professional identity, which embodies the attitudes and behaviours commonly represented within the role (Cruess et al., 2016). The modified pyramid is shown in Figure 3. Cruess and colleagues argued that attaining higher levels of expertise within professional roles, requires more than simply possessing the required knowledge and being able to perform the tasks consistent with the position.

Figure 3 shows Miller’s Pyramid (Miller, 1990, p. 183) adapted to include professional identity (Cruess, Cruess & Steinert, 2016).

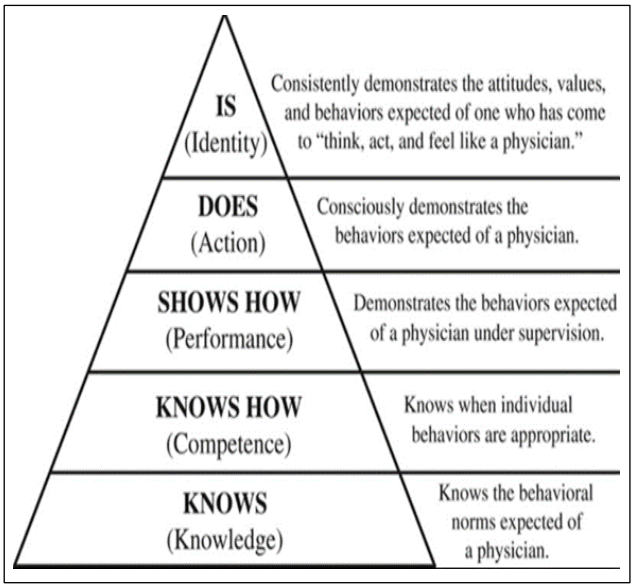


Figure 3. Pyramid (Miller, 1990, p. 183) adapted with Cruess, Cruess & Steinert (2016).

The reforms made in these projects embody these principles through a redesign of the learning experience that emphasises students adopting a paramedic persona. What is more, students are assessed on their application and integration of the holistic requirements of the discipline, using approaches and tools readily identifiable within industry. These changes marked a shift from a construction of graduate abilities as a satisfactory aggregation of elements of the paramedic curriculum across a program to a holistic, authentic clinical performance that is contextualised and defensible, as argued by Schuwirth and Ash (2013). In summary, these collective findings regarding the assessment of work-readiness have argued that decisions about this must be based on students' demonstrations of knowledge in practice across all domains of the discipline. Assessment should be integrated within the context of the discipline and decisions about students should be grounded in results obtained from multiple points and varieties of testing approaches (Schuwirth et al., 2013). Additionally, it is proposed that a work-ready paramedic graduate should be able to demonstrate self-critique and reflective practice skills.

In summary, work-ready paramedic graduate assessment recommendations are that:

- Decisions are informed by demonstration of integrated knowledge and skills from across all recognised domains of the discipline.
- Decisions reflect student performance trends which are informed by multiple and varied assessment results.
- Assessment design is authentic and reflects the context of the discipline.

- Assessment evidences student participation in decisions about their work and understanding of work-readiness.

5.3 Paramedic Student Learning Experience

Central to several of the issues of work-readiness was a failure of teaching design to acknowledge the unique learning needs of individual students and to address different student learning agendas that exist at different points in time during a degree.

The assumption around the student learning experience was outlined in Section 3.4.3 and is: *Each student has unique learning needs that can alter throughout their study. These need to be understood and addressed in curriculum design, learning experiences and assessment in order to ensure that students are "work ready".*

This assumption gave rise to the following research questions:

- How can the individual needs of each student learner be recognised and responded to within a large class?
- What needs to be understood about learning at different stages of a student's study path when designing teaching?
- How can teaching design contribute to improved student learning behaviour?

The publications described in this thesis (Chapter 4) suggest the following propositions:

PROPOSITIONS

- *Innovative use of assessment within a large class can effectively identify and respond to individual learning needs*
- *Students undergo a transformative phase as they begin a transition from undergraduate to paramedic, which has implications for education*
- *Pedagogy which incentivises student grades contributes to unwelcome student learning behaviour, and can impede the attainment of favourable work-ready attributes*

The implications of these propositions are discussed in the following subsections.

5.3.1 Student as individual learner within a large class

The publication *Paramedic capstone education model: Building work ready graduates* (Section 4.2) chronicled a prototype for a paramedic capstone subject developed in response to a complex range of concerns, including poor student satisfaction with their education experience and frustrations at failing a single summative assessment hurdle despite no prior indications of deficits within their knowledge and practice.

Before this publication, the pedagogy of this subject had pursued generic learning objectives, aiming for consistent and identical learning experiences for all, with similar defensible final assessment challenges. This approach failed to cater to the vastly different levels of abilities and knowledge in the final-year student cohort. Unique individual student levels of ability and subsequent learning needs at the point of commencing their final year of study were highlighted in the capstone projects, first through pre-testing and later with the introduction of progress testing. While research addressing the learning challenges posed by large student numbers, and examples of individualised learning responses are evident within other disciplines (Gruppen et al, 2016; Moro & Stromberga, 2019; Sun et al., 2008), such research was not reported for the discipline of paramedicine. Findings on early student testing reported in publications 2 and 7 (Sections 4.2 and 4.7) clearly showed that previous student academic success was an unreliable indication that students were capable of retaining tested knowledge or transferring it into new areas of study. Successful completion of early learning milestones could not be assumed to mean that the knowledge was retained to ensure the individual students' learning needs going forward.

Findings in *Blending formative and summative assessment in a capstone subject: "It's not your tools, it's how you use them"* (Section 4.3) demonstrated the utility of repeated cycles of individualised diagnostic testing with conventional assessment tools to profile core knowledge acquisition and retention. These guided student's learning responses, effectively addressing individual learner needs within large class cohorts. The results shared in *Paramedic capstone education model: Building work ready graduates* (Section 4.2) verify the positive impact this approach had both on contributing to learning attainment as well as improvement of the student experience. The approach taken embedded assessment-as-teaching and replaced the more traditional summative approach of "teach then assess" that is still common in this discipline.

This new paramedic assessment pedagogy – assessment for learning – aligns with contemporary arguments for expanding the role of summative assessment of learning beyond credentialing (Bennet, 2011; Fennel, 2020; Karay et al., 2020). Incorporation of

assessment for the purpose of generating and applying learning analytics repositions the individual student at the heart of the learning event (Maseleno et al., 2020). Adopting such personalised attention to individual students across their study paths additionally fosters levels of self-realisation (Campbell et al. 2007).

5.3.2 Transformative phase for the paramedic graduate

The final passage of study is uniquely challenging and transformative for paramedic students. As students near the end of their studies, expectations of knowledge and skills are heightened as they prepare to enter industry (Tradewell, 1996). As noted in Section 5.3.1, traditional practice of a single pass-or-fail final examination was a source of frustration, while coursework still focused on "loading" students with more curriculum content. Later iterations of the taught capstone subject changed this focus to preparing future graduates for the confronting typical features of a paramedic internship and to provide them with skills they require to respond. Findings from the publication *Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject* (Section 4.7) identified that students considered these approaches to testing to represent – by far – the most challenging experience of their entire undergraduate program. Furthermore, student responses to the increased complexity and frequency of assessment in the final year indicated that, despite their appreciation for the approach, there was considerable discomfort associated with receiving such extensive critical feedback. At the outset, students' test results were often not congruent with their perceptions or expectations they held of their own abilities. Students commonly reported feeling that they were continually being pushed out of their comfort zones, but acknowledged that being challenged in these ways was a highly effective learning strategy.

This is a significant finding as it is evidence of the transformative process occurring as students prepared to assume the identity of paramedics. It also suggests that the final passage of learning can represent much more than an additional subject in a program. Several ritualistic steps have been linked to the process by which humans transform their identity that are particularly relevant to the student nearing the end of their studies (Tradewell,1996; Turner, 2008). As individuals draw towards the end of a defined period of their life, they must surrender their old identity before they are able to take on a new one. A period of liminality exists within which individual identity is neither aligned to the new nor the old affiliations (Turner, 2008). Acknowledging a liminal phase for completing paramedic students has implications for education design, and for the notion of graduate success needing to include graduates' capacity to effectively

transition to their new identity. The inclusion of an employment interview style assessment design was a deliberate attempt to support students who were preparing to leave university by designing the final learning event within their degree as a replica of their next professional challenge.

5.3.3 Beginning paramedic learner

The publication *Assessment partnerships from the start: Building reflective-practice as a beginning paramedic student competency* (Section 4.8) contributed findings that challenged assumptions about capabilities of a beginning paramedic student. In similar fashion to the curriculum designs evident in other disciplines, goals for the first year of university paramedic education often emphasise acquiring and retaining foundational knowledge (Elmore et al, 2015). The first-year reflective practice project outlined in the publication (Section 4.8) identified that commencing students were both capable of critically appraising their own work and recognised the value of doing so. Critical reflective thinking had previously been considered a higher order set of skills not expected in first year curriculum as it was thought that such thinking required prior acquisition of a body of foundation knowledge. As a result, introducing reflective practice skills had been reserved for later stages of study, which meant that student critical judgement of their own work was generally not included in assessment design, certainly not in the early stages of a degree. The regulator's recent recognition of the importance of developing reflective practice (RP) as a domain of professional paramedic capabilities (AHPRA, 2019), coupled with the findings of the publication (Section 4.8), provide a compelling argument for RP to be considered a foundation skill within early stages of course designs.

5.3.4 Understanding and responding to student agendas, motives and behaviours

Publications 5, 6 and 7 (Sections 4.5, 4.6 and 4.7) discuss student behaviours originally evident in the subject and considered counterproductive to effective learning. Behaviours such as cramming before tests, attempts to conceal mistakes and routine challenges of test results are frequent responses that can be attributed to assessment practices that prioritise measurement of achievement through summative test scores (Vleuten et al., 1996). Following the introduction of the new assessment approach, counterproductive student behaviours were largely resolved. This finding indicated that assessment design had been influencing student agendas and motives.

A local culture that emphasised the importance of achieving high grades as a requirement for potential future employment success meant critical feedback on student

learning was unwelcome. Similar circumstances within other disciplines, such as medicine, have influenced the adoption of non-graded assessment approaches to re-prioritise learning-to-learn over mere learning-to-pass that has been linked to an overemphasis on performance scores (Spring et al., 2011). Findings of the progress test project reported in *Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject* (Section 4.7) confirmed that emphasising grade scores undermined students' learning for the longer term, as reported by Boud and Falchikov (2007). Interestingly, the test project (Section 4.7) found that most students required a substantial penalty to change their guessing behaviour in exams.

Mitigating negative assessment behaviour and a disposition to learning-to-pass rather than learning-to-understand for the longer term was significant. The key to addressing these concerns involved more than just an assessment re-design, but also required students to engage with and value the new process, enabling students to fully understand the purpose and rationale behind the new assessment process and to become active, self-regulating participants in assessment.

Refocusing assessment, including providing increased critical feedback for students at the late stages of a teaching program, was confronting to some students. Some contested the fairness of the results of the first progress test, on the basis that their performance was inconsistent with their personal expectations. Despite being an entirely formative instrument designed to guide individual learning, several continued to reject critical feedback as this appeared to be inconsistent with the grade point averages (GPA) they had achieved for previous subjects. It was evident that such students would remain focused on grades and test scores at the expense of the further learning that was required. This detrimental focus could be reduced with course-wide adoption of programmatic assessment approaches, with increased exposure of students to critical feedback throughout all years of study.

5.4 Theory-in-practice Curricula

A theme from literature related to theory-practice gaps, with perceptions of a disconnect between course content (and delivery) and real-world practices of clinicians continuing to fuel critical comparisons with former work-based training models (Willis et al., 2009).

The assumption around theory-in-practice curricula was outlined in Section 3.4.4 and is: *University paramedic curriculum and pedagogical design needs to reflect a focus on "theory-in-practice", to respond to current perceptions of a theory-practice gap.*

This assumption gave rise to the following research question:

- Can an alternative, more authentic, campus-based paramedic pedagogy better respond to the limited scope of work integrated learning experiences?

The publications described in this thesis (Chapter 4) suggest the following propositions:

PROPOSITION

- *A pedagogical shift towards more authentic practices of the discipline responds to theory-practice gap concerns*
- *'Being a paramedic to learn' is an effective alternative to the traditional 'learning paramedicine' paradigm, and can act as a bridge between student and paramedic identities in support of graduate transition*

The original capstone model reported in *Paramedic capstone education model: Building work ready graduates* (Section 4.2) was generated to consolidate and make sense of prior learning and to bridge the gap between university and employment. Paramedic university education had faced similar challenges to other disciplines, such as nursing, in which it has been reported that many continue to regard the workplace as the preferred venue for learning and developing the essential skills for practice (Billett, 2002). What is distinctive about the design reported in this publication (Section 4.2) is that an entirely new, final-year capstone subject was created that did not consider capstone as a project, an honours year, or a work-based placement, as reported in other disciplines (Healey, 2014). Consistent with action research, the model evolved with deliberate and incidental achievements and with discoveries regarding how to achieve learning benefits through educational and assessment design. One of the unique features of this particular capstone approach to design is the personalised focus on each learner's specific requirements. The paramedic capstone was conceptualised as an individualised intensive learning "boot-camp" requiring application and integration of prior learning. Learning structures were designed to help students critically reflect on their abilities and to support them to make appropriate responses to achieve their needed growth. Feedback and project findings consistently reported the value that students placed on this new type of learning experience.

In this new capstone approach to the final year, theory is delivered in the form of authentic problem-based learning cases derived from real clinical events. Student access to information and learning is directed through enquiry-based learning modelled on typical operational practices within paramedicine. By withholding conventional class preparation resources, such as pre-readings and learning guides, students receive similar levels of information to those they would receive during dispatch of a case. This alternative pedagogy-in-context approach re-imagines the role of the paramedic student to one in which they are required to respond to authentic challenges representative of paramedic practice. Students are required to assume the character and professional attributes of practicing paramedics through an enquiry process, reasoning and practice, as a means to support their learning. It has been previously argued that a workplace pedagogy needs to offer more than mere learning through instruction, and should reflect working to learn (Billett, 2002). This approach represents a notion of "being" rather than "learning to be" a paramedic. Incorporating a paramedic identity element in learning expectations acknowledges the conception of Cruess and colleagues (2016) of the highest order of assessment of learning attainment, namely, "Is", as presented in Figure 3.

The publication *A bridge to being a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject* (Section 4.4) introduced the idea of pedagogical practice-in-context knowledge as a key attribute. The publication further asserted that paramedic educators need to possess this attribute in order to be pivotal to the success of design and implementation of "theory-in-practice" curriculum. Paramedic academics typically possess experience and expertise, both as practising paramedics and as university educators. They are able to align and refine classroom theory and experiences with the expectations linked to knowledge, skills and professional attitudes in the discipline. Previous arguments regarding theory-practice gaps within other disciplinary settings have cited that a lack of universal understanding and appreciation of what is meant by the term "theory" (Billsberry & Eichler, 2020), which may have contributed to its misuse. Paramedic academics have an identity and experience in both university and industry domains and so are able to adopt teaching approaches supported by educational research and theory that draw upon paramedic work-based tasks: tasks that, at times, may supplement students experience in traditional field placement. Such cross-discipline expertise challenges perceptions of theory and practice as being entirely separate, with one the exclusive domain of the university and the other of the clinical setting. Classroom-based authentic learning and assessment tasks can address concerns

about inconsistencies and, in some cases, poor experiences that students encounter on placement. Classroom-based learning is able to target specific learning objectives and to optimise priorities of all learners, unlike the random and unpredictable clinical encounters and the variable support experienced on placement (Cooper et al., 2010). Findings from the publication (Section 4.4) confirmed the outcomes of this project: increased level of student preparedness and student recognition of the value of the improved pedagogy in the redesign of the final year curriculum.

5.5 Assessment for Learning in Paramedicine

Assessment design within paramedicine continues to be overshadowed by credentialing expectations and interests of external stakeholders. These stakeholders have perpetuated the dominance of summative assessment as an "assurance of learning", ahead of prioritising student interests and using assessment as a "vehicle for learning". Credentialing based testing within the discipline is not only an Australian phenomenon, but also dominant on an international scale, evidenced on a grand scale in the national registration requirements with the United States. A feature of the educational system emphasising the preparation of students in readiness to attempt and pass credentialing tests for entry to practice (https://www.nremt.org/rwd/public/document/candidates).

The assumption around assessment for learning was outlined in Section 3.4.5 and is: *Implementation of a new paradigm of "Assessment for learning" approaches will improve students' reflective practice and self-regulated learning skills, both of which will enhance graduates' paramedic work-readiness.*

This assumption gave rise to the following research questions:

- What can be done to integrate an *assessment for learning* approach into an existing curriculum design?
- How can an assessment for learning re-design contribute to an improved attainment of graduate paramedic preparedness?
- What would be required of an assessment design to enable students to effectively develop critical self-regulated learning skills, and contribute to high stakes assessment decisions?

The publications described in this thesis (Chapter 4) suggest the following proposition:

PROPOSITION

- *Programmatic assessment for learning approaches contribute to more valid and reliable measures of a paramedic graduate's capabilities and better support the development of the paramedic learner than former summative credentialing assessment approaches.*

The implications of these propositions are discussed in the following subsections.

5.5.1 Assessment for learning solutions for paramedic education

With well-meaning intentions, local paramedic education assessment philosophy had previously pursued summative practices that could illustrate that a majority of students had been able to obtain a good result. Subjects demonstrating results that represented a bell curve of grade distribution were tacitly regarded as exemplars that the curriculum had been taught and assessed to an appropriate standard and taught to a level of the majority of student needs. Wiliam (2011) took an opposite view, arguing that the notion of a normal distribution of student results, rather than symbolising effective teaching, is an indication of failure, by not recognising the diverse needs of learners. With a summative assessment philosophy, it was often only at the end of a period of teaching that the extent of student knowledge limitations could be fully understood, often being too late for remedial action.

These traditions of practice within paramedic education are at odds with a concept of assessment for learning. A key contributor to effective learning is understanding where the learner is at the start (Wiliam 2011). This was a principle adopted in the redesign of the final paramedic subject, by reflecting that student acquisition of pre-requisite curriculum was insufficient as a base for moving their learning forward. The use of early diagnostic testing and later progress testing provided an answer to this challenge. As a result, specific detail of student strengths and weaknesses was generated from the start, thus ensuring knowledge deficits remaining at the end of the subject were not a surprise. Assessment for learning represents significant shift in the assessment traditions that have been built on sorting and ranking students (Tang & Logonnathan, 2016). While ranking paramedic undergraduate results may prove a useful instrument for external parties who are required to make recruitment decisions, continuing

practices that do not preference the learning interests of graduates presents a moral dilemma for academics to negotiate (Popham, 2009).

While traditional summative assessment practice generates student winners and losers, assessment for learning seeks to reward the growth of all through bespoke personalised learning (Pang, 2020). It is claimed that the capstone redesign incorporating assessment for learning has now reprioritised the interests of student learning and graduate development, ahead of the interests of external recruiters. At a time where there is increasing pressure on paramedic students to provide evidence of performance outcomes and personal achievements that will distinguish them from their peers, the capstone subject redesign is, by contrast, introspective and learner- and learning-centric. Preferencing student learning, however, should not be regarded as a sign of "going soft" on students. Programmatic Assessment for Learning (PAL) systems are linked to more confident and definitive student-fail decisions, which have been attributed to examiner access to greater volumes of performance results, informing better decisions and counteracting a common "failure to fail" phenomenon (Wilkinson & Tweed 2018).

5.5.2 Integration of assessment-for-learning approach to existing curriculum

The successful integration of an assessment for learning methodology was achieved using familiar and readily accepted assessment instruments in novel and innovative ways. The publication *Paramedic capstone education model: Building work ready graduates* (Section 4.2) described a reconfiguration of some well-known assessment instruments in order to optimise student learning. By changing the timing and increasing the frequency of assessment, focus was shifted to learning which responded to repeated cycles of testing measures and personalised feedback.

Results of the study in the publication illustrated the positive influence this approach had on the student experience and perceptions of impact on learning. Evaluation of this innovation illustrated that students welcomed transition to this new paradigm of "assessment for learning" and recognised the merits of the approach.

Assessment for learning is not a new concept, with several decades of reported use and merit (Boud, 1995; Schuwirth & van der Vleuten, 2019). Typically, adoption involves a migration of entire teaching programmes to a new system of learning (Schuwirth et al., 2017). Understandably, this can be disruptive, presenting concerns for many involved in the curriculum design and delivery. The work presented in publications 2, 3, 4, 5, 6 and 7 (Sections 4.2 through 4.7) contains examples of

strategies to embrace principles of program-level assessment-for-learning within a single subject that were designed to complement rather than disrupt existing teaching.

Importantly for the discipline of paramedicine, the largely unfamiliar approach of "assessment for learning" (in contrast to "assessment of learning") has been introduced in a cautious and measured way and has been validated. The incremental approach taken to the implementation of PAL has attracted interest within medical education, based on the understanding that a PAL implementation does not need to be an all or nothing decision (Wilkinson & Tweed, 2018).

5.5.3 Graduate attainment of work-readiness through assessment for learning

Assessment for learning is now considered essential to the development of sustainable knowledge and skills required of graduates to manage their evolving learning needs throughout their working life (Taras, 2002). The notion of sustainable assessment practice reflects a recognition that the relevance of an assessment event lasts beyond the moment and looks to the ongoing and future learning needs of the student (Boud, 2000). Expectations of credentialing paramedic capabilities demand that approaches to assessment are seen to retain a rigour readily defensible to external stakeholders (Thompson et al., 2015). Despite this, paramedicine shares a consistent challenge with other practice-based disciplines, namely a perceived disconnect between learning theory and assessment practice (Baird et al., 2017; Boud, 1995).

Adoption of an assessment-for-learning approach in the projects described in this thesis (Chapter 4) responded to issues associated with graduate attainment of a work-ready status. These projects balanced attention to credentialing demands with engagement of contemporary theory and learning for the longer term. One strategy to address the needs of defensible testing rigour was that all scheduled teaching was considered assessable, increasing in the frequency of student assessment and generating a much greater volume of feedback to students: pivotal in shifting how students regarded assessment within the subject. Student relationship with assessment remained at the forefront of the projects, being influenced by literature critical of poor feedback outputs and recommendations for meaningful critical and actionable reviews of student work (Tiwari et al., 2013). Students began to recognise that frequent assessment provided a series of data points enabling tracking of personal progress in detail, as described in Schuwirth andAsh (2013). This change fostered a culture in which it was acceptable to make mistakes while learning: a characteristic of an expert paramedic – one who is reflexive rather than someone who doesn't make errors.

The publication *Paramedic capstone education model: Building work ready graduates* (Section 4.2) reports on an early subject iteration, in which students were required to use tutorials to self-identify their own personal knowledge gaps. These gaps were documented and then addressed by students in an online wiki. Content of the student co-constructed wiki helped inform content of an exam, which, in turn, was used for diagnostic purposes and contributed towards informing a final oral viva. This assessment design illustrated the interconnectedness that was possible between student and their personalised learning. Continual student connection with what they are doing and why, along with regular reporting of progress, are regarded as effective strategies in the development of life-long self-regulated learning (Hawe & Dixon, 2016). In this new system assessment became the primary vehicle for learning, with each event demonstrating multiple purposes of feedback, feeding forwards and outwards, leading students while providing the same impetus for curriculum feedback to learning designers (Nicol & Macfarlane-Dick, 2006). Students reported in the findings of the publication *A bridge to being a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject* (Section 4.4) that this assessment re-design resulted in a greater level of their preparedness to undertake the paramedic role. With each assessment that focused on authentic or holistic paramedic task requirements, students gained confidence that their knowledge and abilities had been measured against standards expected by the profession.

5.5.4 Need for assessment discussions with students

Russell (2006) noted that, despite widespread calls for professions to ensure practitioners are equipped with a reflective practice skill set, little had been done to clarify what this meant or to offer guidance on how to meet this expectation.

The Student-Tutor Consensus Assessment model (STCA) underscores the importance of engaging students in assessment discussions regarding their work. The use of this model was described in the publications *Teaching students to think like a paramedic: Improving professional judgement through assessment conversations* (Section 4.6) and *Assessment partnerships from the start: Building reflective-practice as a beginning paramedic student competency* (Section 4.8). The pragmatic design of the STCA model required students to both reflect-on-action and to demonstrate reflection-in-action, and the model emphasised the importance for teachers not only to observe and grade student efforts, but also to actively seek to understand students' reasoning about their actions. Students self-evaluated their own work in a process that offers all students equal opportunities for learning growth (Fluckiger et al., 2010). Such self-evaluation can

only be effective through an exchange in which students are called upon to justify their actions and question their tutor's judgements (Healey, 2014). Tutors reported it was not uncommon for them to change their initial grade decisions after hearing students' rationales for their actions during these exchanges. This finding highlighted the uncertainty that often accompanies tutor judgements in assessment of student performance (Johnson, 2008).

The STCA method drew upon evaluative judgement learning theory, in which students are encouraged to discuss events, criteria and standards, rather than simply having their output judged (Tai et al., 2017). Such a dynamic assessment exchange gave students a voice in their own assessment and has proved to be a landmark innovation for the way in which paramedic students are taught and assessed. Placing an academic value on students' critique of their own work prioritises the importance of students' reflective capacity to do this well. Methods such as these used in the STCA foster sustainable self-assessment skills and are key to the development of graduate employability and work-readiness (Singh & Terry, 2008).

Publications 5, 6 and 8 (Sections 4.5, 4.6 and 4.8) report improved student learning experiences linked to the STCA design and demonstrated how a STCA model can help prepare students for the ever-changing nature and needs of a patient encounter. These findings echo recommendations of Black and McCormick (2010), who advocate for practice that encourages students to take greater responsibility for their own learning. Using a dialogical approach to assessment judgements rewards students for their ability to self-identify suboptimal practice without the risk of being penalised. This approach resulted in reductions in student defensiveness, in attempts to conceal or refute mistakes and in grade appeals. As a result of this change, the process of grading became a rich interactive learning discussion, rather than being considered a punitive event.

Regarding errors as learning events redefines what demonstrates work-ready paramedic practice to include the ability to reflect, adapt and act on feedback, as noted in Thompson et al. (2016). This was particularly obvious in practical assessments when students were aware of a scenario not progressing as expected or when they experienced an unwanted case outcome following action or inaction. Resulting assessment dialogues provided rich, student-directed learning opportunities of a kind not evident when tutors are the sole assessment deciders (Thompson et al., 2017).

The STCA method expands the assessment process from simple testing of knowledge recall to a far more comprehensive and integrated measure of student's capability, in which both student and assessor gain from the experience.

5.6 Conceptual Framework Summary

This thesis has presented the collective work of eight peer-reviewed publications (Chapter 4), each of which contributed to an improved understanding of, and constructive responses to issues impacting on perceptions of work-readiness of paramedic graduates. As indicated in this chapter, findings from the publications have made key contributions in response to the assumptions related to each initial research problem statement.

In Table 2, a brief summary of each of the publications is mapped to its core area of contribution. Further detail of each publication is included in the indicated section of Chapter 4.

Table 2. Publications and areas of contribution.

Publication (brief title)	Section	Area of Contribution
Defining the paramedic process	4.1	New framework for understanding paramedic practice.
Paramedic capstone education model	4.2	Described new and improved pedagogy and assessment design for determining graduate capabilities and contributed to new overarching theory regarding capstone education.
Blending formative and summative assessment	4.3	Linked assessments to dual purposes, namely, improved pedagogy and improved methods for assessing graduate capabilities.
Bridge to being a practitioner	4.4	Presented pedagogical practice-in-context theory and detailed improved pedagogy underpinning this.
Student and tutor consensus Teaching students to think like a paramedic	4.5, 4.6	Contributed to all four domains. STCA detailing standards of the discipline, offering a method for determining graduate capabilities, improving paramedic pedagogy and new theory relating to teaching and learning within the discipline.
Programmatic assessment condensed	4.7	Reported on new theory of Programmatic Assessment for Learning (PAL) approaches within the discipline and within a single subject, rather than usual full program format. Detailed improved assessment design and rigour for determining graduate capability.
Assessment partnerships from the start	4.8	Described improved pedagogy for first year students and contributed to new theory to how curriculum and assessment should be considered at different stages of student learning.

These outcomes are synthesised in Figure 4, which represents a conceptual framework that integrates the focus of the outcomes of the multiple projects and their publications. This figure presents four broad areas of contribution:

- Definition of a work ready graduate and descriptions of expected practice standards for graduates.
- Curriculum models for improved pedagogy.
- New paramedic education theory.
- Tools and methods to assess graduate capabilities.

Each area deliberately intersected with the others to illustrate these broad areas of contribution in paramedic education, and each element has influenced the development, understanding and appreciation of the others.

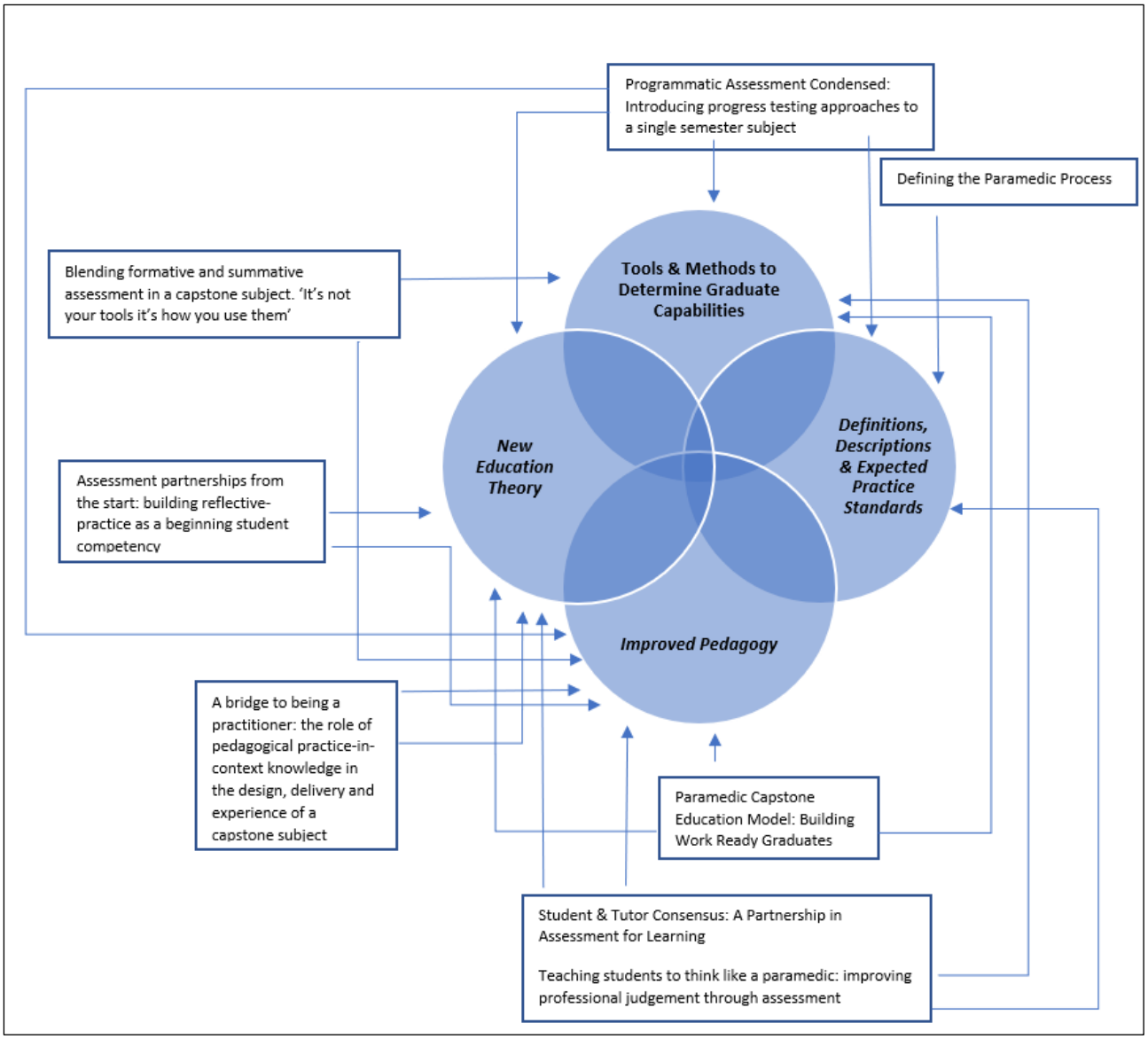


Figure 4. Conceptual framework summarising contributions of publications.

5.7 Limitations of the Research

This body of work addresses the problem of conceptualising what constitutes the work-ready paramedic graduate, a problem that resides at the intersection of academia, local ambulance industry and student. Local factors associated with each of these key groups were linked to study constraints. While the success of the innovations has now been more broadly understood, at the time of the initial design and evaluation of the reforms, initial rejections to consider these changes to teaching practice from within several academic colleagues, constrained projects sizes to a single subject. Across the period that these studies were conducted, efforts to establish formal educational consultancy within industry, were and continue to be hindered by frequent leadership

shifts, which have witnessed a change of four chief executive officers, and multiple interim CEO's, each with differing educational agendas. This meant the industry consultation reported within the studies was limited to those parties accessible to the university, often through teaching affiliations.

As a new profession, little research has been previously conducted in this area, which has resulted in the need to frequently draw upon and interpret the literature of other disciplines. With a lack of reliable data from within the paramedic discipline, limited the scope of analysis available through result comparisons. The body of work presents data to support the benefits of curriculum innovations and reforms to improved student learning outcomes. These data have been drawn predominantly from student study participants, capturing their reflections on their lived experiences of the changing curriculum. Each of the different participant cohorts reflected a single semester subject enrolment period, which also corresponded to the length of the study. Sample selection was therefore limited to a narrow range of available participants, and additionally was unable to explore the more longitudinal impacts of the innovations being evaluated. Further research opportunities exist to evaluate student perceptions and attitudes towards the value of their university experiences, at different intervals of their professional life beyond their graduation. As a sample, students are also just one of the key stakeholders, meaning more work is required to draw conclusions regarding the industry's response to the innovations, reforms and framing concepts. The work has presented a comprehensive suite of frameworks and strategies designed to address perceptions of a theory-practice gap, providing a future avenue for research investigating these changes from an industry perspective.

Reflecting upon each of the reported projects, data was frequently collected through the use of survey instrument. The design of these tools reflected the understanding at the time, which through the collective contributions of the iterative AR process, has expanded considerably. It is recommended that any future research would require a revision of these instruments.

An action-research methodology was applied in response to the unique nature of the local problems linked to a single university site, a single undergraduate programme and the relationship with a single ambulance industry provider. While these studies were not initiated with the intention that their findings would be generalisable to other contexts, there has been proven transferability to education programs for other paramedic and health professions. While it is acknowledged that each university and ambulance service is unique and that relationships between these parties differ, some Australian states have recently been able to demonstrate high levels of cooperation between

parties and have built progressive relationships in which curriculum innovations are shared.

The progress test and paramedic learning list reported within this thesis have been developed and validated locally within this pilot and would benefit from expanded stakeholder contribution and refinement.

5.8 Future Directions and Ongoing Work

As discussed in the previous study limitations chapter, the studies and their collective findings have highlighted extensive opportunities for further study. This thesis has framed the context of concerns that primarily exist at the junction between a university, a completing student, a local industry, a rapidly advancing profession and ultimately, the wider public of health care consumers. The studies have made valuable contributions to the initial body of evidence in this area, which has specifically focussed on the learner and learning process. This opens opportunity for wider investigation across other stakeholder groups, in particular, studies which offer wider inclusive stakeholder membership and participation. This future research direction is consistent with recent international recommendations which have emphasised to need to seek patient perspectives with regards to the standards and capabilities of paramedics (EMS, 2019).

The studies predominantly reflect the issues surrounding the local paramedic undergraduates as they prepare to embark on conventional appointments with the recognised national ambulance providers. Limiting the concepts of work-readiness to the expectations linked to today's South Australian paramedic workforce, neglects to consider how the industry and it's roles will change in the future. Advancing clinical roles, prescribing rights and greater professional autonomy remain ongoing discussions within the discipline globally.

The Student-Tutor Consensus Assessment (STCA) has demonstrated a method for enhancing student learning within the process of assessment. Since its development, this approach has been adopted for use within both nursing and medicine disciplines, illustrating the potential utility of the approach within other disciplines in which professional roles have requirements of self-regulated learners. While there have been anecdotal claims for its effectiveness in these disciplines, translation of the STCA approach is still to be formally evaluated in these new settings.

The STCA has now proved successful within the local university for teaching resuscitation skills to paramedic students. This development holds significance for the

entire paramedicine education sector, especially for credentialing these practices. Unfortunately, resuscitation credentialing continues to employ check-list testing that focuses on student ability to recall memorised algorithms and demonstrate choreographed processes. This is despite resuscitation literature reporting poor advances to patient outcomes linked to poorly sustained clinician knowledge and skill proficiency (Bigham et al., 2001). Early STCA project findings reported deeper student understanding and enhanced critical thinking skills considered essential to real world resuscitation practice.

The pedagogy-in-context theory lends itself well to other disciplines. For disciplines that similarly face actual or perceived theory-practice gap concerns, the projects in this thesis provide an avenue for considering capstone education. The approach embeds theory-in-practice into existing curriculum, integrating learning and providing a vehicle for transitioning students between the two worlds of university and industry. Adopting a capstone conception in this overall project has helped to pioneer and lead program wide pedagogical reform. Lessons learned and innovations created present opportunities for wider application across a range of disciplines.

The projects reported within this thesis demonstrate the effectiveness of applying Programmatic Assessment for Learning (PAL) approaches to a single semester subject as an alternative to adopting a whole of program approach. This limited introduction to PAL has provided an important “proof of concept” that would be required ahead of a broader whole of program cultural shift.

Chapter 6. Conclusion

Workplaces and universities are characterised globally by rapid change. Paramedicine too is at a critical juncture, with the expectations regarding work and the skills and knowledge required of its workforce now receiving more attention than ever before. At this important time where the discipline is being redefined, the contribution of this body of work provides a contemporary understanding of the educational needs of paramedic students and graduates entering the profession.

This thesis by prior publication was based on eight publications peer reviewed by experts within their respective fields and published within respected journals. The publications are the product of a program of action research, chronicling iterative reforms to one paramedic education program in South Australia that occurred over the last decade. These reforms contribute to a substantial portion of the local and Australian university paramedic story.

The thesis argues that it is no longer reasonable to view a graduate in terms of their ability “to get through” a program by “passing” a final test. Instead, students must be able to demonstrate that they have learnt for the longer term. Paramedic graduates must be capable self-regulated learners. This thesis has shared methods that have been validated to support this.

Based on the combined outcomes of these studies, this thesis offers the following set of guidelines to be considered when designing a paramedic program to ensure that its graduates are “work-ready”:

- Begin with a whole of program shared conception of the capabilities, knowledge and dispositions that all graduates should be able to demonstrate at the end of their undergraduate studies.
- Consider how to integrate the whole course and make it all count towards shaping sustainable graduate capabilities.
- Consider pedagogy that embodies authentic work-place practice and events as a method to help bridge the divides between university and industry, theory and practice as well as fostering students’ professional identities.
- Design assessment that prioritises rich and detailed feedback to the learner and encourages students to engage with assessment decisions, assisting them to become self-reflective, self-regulated learners.

The contributions have been endorsed through the receipt of state and national higher education and ambulance education awards that acknowledge their impact. Findings have been presented and critically reviewed at state, national and international conferences and have attracted citations from a range of disciplines. The projects themselves have provoked similar development of curriculum changes in other undergraduate programs. Examples of capstone education design have begun to feature within other paramedic degrees interstate. The Student-Tutor Consensus Assessment (STCA) model now features across all local paramedic curriculum, is utilised within the local medical and nursing programs and is now the focus of another PhD candidate's research.

Reflecting upon the initial wicked problem posed, there is evidence of new insights obtained and provided, and concrete and deliberate improvements made. Their significance is illustrated by the fact that they have been sustained beyond the moment and that they have relevance beyond their setting.

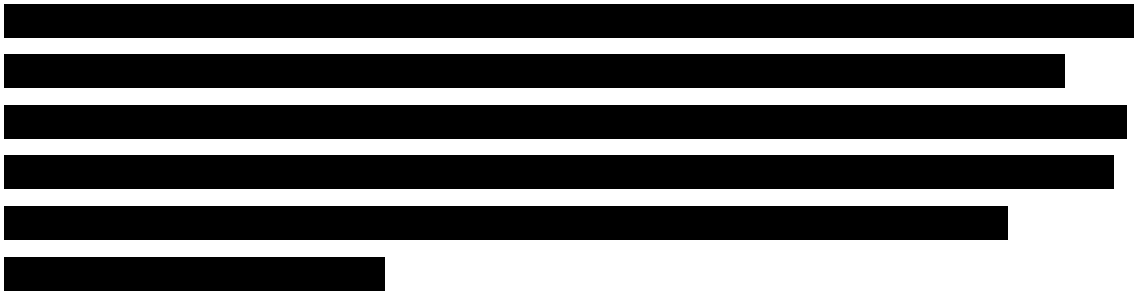
Appendix 1. Co-Authorship Declaration

This declaration relates to Carter and Thompson (2013) (*Defining the Paramedic Process*). (See also Section 4.1.)

Content removed for privacy reasons.

Appendix 2. Co-Authorship Declaration

This declaration relates to Thompson, Grantham and Houston (2015) (*Paramedic Capstone Education Model: Building Work-Ready Graduates*). (See also Section 4.2.)



Content removed for privacy reasons..

Appendix 3. Co-Authorship Declaration

This declaration relates to Houston and Thompson (2017a) (*Blending Formative and Summative Assessment in a Capstone Subject: "It's not your tools, it's how you use them"*). (See also Section 4.3.)

Content removed for privacy reasons.

Appendix 4. Co-Authorship Declaration

This declaration relates to Houston and Thompson (2017b) (*A bridge to Being a Practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject*). (See also Section 4.4.)

Content removed for privacy reasons.

Appendix 5. Co-Authorship Declaration

This declaration relates to Thompson et al. (2016) (*Student & tutor consensus: a partnership in assessment for learning*). (See also Section 4.5.)

Content removed for privacy reasons.

Appendix 6. Co-Authorship Declaration

This declaration relates to Thompson, Houston, and Dansie (2017) (*Teaching students to think like a paramedic; improving professional judgement through assessment conversations*). (See also Section 4.6.)

Content removed for privacy reasons.

Appendix 7. Co-Authorship Declaration

This declaration relates to Thompson and Houston (2020) (*Programmatic Assessment Condensed: Introducing progress testing approaches to a single semester paramedic subject*). (See also Section 4.7.)

Content removed for privacy reasons.

Appendix 8. Co-Authorship Declaration

This declaration relates to Thompson, Couzner and Houston (2020) (*Assessment partnerships from the start: building reflective practice as a beginning paramedic student competency*). (See also Section 4.8.)

Content removed for privacy reasons.

Appendix 9. Questionnaire Paper 3

Below is a copy of the questionnaire instrument used for data collection presented in paper 3: Blending Formative and Summative Assessment in a Capstone Subject: ‘It’s not your tools, it’s how you use them

Please indicate your level of agreement with following statements regarding PARA3007 teaching & learning design component

Content removed for privacy reason

Appendix 10. Questionnaire paper 4

Below is a copy of the questionnaire instrument used for data collection presented in paper 4 " A bridge to ‘being’ a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject."

Content removed for privacy reasons

Appendix 11. Questionnaire paper 5 & 6

Below is a copy of the questionnaire instrument used for data collection presented in papers 5 and 6: Student & tutor consensus: a partnership in assessment for learning, and; Teaching students to think like a paramedic: Improving professional judgement through assessment conversations.

Content removed for privacy reasons.

Appendix 12. Questionnaire paper 7

Below is the instrument used to collect data for the project reported paper 7, "Programmatic Assessment Condensed: Introducing Progress Testing Approaches to a Single Semester Paramedic Subject"

Content removed for privacy reasons

Appendix 13. Questionnaire paper 8

Below is the instrument used to collect data for paper 8, " Assessment partnerships from the start: Building reflective practice as a beginning paramedic student competency"

Content removed for privacy reasons.

References

Abdulmajed, H., Park, Y.S., & Tekian, A., (2015). Assessment of educational games for health professions: a systematic review of trends and outcomes. *Medical Teacher, 37*(Supplement), 27-32. https://doi.org/10.3109/0142159X.2015.1006609

Allen-Collinson, J. (2009). Negative 'marking'? University research administrators and the contestation of moral exclusion. Studies in Higher Education, 34(8), 941-954. https://doi.org/10.1080/03075070902755641

Ambulance Services Act 1992 (South Australia). Retrieved 28/01/2020, from https://www.legislation.sa.gov.au/ Argyris, C., & Schon., D. A. (1974). Theory in practice: Increasing professional effectiveness, San Francisco: Jossey-Bass.

Arocha, J. F., & Patel, V. L. (1995). Novice diagnostic reasoning in medicine: accounting for evidence. *The Journal of the learning sciences*, *4*(4), 355-384. https://doi.org/10.1207/s15327809jls0404_1

Ashman, A. (2010). Modelling inclusive practices in postgraduate tertiary education courses. *International Journal of Inclusive Education, 14*(7), 667-680. https://doi.org/10.1080/13603111003778429

Australian Health Practitioner Regulation Agency (AHPRA), Paramedicine Board of Australia. (2018). Professional Capabilities for Registered Paramedics. Retrieved 30/10/2019, from https://www.paramedicineboard.gov.au/Professional-standards/Professional-capabilities-for-registered-paramedics.aspx.

Australian Health Practitioner Regulation Agency (AHPRA). (2019). Professional capabilities for registered paramedics. Retrieved 30/10/2019, from https://www.paramedicineboard.gov.au/Professional-standards/Professional-capabilities-for-registered-paramedics.aspx.

Australian Qualifications Framework Council. (2013). Australian Qualifications Framework. Retrieved January 28, 2020, from *https://www.aqf.edu.au/.*

Baird, J. A., Andrich, D., Hopfenbeck, T. N., & Stobart, G. (2017). Assessment and learning: Fields apart?. *Assessment in Education: Principles, Policy & Practice*, *24*(3), 317-350. https://doi.org/10.1080/0969594X.2017.1319337

Baum, F., MacDougall, C. & Smith, D. (2006). Participatory action research. *Journal of Epidemiology & Community Health, 60*(10), 854-857. https://doi:/10.1136/jech.2004.028662

Benner, P. (1984). *From novice to expert*. Menlo Park, California: Addison-Wesley.

Bennett, J., Freeman, A., Coombes, L., Kay, L. & Ricketts, C. (2010). Adaptation of medical progress testing to a dental setting. *Medical teacher, 32*(6), 500-502. https://doi.org/10.3109/0142159X.2010.486057

Bennett, R. E. (2011). Formative assessment: A critical review. *Assessment in education: principles, policy & practice*, *18*(1), 5-25. https://doi.org/10.1080/0969594X.2010.513678Berheide, C. W. (2007). Doing less work, collecting better data: using capstone courses to assess learning. *Peer Review, 9*(2), 27-30.

Biggs, J. (1998). Assessment and classroom learning: a role for summative assessment? *Assessment in Education: Principles, Policy & Practice, 5*(1), 103-110. https://doi.org/10.1080/0969595980050106

Biggs, J. (2003). Aligning teaching and assessment to curriculum objectives. *Imaginative Curriculum Project, LTSN Generic Centre, 12*. https://doi.org/10.1111/1467-8535.00249

Bigham, B. L., Koprowicz, K., Rea, T., Dorian, P., Aufderheide, T. P., Davis, D. P., Powell, J., Morrison, L., & ROC Investigators. (2011). Cardiac arrest survival did not increase in the Resuscitation Outcomes Consortium after implementation of the 2005 AHA CPR and ECC guidelines. Resuscitation, *82*(8), 979-983. https://doi.org/10.1016/j.resuscitation.2011.03.024

Billett, S., (2002). Critiquing workplace learning discourses: Participation and continuity at work. *Studies in the Education of Adults*, *34*(1), 56-67. https://doi.org/10.1080/02660830.2002.11661461Billett, S., (2002). Toward a workplace pedagogy: Guidance, participation, and engagement. *Adult education quarterly*, *53*(1), 27-43. https://doi.org/10.1177/07417130223720

Billsberry, J., & Eichler, M. (2020). A Phenomenographic Study of the Understanding of Theory in Management Education. *Academy of Management Proceedings, 1*,11661 https://doi.org/10.5465/AMBPP.2020.97

Black, P., & R. McCormick. 2010. Reflections and New Directions. *Assessment & Evaluation in Higher Education*, *35*(5), 493–499. doi:10.1080/02602938.2010.493696.10.1080/02602938.2010.493696

Bond, H., & Spurritt, D. (1999). *Challenges of assessment. Educating beginning practitioners: challenges for health professional education*. Butterworth-Heinemann, Oxford, 228-235.

Boud, D. (1995). Assessment and learning: contradictory or complementary Published in Knight, P. (Ed.) (1995). Assessment for Learning in Higher Education. London: Kogan, 35-48

Boud, D. (2000). Sustainable assessment: rethinking assessment for the learning society. *Studies in continuing education, 22*(2),151-167. https://doi.org/10.1080/713695728 Boud, D. (2007). Reframing assessment as if learning were important. *Rethinking assessment in higher education: Learning for the longer term:* London: Routledge. 14-25.

Boud, D. & Falchikov, N. (2007). Introduction: assessment for the longer term. In Boud, D. & Falchikov, N. (Eds.) *Rethinking Assessment for Higher Education: Learning for the Longer Term*. London: Routledge, 3-13.

Boud, D., & Falchikov, N. (2007). Developing assessment for informing judgement. *Rethinking assessment in higher education: Learning for the longer term:* London: Routledge, 181-197.

Boud, D., Keogh, R., & Walker, D. (2013). *Reflection: Turning experience into learning.* London: Kogan Page.

Boud, D., Lawson, R., & Thompson, D. G. (2013). Does student engagement in self-assessment calibrate their judgement over time? *Assessment & Evaluation in Higher Education, 38*(8), 941-956. https://doi.org/10.1080/02602938.2013.769198

Boud, D., & Soler, R. (2016). Sustainable assessment revisited. *Assessment & Evaluation in Higher Education, 41*(3), 400-413. https://doi.org/10.1080/02602938.2015.1018133

Boyer, E. L. (1990). *Scholarship reconsidered: Priorities of the professoriate*. Princeton, New Jersey, Carnegie Foundation for the Advancement of Teaching.

Boyle, M., Williams, B., and Burgess, S. (2007). Contemporary simulation education for undergraduate paramedic students. *Emergency Medicine Journal, 24*(12), 854-857. http://dx.doi.org/10.1136/emj.2007.046318

Brewis, J., & Godfrey, R. (2019). 11 From Extreme to Mundane? The Changing Face of Paramedicine in the UK Ambulance Service. Critical Perspectives on the Management and Organization of Emergency Services, 146.

Bridgstock, R. (2009). The graduate attributes we've overlooked: Enhancing graduate employability through career management skills. *Higher Education Research & Development*, *28*(1), 31-44. https://doi.org/10.1080/07294360802444347

Briggs, A. R., Clark, J., & Hall, I. (2012). Building bridges: understanding student transition to university. *Quality in Higher Education, 18*(1), 3-21. https://doi.org/10.1080/13538322.2011.614468

Brock, P. A. (2004). From Capstones to Touchstones: Preparative Assessment and Its Use in Teacher Education. *Assessment Update, 16*(1), 8-9.

Brookfield, S. (1998). Critically reflective practice. *Journal of Continuing Education in the Health Professions, 18*(4), 197-205. https://doi.org/10.1002/chp.1340180402

Brookhart, S. M. (2001). Successful students' formative and summative uses of assessment information. *Assessment in Education: Principles, Policy & Practice, 8*(2), 153-169. https://doi.org/10.1080/09695940123775

Brooks, I. A., Grantham, H., Spencer, C., & Archer, F. (2018). A review of the literature: the transition of entry-level paramedic education in Australia from vocational to higher education (1961–2017). *Australasian Journal of Paramedicine*, *15*(2). https://doi.org/10.33151/ajp.15.2.584

Brown, S. (2005). Assessment for learning. *Learning and teaching in higher education*,*1*, 81-89.

Burton, R. F. (2001). Quantifying the effects of chance in multiple choice and true/false tests: question selection and guessing of answers. *Assessment & Evaluation in Higher Education, 26*(1), 41-50. https://doi.org/10.1080/02602930020022273

Burton, R. F. (2004). Multiple choice and true/false tests: reliability measures and some implications of negative marking. *Assessment & Evaluation in Higher Education, 29*(5), 585-595. https://doi.org/10.1080/02602930410001689153

Burton, R. F. (2005). Multiple-choice and true/false tests: myths and misapprehensions. *Assessment & Evaluation in Higher Education, 30*(1), 65-72. https://doi.org/10.1080/0260293042003243904

Caldwell, D. (2020). A CASE STUDY OF THE UNIVERSITY OF BLUE RIDGE SCHOLARS AND PERSISTENCE. *Higher Education Leadership and Practice Dissertations*. 4.

Campbell, R. J., Robinson, W., Neelands, J., Hewston, R., & Mazzoli, L. (2007). Personalised learning: Ambiguities in theory and practice. *British journal of educational studies*, *55*(2), 135-154. https://doi.org/10.1111/j.1467-8527.2007.00370.x

Carr, W., & Kemmis, S. (1983). *Becoming critical: Knowing through action research*. Victoria, Australia Deakin University Press, ch 5, 132-41.

Carson, A., & Carnwell, R. (2007). Working in the theory–practice gap: the lecturer practitioner's story. *Learning in Health and Social Care, 6*(4), 220-230. https://doi.org/10.1111/j.1473-6861.2007.00163.x

Carter, H., & Thompson, J. (2013). Defining the paramedic process. *Australian Journal of Primary Health, 21*(1), 22-26. https://doi.org/10.1071/PY13059

Chen, H. L., Cannon, D., Gabrio, J., Leifer, L., Toye, G., & Bailey, T. (2005). Using wikis and weblogs to support reflective learning in an introductory engineering design course. *Human Behaviour in Design, 5*, 95-105.

Crichton, H., & McDaid, A. (2016). Learning intentions and success criteria: learners' and teachers' views. *The Curriculum Journal*, *27*(2), 190-203. https://doi.org/10.1080/09585176.2015.1103278

Clawson, J. J., Martin, R. L., & Hauert, S. A. (1994). Protocols vs. guidelines. Choosing a medical-dispatch program. *Emergency Medical Services*, *23*(10), 52-60.

Clinton, M., Murrells, T., and Robinson, S. (2005). Assessing competency in nursing: a comparison of nurses prepared through degree and diploma programmes. *Journal of Clinical Nursing, 14*(1),82-94. https://doi.org/10.1111/j.1365-2702.2004.01015.x

Coffey, A. (2005). The clinical learning portfolio: a practice development experience in gerontological nursing. *Journal of Clinical Nursing, 14*, 75-83. https://doi.org/10.1111/j.1365-2702.2005.01279.x

Cohen, J. (2013). *Statistical power analysis for the behavioural sciences (2nd ed.)* Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Cole, M. (2009). Using Wiki technology to support student engagement: Lessons from the trenches. *Computers & Education, 52*(1), 141-146. https://doi.org/10.1016/j.compedu.2008.07.003

Collier, P. J. (2000). The effects of completing a capstone course on student identity. *Sociology of Education, 73*(4), 285-299. https://doi.org/10.2307/2673235

Coombes, L., Ricketts, C., Freeman, A., & Stratford, J. (2010). Beyond assessment: feedback for individuals and institutions based on the progress test. *Medical Teacher, 32*(6), 486-490. https://doi.org/10.3109/0142159X.2010.485652

Cooper, L., Orrell, J. & Bowden, M. (2010) Work Integrated Learning: A Guide to Effective Practice. New York: Taylor and Francis Publishers.

Council of Ambulance Authorities (2013) Paramedic Professional Competency Standards Version 2.2.(June 12, 2019). https://nasemso.org/wp-content/uploads/PA_Australasian-Competency-Standards-for-paramedics-2011.pdf

Cowan, J. (2010). Developing the ability for making evaluative judgements. *Teaching in Higher Education, 15*(3), 323-334. https://doi.org/10.1080/13562510903560036

Coyne, R. (2005). Wicked problems revisited. *Design studies, 26*(1), 5-17. https://doi.org/10.1016/j.destud.2004.06.005

Crosbie, J., Gass, E., Jull, G., Morris, M., Rivett, D., Ruston, S., Sheppard, L., Sullivan, J., Vujnovich, A., & Webb, G. (2002). Sustainable undergraduate education and professional competency. *Australian Journal of Physiotherapy, 48*, 5-7. https://doi.org/10.1016/S0004-9514(14)60276-2

Cruess, R. L., Cruess, S. R., & Steinert, Y. (2016). Amending Miller's pyramid to include professional identity formation. *Academic Medicine, 91*(2), 180-185. https://doi:10.1097/ACM.0000000000000913

Dijksterhuis, M., Scheele, F., Schuwirth, L., Essed, G., Nijhuis, J., & Braat, D. (2009). Progress testing in postgraduate medical education. *Medical Teacher, 31*(10), e464-e468. https://doi.org/10.3109/01421590902849545

Dreyfus, S. E. (2004). The five-stage model of adult skill acquisition. *Bulletin of Science, Technology & Society, 24*(3), 177-181. https://doi.org/10.1177/0270467604264992

Dutson, A. J., Todd, R. H., Magleby, S. P., & Sorensen, C. D. (1997). A review of literature on teaching engineering design through project-oriented capstone courses. *Journal of Engineering Education, 86*(1), 17-28. https://doi.org/10.1002/j.2168-9830.1997.tb00260.x

Dyson, K., Bray, J. E., Smith, K., Bernard, S., Straney, L., & Finn, J. (2017). Paramedic resuscitation competency: A survey of Australian and New Zealand emergency medical services. *Emergency Medicine Australasia, 29*(2), 217-222. https://doi.org/10.1111/1742-6723.12715

Ebben, R. H., Vloet, L. C., Verhofstad, M. H., Meijer, S., Mintjes-de Groot, J. A., & van Achterberg, T. (2013). Adherence to guidelines and protocols in the prehospital and emergency care setting: a systematic review. *Scandinavian journal of trauma, resuscitation and emergency medicine*, *21(*1), 9. https://doi.org/10.1186/1757-7241-21-9

Edwards, D. (2011) Paramedic preceptor: work readiness in graduate paramedics. *The Clinical Teacher, 8*(2), 79-82. https://doi.org/10.1111/j.1743-498X.2011.00435.x

Elmore, M. S., Fellows, S. B., Gieskes, K. E., & Cummings, L. (2015). Facilitating Learning With a Project-Based Curriculum That Engages 1st-Year Engineering Students. *ASEE Annual Conference & Exposition*. Seattle, Washington.

Emergency Medical Services (EMS). (2019. EMS Agenda 2050, A people-centrered vision for the future of medical services. Retrieved 25/10/2020, from https://www.ems.gov/projects/ems-agenda-2050.html

Epstein, R. M. & Hundert, E. M. (2002). Defining and assessing professional competence. *Journal of the American Medical Association, 287*(2), 226-235. doi:10.1001/jama.287.2.226

Eva, K. W., Cunnington, J. P., Reiter, H. I., Keane, D. R. & Norman, G. R. (2004). How can I know what I don't know? Poor self assessment in a well-defined domain. *Advances in Health Sciences Education, 9*(3), 211-224. https://doi.org/10.1023/B:AHSE.0000038209.65714.d4

Fennell, F. (2020). Then: Assessment—So Much More Than Tests, Testing, and Accountability. *MTLT*. *113*(8): 673-675. https://doi.org/10.5951/MTLT.2020.0040

Fernandez, N. P. (2006). Assessment Matters Integration, Reflection, Interpretation: Realizing the Goals of a General Education Capstone Course. *About Campus, 11*(2), 23-26. https://doi.org/10.1002/abc.163

Fluckiger, J., Vigil, Y. T. Y., Pasco, R., & Danielson, K. (2010). Formative feedback: Involving students as partners in assessment to enhance learning. *College teaching, 58*(4), 136-140. https://doi.org/10.1080/87567555.2010.484031

Freeman, A., C. van der Vleuten, C., Nouns, Z., & Ricketts, C. (2010). Progress testing internationally. *Medical Teacher, 32*(6), 451-455. https://doi.org/10.3109/0142159X.2010.485231

Galdas, P., (2017) Revisiting bias in qualitative research: Reflections on its relationship with funding and impact. *International Journal of Qualitative Methods,16*, 1-2 https://doi.org/10.1177/1609406917748992

Goldik, Z. (2008). Abandoning negative marking. *European Journal of Anaesthesiology*, *25*(5), 349-351. https://doi.org/10.1017/S0265021508003876

Gordon, T. J. (1994). The Delphi method. *Futures Research Methodology, 2*(3), 1-30.

Govaerts, M. J., van der Vleuten, C. P., Schuwirth, L. W., & Muijtjens, A. M. (2007). Broadening perspectives on clinical performance assessment: rethinking the nature of in-training assessment. *Advances in Health Sciences Education, 12*(2), 239-260. https://doi.org/10.1007/s10459-006-9043-1

Gray, J. T., & Wardrope, J. (2007). Introduction of non-transport guidelines into an ambulance service: a retrospective review. *Emergency Medicine Journal*, *24*(10), 727-729. http://dx.doi.org/10.1136/emj.2007.048850

Gruppen, L. D., Burkhardt, J. C., Fitzgerald, J. T., Funnell, M., Haftel, H. M., Lypson, M. L., Mullan, P.B., Santen, S.A., Sheets, K.J., Stalburg, C.M., & Vasquez, J. A. (2016). Competency-based education: programme design and challenges to implementation. *Medical education*, *50*(5), 532-539. https://doi.org/10.1111/medu.12977

Guss, D. A., & Posluszny, M. (1984). Paramedic orotracheal intubation: a feasibility study. *The American Journal of Emergency Medicine, 2*(5), 399-401. https://doi.org/10.1016/0735-6757(84)90041-X

Haladyna, T. M., Downing, S. M., & Rodriguez, M. C. (2002). A review of multiple-choice item-writing guidelines for classroom assessment. *Applied Measurement in Education, 15*(3), 309-333. https://doi.org/10.1207/S15324818AME1503_5

Hammersley, M, & Gomm, R., (1997). Bias in Social Research. *Sociological Research Online, 2*(1), 7-19. https://doi.org/10.5153/sro.55

Hariri, N. B., & Said, M. N. H. B. M. (2020) A Review of the impacts of Authentic-Flipped Google Classroom, *Journal of Critical Reviews*, *7*(11), 504-509. https://dx.doi.org/10.31838/jcr.07.11.90

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112. https://doi.org/10.3102/003465430298487

Hauff, S. R., Hopson, L. R., Losman, E., Perry, M. A., Lypson, M. L., Fischer, J., & Santen, S. A. (2014). Programmatic assessment of level 1 milestones in incoming interns. *Academic Emergency Medicine, 21*(6), 694-698. https://doi.org/10.1111/acem.12393

Hawe, E., & Dixon, H. (2017). Assessment for learning: a catalyst for student self-regulation. *Assessment & Evaluation in Higher Education*, *42*(8), 1181-1192. https://doi.org/10.1080/02602938.2016.1236360

Head, B. W. (2008). Wicked problems in public policy. *Public Policy, 3*(2), 101.

Healey, M. (2014). Integrating undergraduate research into the curriculum: International perspectives on capstone and final-year projects. *Council on Undergraduate Research Quarterly, 34*(4), 26-33.

Healey, M. (2014). Students as partners in learning and teaching in higher education. *Workshop Presented at University College Cork, 12*, 15

Heath, G., & Radcliffe, J. (2010). Exploring the utility of current performance measures for changing roles and practices of ambulance paramedics. *Public Money & Management, 30*(3), 151-158. https://doi.org/10.1080/09540961003794287

Heeneman, S., Schut, S., Donkers, J., van der Vleuten, C., & Muijtjens, A. (2017). Embedding of the progress test in an assessment program designed according to the principles of programmatic assessment. *Medical Teacher, 39*(1), 44-52. https://doi.org/10.1080/0142159X.2016.1230183

Henderson, J., McAdam, R., & Leonard, D. (2006). Reflecting on a TQM-based university/industry partnership. Management Decision, *44*(10), 1422-1440. https://doi.org/10.1108/00251740610715731

Henfield, V. J., & Waldron, R. (1988). The use of competency statements to facilitate individualised learning. *Nurse Education Today, 8*(4), 205-211. https://doi.org/10.1016/0260-6917(88)90150-5

Henscheid, J. M. (2008). Preparing seniors for life after college. *About Campus, 13*(5), 20-25. https://doi.org/10.1002/abc.267

Heritage, M. (2007). Formative assessment. What do teachers need to know and do? *Phi Delta Kappan, 89*(2), 140-145. https://doi.org/10.1177/003172170708900210

Herrington, J., Reeves, T. C., & Oliver, R. (2014). Authentic learning environments. In *Handbook of research on educational communications and technology*. 401-412. Springer, New York, NY.

Historical Society St John Ambulance. (2019). St John History. Retrieved 20/10/2019, from *https://stjohn.org.au/assets/uploads/history%20journal/History_vol_08.pdf.*

Hodges, B., McNaughton, N., & Tiberius, R. (1999). OSCE Checklists Do Not Capture Increasing. *Academic Medicine, 74*, 1129-1134.

Holmboe, E. S., Sherbino, J., Long, D. M., Swing, S. R., Frank, J. R., & International CBE Collaborators (2010). The role of assessment in competency-based medical education. *Medical Teacher*, *32*(8), 676-682. https://doi.org/10.3109/0142159X.2010.500704

Holt, A. (2006). An analysis of negative marking in multiple-choice assessment. In *19th Annual Conference of the National Advisory Committee on Computing Qualifications (NACCQ 2006)*, 115-118.

Houston, D., & Thompson, J. (2017a). A bridge to 'being' a practitioner: the role of pedagogical practice-in-context knowledge in the design, delivery and experience of a capstone subject. *Publications, Conference Proceedings, Research and Development in Higher education: Curriculum Transformation, 40*, 175-185. Higher Education Research and Development Society of Australasia, Sydney, Australia

Houston, D., & Thompson, J. (2017b). Blending Formative and Summative Assessment in a Capstone Subject: 'It's not your tools, it's how you use them'. *Journal of University Teaching & Learning Practice, 14*(3), 2.

Howe, A., Campion, P., Searle, J., & Smith, H. (2004). New perspectives—approaches to medical education at four new UK medical schools. *British Medical Journal, 329*(7461): 327-331. https://doi.org/10.1136/bmj.329.7461.327

Hurtig, J. K., & J. K. Estell (2009). A common framework for diverse capstone experiences. *Proceedings of the 2009 Frontiers in Education Conference*, San Antonio, Texas. https://doi.org/10.1109/FIE.2009.5350460

Husebø, S. E., O'Regan, S., & Nestel, D. (2015). Reflective practice and its role in simulation. *Clinical Simulation in Nursing, 11*(8), 368-375. https://doi.org/10.1016/j.ecns.2015.04.005

Jackson, D. (2015). Employability skill development in work-integrated learning: Barriers and best practice. *Studies in Higher Education, 40*(2), 350-367. https://doi.org/10.1080/03075079.2013.842221

Johnston, T., & Acker, J. (2016). Using a sociological approach to answering questions about paramedic professionalism and identity. *Australasian Journal of Paramedicine*, *13*(1), 1-7. https://doi.org/10.33151/ajp.13.1.301

Johnson, M. (2008). Exploring assessor consistency in a Health and Social Care qualification using a sociocultural perspective. *Journal of Vocational Education & Training*, *60*(2), 173-187. https://doi.org/10.1080/13636820802042446

Jordan, K., Littlewood, K., Kennedy, B., & McLaughlin, P. (2019). Tracking Graduate Teacher Preparedness Through A National Capstone Assessment. *Transformations in Tertiary Education*. Springer: Singapore: 169-186. https://doi.org/10.1007/978-981-13-9957-2_14

Joseph, S., Thomas, M., Simonette, G., & Ramsook, L. (2013). The Impact of Differentiated Instruction in a Teacher Education Setting: Successes and Challenges. *International Journal of Higher Education, 2*(3),28-40

Jun, G. T., Ward, J., Morris, Z., & Clarkson, J. (2009). Health care process modelling: which method when?. *International Journal for Quality in Health Care*, *21*(3), 214-224. https://doi.org/10.1093/intqhc/mzp016

Karay, Y., Reiss, B., & Schauber, S. K. (2020). Progress testing anytime and anywhere–Does a mobile-learning approach enhance the utility of a large-scale formative assessment tool?. *Medical Teacher*, 1-9. https://doi.org/10.1080/0142159X.2020.1798910

Kennedy, S., Kenny, A., & O'Meara, P. (2015). Student paramedic experience of transition into the workforce: A scoping review. *Nurse Education Today, 35*(10), 1037-1043. https://doi.org/10.1016/j.nedt.2015.04.015

Kerka, S. (2001). Capstone Experiences in Career and Technical Education. *Practice Application Brief* No 16

Kinzie, J. (2013). Taking stock of capstones and integrative learning. *Peer Review, 15*(4), 27.

Kneafsey, R., & Haigh, C., (2006). Learning safe patient handling skills: Student nurse experiences of university and practice based education. *Nurse Education Today, 27*(8), 832-839. https://doi.org/10.1016/j.nedt.2006.11.005

Konstantinou-Katzi, P., Tsolaki, E., Meletiou-Mavrotheris, M., & Koutselini, M. (2013). Differentiation of teaching and learning mathematics: An action research study in tertiary

education. *International Journal of Mathematical Education in Science and Technology*,*44*(3), 332-49. https://doi.org/10.1080/0020739X.2012.714491

Latman, N. S., & Wooley, K. (1980). Knowledge and skill retention of emergency care attendants, EMT-As, and EMT-Ps. *Annals of Emergency Medicine, 9*(4), 183-189. https://doi.org/10.1016/S0196-0644(80)80003-5

Lawrie, G., Wright, A., Schultz, M., Dargaville, T., O'Brien, G., Bedford, S.B., Williams, M., Tasker, R., Dickson, H., & Thompson, C., (2013). Using formative feedback to identify and support first year chemistry students with missing or misconceptions. A practice report. *The International Journal of the First year in Higher Education, 4*(2), 111-116. https://ro.uow.edu.au/smhpapers/1025

Lazarsfeld-Jensen, A. (2010). Starting young: the challenge of developing graduates' road readiness. *Journal of Paramedic Practice, 2*(8): 368-372. https://doi.org/10.12968/jpar.2010.2.8.78011

Lesage, E., Valcke, M., & Sabbe, E. (2013). Scoring methods for multiple choice assessment in higher education–Is it still a matter of number right scoring or negative marking? *Studies in Educational Evaluation, 39*(3), 188-193. https://doi.org/10.1016/j.stueduc.2013.07.001

Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues, 2*(4), 34-46.

Lipnevich, A.A., & Smith, J.K. (2018). *The Cambridge handbook of instructional feedback*. Cambridge University Press.

Litchfield, A., Nettleton, S., & Taylor, T. (2008). Integrating work-ready learning into the university curriculum contextualised by profession. *WACE Asia Pacific Conference*,340

Long, D.N., Lea, J. & Devenish, S., (2018). The conundrum of defining paramedicine: more than just what paramedics' do'. *Australasian Journal of Paramedicine, 15*(1),1-3. https://doi.org/10.33151/ajp.15.1.629

Lucas, G., Gallagher, A., Zasada, M., Austin, Z., Jago, R., Banks, S., & Van der Gaag, A. (2019). Understanding complaints about paramedics: a qualitative exploration in a UK context. *Australasian Journal of Paramedicine, 16*.1-7. https://doi.org/10.33151/ajp.15.1.629

Mann, K., Gordon, J., & MacLeod, A. (2009). Reflection and reflective practice in health professions education: a systematic review. *Advances in health sciences education, 14*(4), 595-621. https://doi.org/10.1007/s10459-007-9090-2

Maseleno, A., Sabani, N., Huda, M., Ahmad, R., Jasmi, K. A., & Basiron, B. (2018). Demystifying learning analytics in personalised learning. *International Journal of Engineering & Technology*, *7*(3), 1124-1129.

Matthews, K. (2016). Students as partners as the future of student engagement. *Student Engagement in Higher Education Journal, 1*(1),1-5.

Matthews, K. E. (2017). Five propositions for genuine students as partners practice. *International Journal for Students as Partners, 1*(2),1-9. https://doi.org/10.15173/ijsap.v1i2.3315

Mavin, T. J., & Roth, M.W. (2014). Between reflection on practice and the practice of reflection: a case study from aviation. *Reflective Practice, 15*(5), 651-665. https://doi.org/10.1080/14623943.2014.944125

McHarg, J., Bradley, P., Chamberlain, S., Ricketts, C., Searle, J., & McLachlan, J. C. (2005). Assessment of progress tests. *Medical Education, 39*(2), 221-227. https://doi.org/10.1111/j.1365-2929.2004.02060.x

McKay, J., & Marshall, P. (2001). The dual imperatives of action research. *Information Technology & People, 14*(1), 46-59. https://doi.org/10.1108/09593840110384771

McTaggart, R. (1991). Principles for participatory action research. *Adult Education Quarterly, 41*(3), 168-187. https://doi.org/10.1177/0001848191041003003

Meier, R. L., Williams, M. R., & Humphreys, M. A. (2000). Refocusing our efforts: Assessing non-technical competency gaps. *Journal of Engineering Education, 89*(3), 377-385. https://doi.org/10.1002/j.2168-9830.2000.tb00539.x

Michau, R., Roberts, S., Williams, B., & Boyle, M. (2009). An investigation of theory-practice gap in undergraduate paramedic education. *BMC Medical Education, 9*(1), 23. https://doi.org/10.1186/1472-6920-9-23

Miller, G. E. (1990). The assessment of clinical skills/competence/performance. *Academic Medicine, 65*(9), S63-67.

Moro, C., & Stromberga, Z. (2019). Virtual reality using advances in modern technology to enhance the individualised learning experience. *Independence, 2*(44), 28.

Muijtjens, A., Hoogenboom, R., Verwijnen, G., & van der Vleuten, C. (1998). Relative or absolute standards in assessing medical knowledge using progress tests. *Advances in Health Sciences Education, 3*(2), 81-87. https://doi.org/10.1023/A:1009728423412

Muijtjens, A. M., Schuwirth, L. W., Cohen-Schotanus, J., & van der Vleuten, C. P. (2008). Differences in knowledge development exposed by multi-curricular progress test data. *Advances in Health Sciences Education, 13*(5), 593-605. https://doi.org/10.1007/s10459-007-9066-2

Narayanan, T. R. (2009). Academia–industry partnership: an impetus for strengthening teaching and research in higher education institutions. *Current Science*, *96*(3), 343-346.

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199-218. https://doi.org/10.1080/03075070600572090

Norman, G., Neville, A., Blake, J. M., & Mueller, B. (2010). Assessment steers learning down the right road: impact of progress testing on licensing examination performance. *Medical Teacher, 32*(6), 496-499. https://doi.org/10.3109/0142159X.2010.486063

Notari, M. (2006). How to use a Wiki in education: 'Wiki based effective constructive learning'. *Proceedings of the 2006 International Symposium on Wikis*, Odense, Denmark, 131-132 https://doi.org/10.1145/1149453.1149479

O'Brien, K., Moore, A., Dawson, D. A., & Hartley, P. R. (2014). An Australian story: paramedic education and practice in transition. *Australasian Journal of Paramedicine, 11*(3), 4. https://doi.org/10.33151/ajp.11.3.14

Oliver, B., & Jorre de St Jorre, T. (2018). Graduate attributes for 2020 and beyond: Recommendations for Australian higher education providers. *Higher Education Research & Development, 37*(4), 821-836. https://doi.org/10.1080/07294360.2018.1446415

O'Meara, P. (2015). Searching for paramedic academics: vital for our future, but nowhere to be seen!. *Australasian Journal of Paramedicine, 4*(4),1-3.

O'Meara, P. F., Furness, S., & Gleeson, R. (2017). Educating Paramedics for the Future: A holistic approach. *Journal of Health & Human Services Administration, 40*(2),219-251.

O'Meara, P., & Furness, S. (2013). Education in the emerging professions. In S. Loftus, T. Gerzina, J. Higgs, M. Smith, & E. Duffy (Eds.), *Educating Health Professionals: Becoming a University Teacher*. Boston: Sense Publishers.93-102

O'Meara, P., Maguire, B., Jennings, P., & Simpson, P. (2015). Building an Australasian paramedicine research agenda: a narrative review. *Health Research Policy and Systems, 13*(1), 79. https://doi.org/10.1186/s12961-015-0065-0

Orrell, J. (2011). *Good practice report: Work-integrated learning*. ALTC: Strawberry Hills.

Owens, L., & Straton, R. (1980). The development of a co-operative, competitive, and individualised learning preference scale for students. *British Journal of Educational Psychology 50*(2), 147-161. https://doi.org/10.1111/j.2044-8279.1980.tb02440.x

Panadero1, E. 2 & J. Broadbent (2018). Developing evaluative judgement: A self-regulated learning perspective. In D. Boud, R. Ajjawi, P. Dawson, & J. Tai (Eds.), *Developing evaluative judgement: Assessment for knowing and producing quality work*. Abingdon: Routledge

Pang, N. S. K. (2020). Teachers' Reflective Practices in Implementing Assessment for Learning Skills in Classroom Teaching. ECNU Review of Education, https://doi.org/10.1177/2096531120936290

Pannucci, C.J., & Wilkins, E.G., (2010). Identifying and Avoiding Bias in Research. *Plastic and reconstructive surgery, 126*(2), 619-625. https://doi.org/10.1097/PRS.0b013e3181de24bc

Parker, K., & Chao, J. (2007). Wiki as a teaching tool. *Interdisciplinary Journal of e-learning and Learning Objects, 3*(1), 57-72.

Paterson, C., & Chapman, J. (2013). Enhancing skills of critical reflection to evidence learning in professional practice. *Physical Therapy in Sport, 14*(3), 133-138. https://doi.org/10.1016/j.ptsp.2013.03.004

Pearn, J. (1994). The earliest days of first aid. *British Medical Journal, 309*(6970), 1718-1720. https://doi.org/10.1136/bmj.309.6970.1718

Peters, B. G. (2017). What is so wicked about wicked problems? A conceptual analysis and a research program. *Policy and Society, 36*(3), 385-396. https://doi.org/10.1080/14494035.2017.1361633

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33. https://doi.org/10.1037/0022-0663.82.1.33

Pollock, A. (2013). Ambulance services in London and Great Britain from 1860 until today: a glimpse of history gleaned mainly from the pages of contemporary journals. *Emergency Medical Journal, 30*(3), 218-222. http://dx.doi.org/10.1136/emermed-2011-200086

Popham, W.J. (2009). Our failure to use formative assessment: Immoral omission. *Leadership, 1*(2),1-6.

Pugh, D., Touchie, C., Wood, T. J., & Humphrey-Murto, S. (2014). Progress testing: is there a role for the OSCE? *Medical Education, 48*(6), 623-631. https://doi.org/10.1111/medu.12423

Reid, D., Street, K., Beatty, S., Vencatachellum, S., & Mills, B. (2019). Preparedness of graduate paramedics for practice: a comparison of Australian and United Kingdom education pathways. *Australasian Journal of Paramedicine, 16*(1),1-11. https://doi.org/10.33151/ajp.16.666

Regehr, G., MacRae, H., Reznick, R., & Szalay, D. (1998). Comparing the psychometric properties of checklists and global rating scales for assessing performance on an OSCE-format examination. *Academic Medicine, 73*(1), 993–997.

Rethans, J.J., Sturmans, F., Drop, R., van der Vleuten, C., & Hobus, P. (1991). Does competence of general practitioners predict their performance? Comparison between examination setting and actual practice. *British Medical Journal, 303*(6814),1377-1380. https://doi.org/10.1136/bmj.303.6814.1377

Reynolds, L. (2004). Is prehospital care really a profession? *Australasian Journal of Paramedicine, 2*(1),6. https://doi.org/10.33151/ajp.2.1.254

Ricketts, C., Freeman, A. C., & Coombes, L. R. (2009). Standard setting for progress tests: combining external and internal standards. *Medical Education, 43*(6), 589-593. https://doi.org/10.1111/j.1365-2923.2009.03372.x

Rittel, H. W., & Webber, M. M. (1973). 2.3 planning problems are wicked. *Polity*, *4*(155), e169.

Rodríguez-Gómez, G., & Ibarra-Sáiz, M. S. (2015). Assessment as learning and empowerment: Towards sustainable learning in higher education. In *Sustainable learning in higher education*,1-20. Springer, Cham. https://doi.org/10.1007/978-3-319-10804-9_1

Rowles, C. J., Koch, D. C., Hundley, S. P., & Hamilton, S. J. (2004). Toward a model for capstone experiences: Mountaintops, magnets, and mandates. *Assessment Update, 16*(1), 1-2.

Russell, T. (2005). Can reflective practice be taught? *Reflective Practice, 6*(2), 199-204. https://doi.org/10.1080/14623940500105833

Ryan, R. M., & Weinstein, N. (2009). Undermining quality teaching and learning: A self-determination theory perspective on high-stakes testing. *Theory and Research in Education, 7*(2),224-233. https://doi.org/10.1177/1477878509104327

SA Ambulance Service (2015). *Annual Report 2014-2015*, Adelaide, Australia. http://www.saambulance.com.au/LinkClick.aspx?fileticket=5bl6rl7CjeY%3D&tabid=122

Sangestani, G. & Khatiban, M. (2013). Comparison of problem-based learning and lecture-based learning in midwifery. *Nurse Education Today, 33*(8), 791-795. https://doi.org/10.1016/j.nedt.2012.03.010

Schön, D. A. (1987). *Educating the reflective practitioner*. San Francisco: Jossey-Bass

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*,*19(*4), 460-475.

Schuwirth, L., Southgate, L., Page, G., Paget, N., Lescop, J., Lew, S., Wade, W., & Baron-Maldonado, M. (2002). When enough is enough: a conceptual basis for fair and defensible practice performance assessment. *Medical Education, 36*(10), 925-930. https://doi.org/10.1046/j.1365-2923.2002.01313.x

Schuwirth, L. W. (2004). Assessing medical competence: finding the right answers. *The Clinical Teacher, 1*(1), 14-18. https://doi.org/10.1111/j.1743-498X.2004.00012.x

Schuwirth, L. W., & van der Vleuten, C. P. (2012). The use of progress testing. *Perspectives on Medical Education, 1*(1), 24-30. https://doi.org/10.1007/s40037-012-0007-2

Schuwirth, L. & J. Ash (2013). Assessing tomorrow's learners: in competency-based education only a radically different holistic method of assessment will work. Six things we could forget. Medical Teacher, *35*(7), 555-559. https://doi.org/10.3109/0142159X.2013.787140

Schuwirth, L., Valentine, N., & Dilena, P. (2017). An application of programmatic assessment for learning (PAL) system for general practice training. *GMS journal for medical education*. *34*(5). https://doi.org/10.3205/zma001133

Schuwirth, L. W., & van der Vleuten, C. P. (2019). Current Assessment in Medical Education: Programmatic Assessment. *Journal of Applied Testing Technology*, *20*(S2), 2-10.

Shepard, L. A. (2000). The role of assessment in a learning culture. *Educational Researcher, 29*(7), 4-14. https://doi.org/10.3102/0013189X029007004

Sibson, L., & Mursell, I. (2010). Mentorship for paramedic practice: bridging the gap. *Journal of Paramedic Practice, 2*(6), 270-274. https://doi.org/10.12968/jpar.2010.2.6.48809

Singh, K., & Terry, J. (2008). Fostering students' self assessment skills for sustainable learning. *Proceedings of the EDU-COM 2008 International Conference*. 19–21

Skelton, M. B., & McSwain, N. E. (1977). A study of cognitive and technical skill deterioration among trained paramedics. *Journal of the American College of Emergency Physicians, 6*(10), 436-438. https://doi.org/10.1016/S0361-1124(77)80238-4

Smith, M., Brooks, S., Lichtenberg, A., McIlveen, P., Torjul, P., & Tyler, J. (2009). Career development learning: Maximising the contribution of work-integrated learning to the student experience. *Final project report June 2009, University of Wollongong*.

Spring, L., Robillard, D., Gehlbach, L., & Moore Simas, T. A. (2011). Impact of pass/fail grading on medical students' well-being and academic outcomes. *Medical education*, *45*(9), 867-877. https://doi.org/10.1111/j.1365-2923.2011.03989.x

Stetsenko, A. (2008). Collaboration and cogenerativity: On bridging the gaps separating theory-practice and cognition-emotion. *Cultural Studies of Science Education*, *3*(2), 521-533. https://doi.org/10.1007/s11422-008-9123-z

Stewart, H., Gapp, R., & Houghton, L. (2019). Large Online First Year Learning and Teaching: The Lived Experience of Developing a Student-Centred Continual Learning Practice.

Systemic Practice and Action Research, 1-17. https://doi.org/10.1007/s11213-019-09492-x

Sun, S., Taylor, P., & Wilkinson, L., Khoo, L. (2008). Individualised training to address variability of radiologists' performance. In*: Proceedings of the SPIE Symposium on Medical Imaging.* SPIE, San Diego.*6917*. https://doi.org/10.1117/12.770296

Susman, G. I., & Evered, R. D. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly*, *23*(4): 582-603. https://doi.org/10.2307/2392581

Tai, J., Ajjawi, R., Boud, D., Dawson, P. & Panadero, E. (2018). Developing evaluative judgement: enabling students to make decisions about the quality of work. *Higher Education, 76*(3), 467-481. https://doi.org/10.1007/s10734-017-0220-3

Tang, S.F., & Logonnathan, L. (2016). *Assessment for Learning Within and Beyond the Classroom.* Springer Verlag.

Taras, M. (2002). Using assessment for learning and learning from assessment. *Assessment & Evaluation in Higher Education*. *27*(6), 501-510. https://doi.org/10.1080/0260293022000020273

Taras, M. (2008). Issues of power and equity in two models of self-assessment. *Teaching in Higher Education*, *13*(1), 81-92. https://doi.org/10.1080/13562510701794076

Tavares, W., Boet, S., Theriault, R. Mallette, T., & Eva, K. W. (2013). Global rating scale for the assessment of paramedic clinical competence. *Prehospital Emergency Care, 17*(1), 57-67. https://doi.org/10.3109/10903127.2012.702194

Thomas, K., Wong, K. & Li, Y. (2014). The capstone experience: student and academic perspectives. *Higher Education Research & Development, 33*(3), 580-594. https://doi.org/10.1080/07294360.2013.841646

Tiwari, A., Lam, D., Yuen, K. H., Chan, R., Fung, T., & Chan, S. (2005). Student learning in clinical nursing education: Perceptions of the relationship between assessment and learning. *Nurse education today*, *25*(4), 299-308.https://doi.org/10.1016/j.nedt.2005.01.013

Thompson, J. (2013). Exploring paramedic patient assessment. *Journal of Paramedic Practice, 5*(6), 342-347. https://doi.org/10.12968/jpar.2013.5.6.342

Thompson, J., Grantham, H., & Houston, D. (2015). Paramedic capstone education model: Building work ready graduates. *Australasian Journal of Paramedicine, 12*(3), 1-8. https://doi.org/10.33151/ajp.12.3.15

Thompson, J., Houston, D., & Dansie, K. (2017). Teaching students to think like a paramedic: Improving professional judgement through assessment conversations. *Australasian Journal of Paramedicine, 14*(4),1-5. https://doi.org/10.33151/ajp.14.4.543

Thompson, J., Houston, D., Dansie, K., Rayner, T., Pointon, T., Pope, S., Cayetano, A., Mitchell, B., & Grantham, H. (2016). Student & tutor consensus: a partnership in assessment for learning. *Assessment & Evaluation in Higher Education*,*42*(6), 942-952. https://doi.org/10.1080/02602938.2016.1211988

Thompson, J., Couzner, L. & Houston, D., (2020). Assessment partnerships from the start: Building reflective practice as a beginning paramedic student competency. *Australasian Journal of Paramedicine, 17*(1),1-8. https://doi.org/10.33151/ajp.17.750

Thompson, J., & Houston, D. (2020). Programmatic Assessment Condensed: Introducing Progress Testing Approaches to a Single Semester Paramedic Subject. *Journal of University Teaching and Learning Practice*, *17*(3), 1-16.

Thompson, N., & Pascal, J. (2012). Developing critically reflective practice. *Reflective practice*,*13*(2), 311-325. https://doi.org/10.1080/14623943.2012.657795

Tickle, L. (2001). Opening windows, closing doors: Ethical dilemmas in educational action research. *Journal of Philosophy of Education, 35*(3), 345-359. https://doi.org/10.1111/1467-9752.00231

Tio, R. A., Schutte, B., Meiboom, A. A., Greidanus, J., Dubois, E. A., & Bremers, A. J. (2016). The progress test of medicine: the Dutch experience. *Perspectives on Medical Education, 5*(1), 51-55. https://doi.org/10.1007/s40037-015-0237-1

Todd, R. H., Magleby, S. P., Sorensen, C. D., Swan, B. R., & Anthony, D. K. (1995). A survey of capstone engineering courses in North America. *Journal of Engineering Education, 84*(2), 165-174. https://doi.org/10.1002/j.2168-9830.1995.tb00163.x

Torkel, S., Abraham, R. R., Ramnarayan, K. & Asha, K. (2010). The impact of viva-voce examination on students performance in theory component of the final summative examination in physiology. *Journal of Physiology and Pathophysiology, 1*(1), 10-12. https://doi.org/10.5897/JPAP.9000024

Tradewell, G. (1996). Rites of passage. Adaptation of nursing graduates to a hospital setting. *Journal of Nursing Staff Development, 12*(4),183-189.

Turner, E. (2008). Exploring the work of Victor Turner: Liminality and its later implications. Suomen Antropologi: *Journal of the Finnish Anthropological Society, 33*(4).

Van Berkel, H. J., Nuy, H. J., & Geerligs, T. (1994). The influence of progress tests and block tests on study behaviour. *Instructional Science, 22*(4), 317-333. https://doi.org/10.1007/BF00891784

van der Vleuten, C. P., & L. W. Schuwirth (2005). Assessing professional competence: from methods to programmes. *Medical Education, 39(*3), 309-317. https://doi.org/10.1111/j.1365-2929.2005.02094.x

van der Vleuten, C. P., & L. W. Schuwirth (2019). Assessment in the context of problem-based learning. *Advances in Health Sciences Education, 24*(5),1-12. https://doi.org/10.1007/s10459-019-09909-1

van der Vleuten, C. P., Verwijnen, G.M., & Wijnen, W.H.F.W. (1996). Fifteen years of experience with progress testing in a problem-based learning curriculum. *Medical Teacher, 18*(2), 103-109. https://doi.org/10.3109/01421599609034142

Vanhaecht, K., De Witte, K., Panella, M., & Sermeus, W. (2009). Do pathways lead to better organized care processes?. *Journal of evaluation in clinical practice*, *15*(5), 782-788.https://doi.org/10.1111/j.1365-2753.2008.01068.x

Vaughan, A. D., Stoliker, B. E., & Anderson, G. S. (2020). Building personal resilience in primary care paramedic students, and subsequent skill decay. *Australasian Journal of Paramedicine*, *17*(1). https://doi.org/10.33151/ajp.17.803

Verhoeven, B., Verwijnen, G., Scherpbier, A., & van der Vleuten, C. (2002). Growth of medical knowledge. *Medical Education, 36*(8), 711-717. https://doi.org/10.1046/j.1365-2923.2002.01268.x

Vince, R., & Reynolds, M. (2009). Reflection, reflective practice and organizing reflection. *The SAGE Handbook of Management Learning, Education and Development* London: SAGE, 89-103.

Wade, L., Harrison, C., Hollands, J., Mattick, K., Ricketts, C., & Wass, V. (2012). Student perceptions of the progress test in two settings and the implications for test deployment. *Advances in Health Sciences* Education, *17*(4), 573-583. https://doi.org/10.1007/s10459-011-9334-z

Waghid, Y., & Davids, N. (2020). *Teachers Matter: Educational Philosophy and Authentic Learning*. Lexington Books.

Wik, L., Myklebust, H., Auestad, B. H., & Steen, P. A. (2005). Twelve-month retention of CPR skills with automatic correcting verbal feedback. *Resuscitation, 66*(1), 27-30. https://doi.org/10.1016/j.resuscitation.2004.12.022

Wikipedia. (2019). Paramedic. Retrieved Date retrieved: 28 October 2019 from *https://en.wikipedia.org/w/index.php?title=Paramedic&oldid=922637054*.

Wilbarger, J., & Howe, S. (2006). Current practices in engineering capstone education: Further results from a 2005 nationwide survey*. Proceedings. ASEE/IEEE Frontiers in*

Education. 36th Annual Conference, Sandiego, California. https://doi.org/10.1109/FIE.2006.322616

Wilkinson, T. J., & Tweed, M. J. (2018). Deconstructing programmatic assessment. *Advances in medical education and practice*, *9*,191-197https://doi.org/10.2147/AMEP.S144449

Wiliam, D. (2011). What is assessment for learning? *Studies in Educational Evaluation, 37*(1), 3-14. https://doi.org/10.1016/j.stueduc.2011.03.001

Wilkinson, T. J., Frampton, C. M., Thompson-Fawcett, M., & Egan, T. (2003). Objectivity in objective structured clinical examinations: checklists are no substitute for examiner commitment. *Academic Medicine, 78*(2), 219-223.

Williams, B. (2005). Case based learning—a review of the literature: is there scope for this educational paradigm in prehospital education?, *Emergency Medicine Journal, 22*(8), 577-581. http://dx.doi.org/10.1136/emj.2004.022707

Williams, B., Onsman, A., & Brown, T. (2009). From stretcher-bearer to paramedic: the Australian paramedics' move towards professionalisation. *Australasian Journal of Paramedicine, 7*(4), 148-68. https://doi.org/10.33151/ajp.7.4.191

Williams, B., Onsman, A., & Brown, T. (2010). Australian paramedic graduate attributes: a pilot study using exploratory factor analysis. *Emergency Medicine Journal, 27*(10), 794-799. http://dx.doi.org/10.1136/emj.2010.091751

Willis, E., Williams, B., Brightwell, R., O'Meara, P., & Pointon, T. (2010). Road-ready paramedics and the supporting sciences curriculum. *Focus on Health Professional Education, 11*(2), 1.

Wood, D. F. (2003). Problem based learning. *British Medical Journal, 326*(7384): 328-330. https://doi.org/10.1136/bmj.326.7384.328

Wrigley, W., van der Vleuten, C. P. M., Freeman, A., & Muijtjens, A. (2012). A systemic framework for the progress test: Strengths, constraints and issues: AMEE Guide No. 71. *Medical Teacher, 34*(9), 683-697. https://doi.org/10.3109/0142159X.2012.704437

Yanhua, C., & Watson, R. (2011). A review of clinical competence assessment in nursing. *Nurse Education Today, 31*(8), 832-836. https://doi.org/10.1016/j.nedt.2011.05.003

Yanow, D., & Tsoukas, H. (2009). What is reflection-in-action? A phenomenological account. *Journal of Management Studies*, *46*(8),1339-1364. https://doi.org/10.1111/j.1467-6486.2009.00859.x

Yorke, M. (2003). Formative assessment in higher education: Moves towards theory and the enhancement of pedagogic practice. *Higher Education, 45*(4), 477-501. https://doi.org/10.1023/A:1023967026413

Zautcke, J. L., Lee, R. W., & Ethington, N. A. (1987). Paramedic skill decay. *The Journal of Emergency Medicine, 5*(6), 505-512. https://doi.org/10.1016/0736-4679(87)90214-9