Mega65 and Basic Programming Language in Australian ICT Curriculum.

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Declaration of originality

I certify that this work 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.

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Abstract

Modern computers are intriguing, and they can do any difficult task in a fraction of a second with ease. However, for novices, learning a programming language for powerful computers nowadays may be exceedingly challenging. The fundamental motivation for this study is that students are becoming less interested in pursuing a career as a programmer, yet in the digital age, the most important skills, or at least the basics, should be learned by everyone. The research looks into a number of challenges that students face as a result of a lack of understanding of computer programming languages. The study also found that people in the 1980s were not exposed to a wide range of computer-related material, that work was not exclusively dependent on computers in the early days, and that there were no search institutions where these programming languages could be taught. People in that era, however, frequently learned computer programming languages on their own, relying exclusively on product manuals for information. Students nowadays, on the other hand, are less concerned with learning programming languages.

The study is primarily concerned with analysing system performance as well as the characteristics of this 8-bit computer, as well as identifying the numerous algorithms employed by the Mega 65 computer. The study's purpose is to see if incorporating this computer into the Australian ICT curriculum would be satisfactory enough to be utilised as a teaching tool to increase student knowledge of computer programming. Mega 65 computers were chosen for the study because their technologies are simple, and the programming structure is interactive. 8-bit computation is the foundation of computer programming. As a result, the study's goal is to examine the various strategies for incorporating Mega 65 into the Australian ICT curriculum for teaching.

The first phase of study focused on confirming Mega 65 and its characteristics as significant enough to be included in the Australian Curriculum, while the second part focused on the Australian Curriculum Structure and teaching methodologies. In addition, we'll determine the optimal year to use this framework in order to get the best outcomes, foster the motivation particularly for pupils interested in pursuing a career in IT or computer science.

Keywords- Mega 65 Computer, 8-bit computer, Commodore 65, Australian ICT Curriculumm

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CHAPTER 1: INTRODUCTION

1.1 Introduction

This research has been conducted to find out the effectiveness of the primary programming language of Mega65 in the Australian curriculum. Mega65 is an entirely open-source computer like the C64. Several features present in this Mega65 Computer are including 8-bit memory, HD output, Ethernet, support of SD cards, etc. BASIC refers to the overall structure of a programming language, which consists of instructions about the integrated codes. In 1964, researcher John and Thomas together developed the initial version of a BASIC programming language. The intention behind this invention is to educate people with proper technical skills and knowledge. The interface of the language was made in such a way so that multiple users can edit and run their codes.

A detailed analysis of MEGA65 and its primary programming language has been made in the latter part of this study. The overall research has been divided into five chapters, introduction, literature review, methodology, data analysis, recommendation, and conclusion. The second chapter of the research consists of previous research analysis, whereas the third chapter will discuss the applied methodological approach for this research. The fourth chapter will analyse the collected data sets for the research. The last chapter of the research will provide ultimate recommendations and conclusion of the research.

1.2 Study Background

Research background refers to the summary of critical studies that have been considered in the research. Through these sections, the ultimate motive of the research can be identified. One of the crucial studies that have been considered in this research is the effect of basic programming language on the learning process. Through these studies, a clear understanding of the importance of the BASIC programming language in the learning procedure can be understood (Degenhardt et al., 2019). These studies have found that several universities have implemented BASIC programming language as a teaching procedure for the students. Some other studies by (Kirby, T., 2017) were also considered through which the importance of BASIC programming language towards a problem-solving ability can be understood. It has been found that Mega65 computers lack problem-solving ability in comparison with modern computers. In Mega65 computers, "Twp ward t-tests"

are mainly used for solving critical problems. Another significant study that has been considered in the research is the press to features of a Mega65 computer.

As per analysis, the features of Mega65 systems can be used as teaching tools in the ICT curriculum. From the previous researchers, it has also been found that the basic needs can be provided through an easy teaching process, where a complex system can affect the learning procedure (Guri et al., 2017). The previous development regarding an 8-bit computer was also considered during the research period. As per analysis, the considered models are 1960s PFP-11, HP2000, etc. The basic concept behind an 8-bit computer and the present com and lines of those systems can be understood through these models. After critically reviewing those systems, it can be understood that an 8-bit register can store values up to 2^8. The CPUs of an 8-bit computer uses an 8-bit data bus for getting control over an 8-bit data set through a single instruction.

1.3 Aim

This research aims to identify the impact of a MEGA65 computer and its basic language on the Australian ICT curriculum. The research will also discuss the required resources to develop the MEGA65 computer as a teaching tool in the ICT curriculum in this research.

1.4 Objectives

The required stages to meet the ultimate aim of the research are.

- To find out the required features for the teaching tool of the ICT curriculum
- To determine the present features in a Mega65 computer
- To find out the required resources for developing Mega65 as a teaching tool
- To know the future possibilities of Mega65 computer

1.5 Research question

- What are the requirements for the teaching tool in the Australian curriculum?
- What are the features present in a Mega65 computer?
- What are the required resources to develop Mega65 as a teaching tool in the Australian curriculum?
- What will be the usability of Mega65 in future times?

1.6 Hypothesis

H1 There are some requirements of features as a teaching tool in the Australian curriculum.

H0 There are no requirements for additional features in the teaching tool of the ICT curriculum.

H2 There are some features present in a Mega65 computer

H0 There is no such and such feature present in a Mega65 computer

H3 There are some requirements of resources for developing Mega65 as a teaching tool in the ICT curriculum

H0 There are no requirements of resources for developing Mega65 as a teaching tool in the ICT curriculum

H4 There are some future usability presented for a Mega65 computer

H0 There are no such and such future usability for a Mega65 computer

1.7 Rationale

Rationale refers to the issues and reason behind the presence of the issue. Through these sections, a clear understanding of the reason behind the research can be gathered. As per analysis, the main challenge present in the utilisation process of Mega65 as a teaching tool is the required improvements. Researchers have stated that the easy command line will provide additional support for beginners to understand the operations. Besides that, programmers feel Mega65 is more efficient than modern systems in terms of coding. One of the crucial difficulties of these Mega65 computers is the interaction method. In these computers, the overall interaction method is fully based on com and lines; users have faced difficulties during the interaction process due to com and lines. As per analysis, it can be stated that the use of com and line as an interaction method makes the system hard to use. The main reason behind these issues is the lower-level hardware of hardware implementations within the system. This communication system challenges can be reduced through proper hardware and software installations within the system (Saam, 2019). One of the major challenges behind the utilisation process of Mega65 is the lower level of acceptance among the students. In this technological era, students are attracted to modern gadgets, which have an attractive outer look. In response to these difficulties, there is a requirement to maintain the outer look of the computer in a proper format so that it can attract learners towards itself.

1.8 Conclusion

This chapter of the research can be concluded as a brief introduction has been made to the Mega65 computers and their basic programming. The ultimate focus of this research is to develop Mega65 as a retool in the Australian circular. In response to this purpose, the research has been divided into several objectives. Along with those intentions, the research has been conducted in such a way so that its future possibilities can also be analysed in a proper format. The rationale section discussed the present issues in the research and ways to mitigate those. The main issue is the usability of Mega65 as a teaching tool in the ICT curriculum, whether it can be possible or not. As per analysis, if the required resources in a teaching tool of ICT circular can be maintained in Mega65, it can be usable in ICT circulars. As per background studies, the communication feature and speed of Mega65 can provide additional support towards the usability of Mega65 as a teaching tool. Besides that, it also found that a simple programming language is more effective than a complex language teaching procedure.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter of the research is focused on providing an analysis of the existing literature. Through this chapter, a proper justification of the reason can be provided. The chapter consists of a brief discussion about the related theories, conceptual framework, gaps of the research, etc. The provided conceptual framework of the research will provide a clear understanding of the dependent and independent variable of the research. The concept behind the dependent and independent variable has also been discussed in the chapter. The provided theories will clarify the exact need behind the research. From the literature gap, a brief understanding of the lacking areas of the research will be provided. The ultimate conclusion of this chapter is also drawn through the last section of the chapter.

2.2 Empirical studies

Empirical studies are the process of reviewing existing literature conducted by different researchers in previous times. These sections of the study focused on measuring the observation and phenomena directed by other researchers. Through these sections, a brief understanding of the research can be gathered.

Researcher Kirby (2017) researches the importance of the Mega65 project in the field of teaching tools. The Mega65 project is considered as an open-source platform with the similarity from C64 and C65. Along with that, the Mega65 is 50 times faster than the C64 and C65. Besides that, the computer has been featured with modern technologies like, SD card ports, resolution display, networking, etc. The computer has been made in such a way so that it can be runnable on an FPGA improvement board. The main reason behind this selection of FPGA board is that it is cost-efficient as well as higher performance rate. As an additional feature of the computer, it includes on board peripherals like; VGA, Ethernet, I/o devices, audible outputs, etc.

The feature of the computer made it user friendly by eliminating constraints. As per the researcher, the computer features made it under stable towards the students in response to a complex system. In addition, research also states that this computer has a future in the teaching field for children's basic knowledge. Through this utilisation, the basics of a system can be made clear for a beginner. In today's situation, the importance of the Mega65 computer has decreased over time due to the

invention of complex systems. In the early 80s, these 8-bit computers were more acceptable than in the present time. The main difficulty that has been raised with the Mega65 is the distribution procedure of data sets. But programmers found that Mega65 has the easiest form of typing codes and understanding it. The hardware concepts of the project can deliver a deeper understanding of the frameworks. One of the significant advantages that the computer provides is lower complexity with lower security constraints. As per researcher McCabe, the increase in complexity of systems leads to an increase of security bugs in the software (Kirby et al. 2017). The main reason behind the increase of security bugs in the com and lines lies between the user and the system. Along with that, the complex systems lead the architecture towards complex testing procedures of the security measurements.

- Architecture Of System.

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Figure 1: Architecture of security system

(Source: Kirby, 2017)

There are requirements for complex systems in real-life conditions, but for teaching purposes, a simple error-free open-source system can be effective. From these statements, it can be understood that, depending on the situation, the complexity of a system can be enhanced. In modern computers, the number of transistors was more than 5 billion, whereas a Mega65 computer has 3510 transistors. From these statistics, the increased level of complexity in modern computers can be identified. Another advantage of this Mega65 Computer is the security isolation system. The isolation process refers to the different segmentation of the internal security system. Through this maintenance, one affected part of the computer won't affect the other segmentations of the computer. Besides that, the security isolation system will provide additional support towards the maintained cost of the

computer. So, from these upper mentioned advantages, it can be stated that the Mega65 computers can be used as a learning method.

The "Mega Museum electronics community" has provided a full proof user guide regarding the Mega65 computers. Through this guidance, the rear and side connections of the Mega65 computers can be understood. As per the computers rear connections, there are 8 ports available, audio connection, connection for SD card, LAN connection, video connector, DC power supply port, etc. As per the side connections, there are four ports present, two controller ports, one power button and a reset button. The controller ports are mainly used for connecting virtual peripherals. As per the installation guideline, there are three stages present. The first stage relates to the connection of power sockets with the power supply. Then the next connection represents the connection of the VGA port with the display. Then the ultimate stage represents the connection of LAN (Kirby et al. 2017). Through these three stages, the overall connection of the computer can be maintained.

Along with those connections here also some optimal connections are present, like floppy disks and all. Once the overall connections are brought down, the flashing cursor will display on the monitor. The keyboard of the computer has been maintained in such a way so that multiple tasks can be performed. There are a total of four command keys: present, return, control, shift and restore. With the use of the return key, the users can get back to any mistakes that have been made earlier on the command line. If there are no such and such errors, then the return com will act according to the code. The shift buttons have a significant impact on the computer writing any com and line. Through the shift key, the upper case and lower case of alphabets can be maintained. Even the function key can also be usable through the shift keys. Besides that, the shift keys can also be used for locking up the window. The cursor keys can move the cursor all around the code, where the programmer wants to move. In addition, several other keys are present for operating different functions. As per analysis, the modern keyboards have the same features moreover in comparison to a Mega65 keyboard.

According to researcher Xilu (2018), Mega65 is one of the lower complexity computers that can enhance the user experience. The main reason behind this enhancement of user experience is the lower complexity. Sometimes it has been seen that computers with higher complexity can damage the user satisfaction rate. The main attractions of these computers are compatibility, creativity, and scope of improvement. The presence of these three attractions made the computer usable in future time also. The computer is based on open source, which reduces most of the complexity, contrasting with modern FPGA based computers. Along with that, the designing procedure of the Mega65 Computer is fully comparable with C65 and C64.

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Figure 2: Method of data exfiltration

(Source: Kirby, 2017)

In addition, the Mega65 is fifty times faster than C65 and C64 computers. The computer also supports users' creativity through several easy-to-understand programs and command lines. Considering the ease of the C64 computer with fifty times faster speed, the Mega65 Computer can enhance the user experience in a higher term. The computer also provides a higher gaming experience and several fun features for the users. Several retro games can be played on Mega65 computers with higher floating. Another upgrade that has been made in Mega65 is the enhancement of portability. The new form of portable Mega65 makes it unique with a 4G supported network connection. Along with that, the new form of Mega65 has been maintained in such a way so that it can be upgraded to use the 5G network. The computer's battery pack corresponds to 1000 hours daily standby mode with an integrated speaker of 2W. The required time to boot the speakers is about less than one second.

Researcher Gerblich (2017) research to find out the secure designing system of Mega65 computers. As per the researcher, the computer was being performed through error and trial methods to fix the system's bugs. The existing codes of Mega65 were being analysed, and new features were being implemented in the system. The overall software design of the computer was being deployed on FPGA hardware and evaluated. The system's initial development was being performed within the **"Xilinx ISE 14.7"** software package by using the VHDL language. From these utilisations, it can be stated that Mega65 computers were developed to enhance the technical ability of people. The 6502 assemblers were supporting the VHDL language to maintain the performance rate. The

operating system of the computer was "Ubuntu 15.04", which makes the system user friendly. The compile scripts of the system were being used to integrate necessary files.

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Figure 3: Rear connections of Megs65 Computer

(Source: Gerblich, 2017)

The configuration for the FPGA board of Mega65 was **"Digital Nexus 4 DDR".** The upper figure represents the FPGA board of Mega65. In the FPGA board, an additional 512 MB SD card was installed for storing the data sets (Gerblich, 2017). The board was being connected with the system through a VGA power supply and a USB cable. The inspection procedure of the machine state was being accomplished through different stages. The main thing that has been maintained during the inspection procedure is the confidentiality of the inspection state from the CPU. These measurements have been maintained as the CPU can manipulate the state of inspection in a higher manner. The first-ever inspection state that has been installed was the "remote serial monitor". Through these measurements, the developers were able to identify the bugs in the system. In these remote monitoring procedures, USB cables were being plugged in with the FPGA board. The system identifies the connection as a virtual port. The performed operations through remote monitoring procedure were display of contents, an inspection of flags and registers in CPU, memory writing, single-stepping operations of CPU, and CPU freezing. As per developers, through these

inspection methods, proper identification of bugs can be possible. Another inspection procedure that has been conducted within a Mega65 computer was an integrated monitoring process.

Image removed due to copyright restriction.

Figure 4: Side connections of Megs65 computers

(Source: Gerblich, 2017)

An internal user interface will move directly with the function from an external system in these monitoring procedures. A VGA port was also being connected with the system to maintain a more secure inspection procedure. During the procedure, the integrated serial mode was being overplayed on the upper hand of the video output (Gerblich, 2017). One of the significant limitations of the computer is the alpha bend can't be produced through VIC-4 software. In addition, researchers have identified some required developments in a Mega65 computer to improve the system's efficiency without increasing complexity.

According to researcher Hicks (2018), the features of the teaching tool in the ICT curriculum creates several difficulties towards the utilisation of Mega65 as a teaching tool. The features of teaching tools in the ICT curriculum were acquisition storage, characteristics of IT software, availability of data sets, geographic connections, etc. Besides that, the other type of features can maintain a proper demonstration and presentation towards the students. The five-tier protection level of data sets provides an additional user experience. These higher levels of data set protection can increase the user satisfaction rate in a higher format. In the Australian curriculum, the ICT based teaching tool is mainly utilised to improve the knowledge and ability of students. Researcher Xilu has argued over the utilisation of ICT based teaching tools on the Australian circular. As per

the researcher, the Mega65 Computer can also be an effective teaching tool in the ICT circular with proper development in the command line. The effective communication feature and lower level of complexity can improve the basic knowledge of learners (Hicks, 2018). A system with lower complexity can be an effective one in terms of teaching compared to modern systems. As per statistics, the increased rate of complexity in systems can affect the knowledge gaining learners' ability in a negative manner. The same type of features offered by a Mega65 computer compared to modern computers is proper communication, LAN connection, speed efficiency, data security, etc.

Researcher Lloyd (2019) proposed the model for Mega65 Computer consists of general features, including software and hardware elements. Through these models, the present hardware and software equipment of the computer can be understood in a proper manner. As per the researcher, the general features of the system, which makes it more usable are three different FPGA boards, fully open-source, internal floppy disk driver (3.5), etc. The FPGA boards were not maintained with the closure of ARM code internally. The open source will enhance the speed of the computer at around 50 times faster than C64. As per the model, the present hardware features of the computer are high quality "Cherry-MX", powerful "Xilinx Attic A7 200T", serial RAM of 8MB, 8-bit CPU of 40 MHz, audio socket with four different pins, which enables the use of 1541, 1581, AMD 1571 commodore series, etc. The presence of these hardware features makes the system efficient and user friendly. The support of the Commodore series makes the computer usable for different multiple working purposes. Another hardware feature of these systems was the highly maintained battery packs within the quarter. Through this utilisation, the system can be workable for a long hour. The present software features of the system are highly enhanced GEOS versions, Linux AMD MAC tool utilisation for coding purposes, supportive of D81 disk display, etc. All the present features of the computer indicate the utilisation of Mega65 as a teaching tool. In addition, researchers also state that, with proper up gradation, Mega65 computers can be used for gaming and coding purposes (Lloyd, 2019). There are several Xbox games present, which can be played through Mega65 computers. So, not only for teaching purposes but also in multiple operations, the computer can be used. In addition to that, the researcher has implemented some characteristics that a teaching tool in the Australian circular requires. As per analysis, their total of six characteristics is present, through which an effective learning process can take place within the curriculum. The characteristics are speed, accuracy, reliability, diligence, versatility, and lastly the memory. Most of the characteristics are already present in a Mega65 computer. The main improvement required in the Mega65 is related to diligence. It has been doubted whether the Mega65 computers are able to maintain the accuracy rate for millions of students or not.

Researcher Han (2020) conducts research regarding the advantages and disadvantages of a Mega65 computer. As per the researcher, there are several advantages present for which the Mega65 Computer can be effectively used as a teaching tool in the Australian curriculum. The present advantages of the Mega65 computers are long-term availability, real-time application, continued up gradation of features, system efficiency, etc. Through these advantages, the learning procedure of basic command lines can be possible. The advantage of long-term availability will provide additional support towards the students in terms of adjusting the level with FPGA. The speed efficiency of the software will provide additional support towards the acceleration process of software installation. Several complex problems can be solved easily with the implementation of software's with fast processors. Along with that, the real-time application procedure has provided additional support towards the achievement of deterministic behaviour in an operation mode (Han, 2020). In several modern computers, the increase of incoming data sets may affect the timely manner of systems. In a Mega65 computer, there is the availability of parallel data processing. Through this, a huge amount of dataset can be gathered within the system without affecting the computer. In addition, researchers have also identified some critical developments that a Mega65 computer required. As per the researcher, the interaction procedure by using Mega65 Computer requires to be developed. The current interaction procedure is not justified for using it as a teaching tool in the Australian curriculum. The researcher has suggested that the new interaction method should be developed by maintaining those criteria's, well-maintained text base interaction, proper feedback giving procedures toward the students, web-based interaction through video methods, etc. With the maintenance of those criteria, the communication procedure via Mega65 Computer can take place properly. Along with that, the data security measurements of the system also need to be developed in a higher manner.

According to Liu (2018), there are several advantages present for using an 8-bit computer over a modern-day 32-bit computer. This presence of advantages over a 32-bit computer makes the Mega65 Computer usable in the Australian curriculum. The main advantages that the Mega65 computers provide to a user are simplicity, small package, a wide range of voltages, no requirement of external elements, and lastly, the higher efficiency in bit manipulation. Through these advantages, a higher rate of user satisfaction can be maintained. The voltage range of the system will be between 1.8 volts to 5.5 volts. Through this wider range of voltages efficiency, the system can be run effectively for a long hour. This advantage of Mega65 makes it more acceptable towards the utilisation process as a teaching tool. The system also can be effective in performing bit manipulation. Through this effectiveness, in bit manipulation, the error direction procedure of a system can be performed properly. Along with that, prices like; encryption of algorithms and data

compressions can also be performed properly. In addition, researchers have also identified some disadvantages for these Mega65 computers. The major difficulties with these systems are the; width of 8-bit, lack of memory section, lower number of ports, lower MIPS, and peripherals, etc. These disadvantages make the system less acceptable in society. The low-level construction of MIPS architecture increased the set of instructions within the memory of the system (Liu, 2018). As the memory of the system is comparatively lower, the addition of commands makes it congested and reduces the speed of the system. A desire that the Mega65 computers are 50 times faster than C64 computers. The challenges in expanding the memory section of a Mega65 computer creates huge difficulties in the utilisation process if. It has been recommended that the memory section of the computer needs improvement so that it can be widely utilised in the era of modern technologies (Liu, 2018). As per analysis, it can be stated that disadvantages are also observed in 32 not computers, but with respect to an 8-bit computer, the disadvantages are higher than it. With proper technological improvement, a Mega65 computer can be used as a teaching tool in the Australian curriculum.

According to Lingard (2018), there are a total of eight learning areas present in an Australian circular. The learning areas are Mathematics, humanities, social science, health, English, physical education, technologies, and arts. Among those learning areas, Mega65 can be implemented in technological learning areas. As per the requirements of a technological learning area in the Australian curriculum, the components should be solution-oriented and easy to understand. With respect to these requirements, a Mega65 computer can be used to maintain the dignity of the circular.

2.3 Conceptual framework
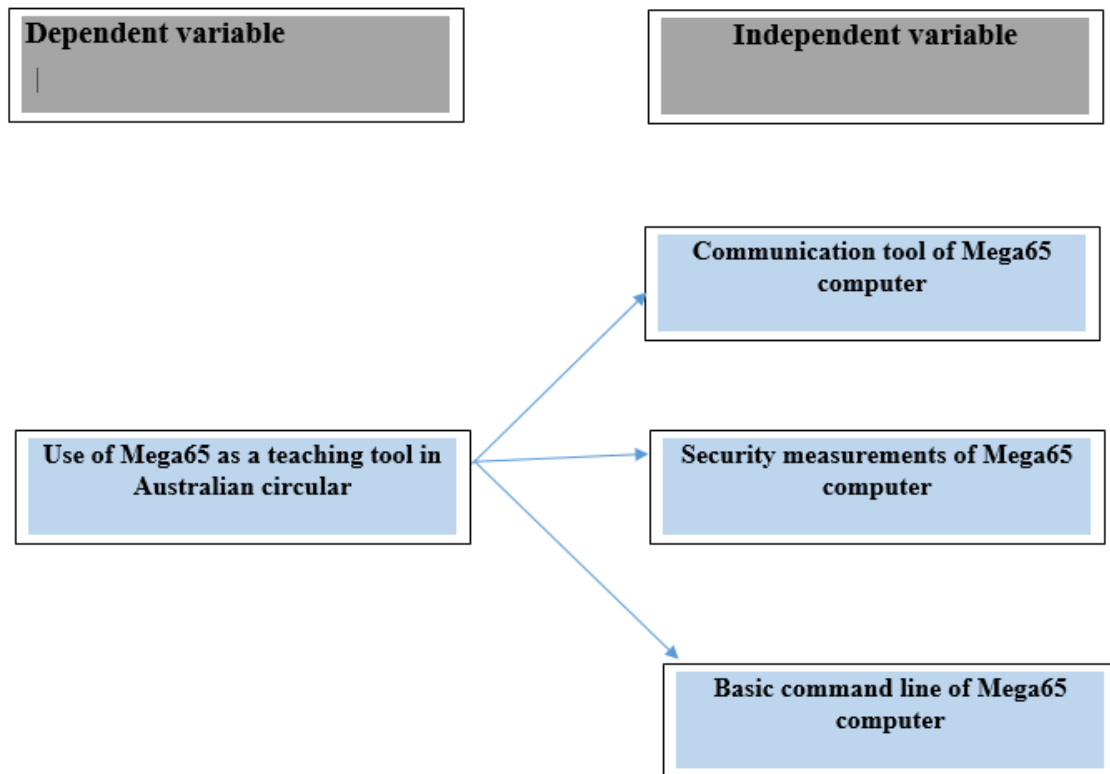
Figure 4: Conceptual framework

(Source: Self-created)

2.4 Concept of IV/DV

IV /DV refers to the independent and dependent variables of the research. From the upper representation, a clear understanding of the dependent and independent variable can be gathered. As per the representation, the utilisation process of Mega65 Computer as a teaching tool in the Australian circular is the dependent variable of the research (Cao, 2017). This utilisation process is dependent on several variables, which are indicated as independent variables of the research. As per the representation, the independent variables of the research are communication tools, security measurements, and basic com and line of the Mega65 Computer. On the basis of these independent variables, the ultimate utilisation of Mega65 as a teaching tool is dependent. Among those independent variables, the major one is the basic com and line of Mega65 computers. These features of the system require it to be accepted in the Australian curriculum to be used as a teaching tool.

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2.4 Theories and models

This section of the research has been focused on providing related theories for the research. The main reason behind the formulation of theories is to understand and explain phenomena in terms of gathering more knowledge (Antonik et al., 2021). The provided models of research will provide additional support towards the visualisation of concepts behind the research. The delayed discussion of related theories for the research are in below.

Constructivism theory:

Researcher Greene (2020) has provided these theories regarding the effective learning process for students. As per the theory, the effectiveness of a student is always judged by the previous experience or the basic experience of a student. So here, there is a requirement of an effective learning process that can provide additional support towards the learning process of a student. The improvement of these previous experiences makes a student different from others, and these will provide additional support towards the future development of the learner (Greene et al., 2020). This theory has also recommended universities and schools improve their learning process in an effective way. So that it can be understandable for each of the students, this theory has also stated that an easy way of the learning process with effectiveness is always better than a complex learning system. As a classroom is consistent with different types of learners, it is necessary to maintain a Learning process that can be understandable for every student. Besides that, one of the crucial advantages of this easy way of the learning procedure, it can enhance the personality of a learner in a higher format. In a Mega65 computer, the basic command has the ability so that can be unbeatable for every learner in the Australian circular. Besides that, the features of the computer provide addition and support to the programmers in terms of coding through Mega65.

Experimental theory:

The experimental theory states that the most effective way of gathering knowledge for learners is the way of self-experience. When a Learner is learning something through daily experience, it will automatically increase the effectiveness of the procedure. In response, these effective universities have implemented practical sections in their circulars (Fujioka et al. 2020). In another experiential learning procedure, there are a total of four different stages present: observation, concrete study, knowledge gathering and increased experience. The mega65 computer also provides free space for the users to gather knowledge by doing different types of coding on the open-source platform.

Automata theory:

Automata theory refers to the study of the existing mechanism of the computer. Through this study of the existing mechanism of a system, the ultimate computation problems can be solved. In the process of automation, some predetermined operational steps were being followed in terms of solving any computation problem (Wilson et al., 2018). This theory follows four different stages through which the problems of a system can be solved. The following stages of these theories are machine turns on, pushdown automaton, finite-state automaton, and lastly, logic combination. As per the theory, with the follow up of these four individual stages, any type of computational problems of a system can be solved. As per analysis, it can be stated that Automata Theory is closely related to "Formal language theory". As the theory can be defined in the form of formal languages. Through this representation, the relationship among the different stages of automation can be identified properly. Another intention of theory is to identify the behavioural constraints of the discrete parameters in a system. In this Mega65 Computer, the implementation of Automata theory will provide additional support in terms of solving any computation problem. Besides that, the behavioural constraints of parameters can also be justified properly through this theory.

Theories

- **Constructivism theory**
- **Automata theory**
- **Experimental theory**

Figure 5: Theories

(Source: Self-created)

2.5 Literature gap

Literature gap refers to the missing parts of research due to specific reasons. The research gap has a significant impact in terms of identifying the future scope of research. In this research, the main gap has been obtained in the recommendation part for improving Mega65 as a teaching tool in the

Australian curriculum. The research has failed to provide the exact requirements or resources to develop Mega65 as a teaching tool. This gap in the research has been obtained due to a lack of information on the computer. Along with that, the data collection process of this research has also faced some difficulties due to a lack of resources. These unexplored areas lead the research towards an improper conclusion. From these lacks, it can be stated that the provided recommendation for Mega65 Computer is not executed in a proper manner. The provided theories and models for the research states that the teaching process of a university should be developed in an easier process so that it can be unbeatable for each of the students. Along with that, the theory also states that, with efficient basic learning procedures, the next learning stages of a student can be achieved in a higher format.

2.6 Conclusion

This part of the study can be concluded as there is a brief discussion that has been made regarding the existing literature on the Meg65 project. Many researchers had stated that Mega65 could be utilised as a teaching tool in the ICT curriculum.

The present features of the computer make it user friendly. Users have often found it more acceptable as a basic understanding in comparison with modern systems. The increased complexity of the systems makes it difficult to get a clear understanding of the basic command line of a system. From the literature gap, it can be stated that the required resources for improving the Mega65 Computer have not been provided properly. The research rationale has provided a brief justification about the presence of the current issues in a Mega65 computer.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In the modern era of technological advancement, peoples across the world are now enjoying technologies on an everyday basis. Students are more focused on using these technologies very often. The study has identified that in the early 1980s the people were more capable of using 8-bit computer programs without having proper guidance and by only taking help from the user manual. Whereas in current times, students face trouble making codes on their own, and thus they go for learning computer programs and algorithms. The study has also identified that the coding practices these days are more complex and complicated for a learner to learn, having no programming knowledge. The study has gathered various resources and reviewed those data in order to gather knowledge about the advantages of programming 8-bit computers in terms of learning and teaching as well as growing interest on the students in the Australian National ICT curriculum and growing awareness among the students for programming practices and learning codes for 8-bit computer would be easier options to be utilised as a teaching and learning tool. Therefore, this part of the study is aiming to address the various methods that can be followed through the whole research process as well as discussing the tools and techniques that can be followed in identifying the effectiveness of the MEGA65 computers. This part of the study is also concerned with discussing the various approaches and ways the analysis process could occur for better interaction and interpretation of the data.

3.2 Research philosophy

Research philosophy refers to the way in which the whole research process will be done. The research philosophy does help to determine the way of collecting data analysis and process. The research philosophy, according to Saunders, is mainly three types, including interpretivism, positivism and Realism. in some research, pragmatism is also followed in philosophy research. The realism philosophy offers research when analysis of the data is being done on a particular aspect that has significant value in the physical world. The realism philosophy of research involves an independent method of research in which primary data is being used. Interpretivism research philosophy refers to those research areas in which the research process is being done in a social environment and mainly based on the observation pattern (Rasekh et al. 2020). Therefore, the interpreter wisdom research philosophy can be considered as dependent on the researchers' interest, and also it is open-ended where the positive research philosophy is quite different from both of the

research philosophy; the positivism research philosophy is focused on analysing the data present in the physical world and also followed in order to gather existing data and interpreting those real-world data through the research process.

This study is focused on identifying various types of data available related to the Mega 65, commodore 65 and also focused on analysing the basic programming language used in these 8-bit computers and also implementing a new programming language using the semantics of Mega 65 programming language. As all the data related to the study are mostly available and positive to the real-world context, this study is involved in performing the research based on the positivism research philosophy (Stryker, 2019). The features of the study are focused on identifying the research problems and resolving these problems, as well as developing some innovative ideas for the implementation of Mega 65 8-bit computers in the Australian ICT curriculum allowing the students to learn to program easily and effectively.

3.3 Research onion

Image removed due to copyright restriction.

Figure 6: Research Onion

(Source: Saunders *et al.* 2018)

3.4 Research approach

The approach for research is a very crucial aspect of the research methodology as the research approach is concerned with discussing the possible approach for developing research. Their approach for the research can be of two different types. These are inductive and deductive research approaches. These are very common and applicable in any dissertation topic (Johnson, 2018). The deductive research approach is followed in research, according to Saunders, in which the research phase problems and issues. For this reason, that deductive research approach uses existing theories and models as well as different types of secondary data also being analysed. The deductive research approach is mainly used different issues or cases that have already been faced and also solved by various researchers in fast. Therefore, the deductive research approach is focused on analysing the existing theories that are already present, and in further research, there can be new issues faced or questions that may arise.

In the other case, the inductive research approach follows observation, analysis of any situation from different secondary sources related to the problem areas or issues. Therefore, the inductive research approach is focused on developing new theories for finding ways of mitigating some issues by solving questions of the research through observation of the cases (Biswas et al., 2018). Therefore, the inductive research approach can be most suitable for developing research on new areas in which there is a lack of research and data.

In this study, the study dissertation is based on identifying the various aspects of using 8-bit computer programming language and devices such as Mega 65, commodore 65 and many other 8-bit microprocessor-based computer systems developed in the early 1980s. The study is also focused on developing ideas related to the pseudo-code of this type of programming language in order to allow the students of the Australian national ICT curriculum to effectively learn the basic programming languages with simple programming structure (Guri et al. 2019). The study also focused on understanding if these approaches can be beneficial for the students in Australia and also determined the possibilities of Mega 65 used as a tool for teaching programming language effectively.

Thus, in this study, an inductive research approach is being followed in order to perform the death analysis for the following issues and identify how these considerations can be effective enough in solving those problems regarding the complex programming in modern computers.

3.5 Research strategy

The research strategy helps to describe the process of carrying out different activities in the research in collecting data related to the study area. Therefore, the research strategy is a crucial aspect of research methodology as it addresses the various methods and number of approaches in order to complete research properly. There can be various types of research strategies in order to collect the data. The different research strategies include experimental strategy, case study, survey, ethnography, grounded theory and action-oriented research (Cross et al., 2019). Experimental research can be described as the strategy that exam means different types of results by following experiments with the expected results. Science-based topics within the control environment, the experimental research strategy can be followed in order to check the accuracy of the result, and the experimental research strategy can be used where the factors are of limited number. On the other hand, the survey research strategy can be considered as collecting data from different participants in order to find the relative risk of the existing theories or results. Does the service strategy can be followed in those types of research where an approach has been taken Strategy is used in collecting the qualitative data, and also it involves sampling the data collected from the various participants. For this reason, the survey research strategy is widely used and knobs Irving different contributing variables among various types of data, and also it permits the gathering of the largest amount of data in answering the research questions. The case study strategy is different from the service strategy as it is focused on a particular research area. According to this strategy, the researcher follows a single case study for identifying the research questions (Tannu et al., 2019). This strategy can be effective for the financial research where II-II comparison needs to be drawn regarding the experiences of two or more companies in order to get knowledge about the effects of investment. Action-oriented research is another type of research strategy that is mostly followed in professions like teaching and nursing. In action-oriented research, it is focused on finding the solution to a particular problem through performing different actions.

This study is focused on addressing whether the use of Mega 65 and similar types of 8-bit computers with simple programming structure can be used as a teaching tool in the Australian ICT curriculum. Along with other studies also aiming to develop various other types of simple pseudo-code for this 8-bit computers platform and allowing the students to learn this. Therefore, the study can follow an action-oriented research strategy.

3.6 Research Design

The design for research can be considered as a framework of the research methodology that involves following different techniques for the research. The design of the research allows researchers to identify which type of research methods and data collection needs to be followed. The design for the research can be categorised into two different types of design depending upon the data type that is going to be collected and analysed. Depending upon the data used in the dissertation study, the research design can be qualitative or quantitative. The qualitative research design helps to determine the relationship or connection between the observation and collected data based on mathematical calculations (Guri, 2020). The theories regarding a pre-existing natural phenomenon can be disproved and approved depending upon the mathematical data for statistical methods. The qualitative research design follows mostly in those types of research where the main objective of the research is to understand the context of existing theory as well as providing solutions and suggestions regarding the theory.

On the other hand, the quantitative research design mostly followed industry searches for statistical conclusions that needed to be drawn, and it is very much crucial. The numbers from the research help to provide very much critical decisions in businesses. The quantitative research design follows in order to analyse the growth of any organisation. The numerical data and the analysis help to provide effective decision making in future business processes. Therefore, qualitative research is mostly followed in scientific research (Škoric, 2017). Researchers use statistical tools used such as anova test, correlation test, factor analysis, regression analysis etc., as this study is concerned with developing the analysis of the data and collecting secondary data. Thus, the study follows a qualitative research design.

3.7 Data collection method

The data collection process is a very crucial and important part of the research. Through effective data collection methods and collecting appropriate data, researchers get proper knowledge recording a subject on which the research is going to occur (Ney et al., 2017). The analysis part of a dissertation is totally dependent on the collected pieces of information. The data can be collected by following different types of data collection methods. Among the most common data collection methods, according to Saunders, are known as primary data collection method, secondary data collection method and mixed method. The primary data collection methods involve collecting radius pieces of information regarding the personal demographic data as well as opinion from different individuals during the research process on a particular study area. The primary data

collection method involves collecting different data from primary sources, including the distribution and development of the questionnaire, interviews, historical research, conducting surveys and also utilising mathematical reports. All of these above sources are considered as primary sources of the data. The secondary data collection method involves collecting different types of information through various secondary sources such as published journals, online articles, websites and even books (Patterson, 2018). The secondary data collection method takes a lot of time and also allows the researcher to gather in-depth knowledge about a particular study area without visiting any place or involving any survey or interviews. Therefore, the secondary data collection method has advantages as it requires less time. On the other hand, the mixed method of the data collection process is focused on collecting both the primary and secondary data related to the research area.

The data collection method in this study is mainly secondary. The various pieces of information are being collected from various secondary resources and another research as these are easily available (Manjunath et al., 2021). This study is focused on collecting different types of data related to the commodore 64, commodore 65 and Mega 65 computers that have developed since the 1980s and the availability of the resources used. The study is also aiming to gather in-depth knowledge about the programming languages in the 8-bit computer technologies and their simple programming structure. The various other resources related to these technologies and other open-source programming languages are also being identified and going to be collected through 2 different secondary sources available on the "Google scholar" database.

3.8 Data analysis method

after the data has been collected, the very next step is to select the proper data analysis method in which discuss the type of analysis that is going to be done throughout the entire data analysis chapter. Depending upon the type of data, the data analysis method can be of two different types, including quantitative method of analysis and qualitative method of analysis. As in this study, the data that has been collected from secondary sources and the data is mostly related to the 8-bit computer programming languages and their advantages such as faster operating speed, easier language, less complex operation. The study is going to follow a qualitative method of data analysis (Jang et al., 2021). The qualitative methods are mainly based on the theoretical context, and all the logical algorithms and pseudo-codes are previously developed and available; the study is focused on analysing those resources, including the advantage, and identifying some of the issues in these technologies.

3.9 Research ethics

The research ethics can be understood as the wide variety of norms, values and institutional arrangement that helps to regulate and constitutes the academic activities. Therefore, the research ethics can be considered as mortality in practice and following the guidelines of research within specific norms (Lu, 2019). Research ethics is very important, and it promotes the research aim, supporting different actions performed in the research. This study is mostly related to scientific practice as it is related to analysing the effectiveness of Mega 65, which is the 8-bit computer developed in the 1980s and the operating system is open source. Therefore, this study is concerned with maintaining the ethical behaviour regarding the use of adequate and accurate knowledge of the study area, as well as the study is concerned with academic freedom, maintaining trustworthiness through not involving plagiarism (Moon et al. 2019). all the data that has been present throughout the study are properly cited, and the figures used in this study are also properly sourced in order to maintain the research ethics.

3.10 Research limitation

This study discusses the various programming structure, hardware optimisation and popularity of commodore 64, commodore 65 and Mega 65. The above-mentioned devices are basically open-source 8-bit computers, and this was launched in the market around the 1980s (Johnston et al. 2019). During that time, people were able to use programming languages by taking help from only instruction manuals because these computers using simple programming languages, unlike the modern 64 bit and 32-bit computers. This study was to address the various aspects of utilising these computers in the modern-day to allow students to learn and get interested in programming languages through involving these 8-bit computers in the Australian ICT curriculum. But the study faced many problems while gathering data related to the 8-bit codes (Asadinia, 2020). Due to limited availability of data for the research, the study also tries to discuss some of the aspects related to the study in brief. Due to the lack of authentic data regarding the Mega 65, C64 and C65 8-bit computer algorithms, the study has discussed an overview of most of the aspects of this programming platform in brief.

3.11 Time horizon

		Name	Duration	Start	Finish
1		Incorporation of Basic Mega 65 Language in Curriculam	181 days	3/3/21 8:00 AM	10/11/21 5:00 PM
2		Identification of Research Area	10 days	3/3/21 8:00 AM	16/3/21 5:00 PM
3		Background Research	18 days	16/3/21 2:00 PM	9/4/21 2:00 PM
4		Background Survey	7 days	9/4/21 4:00 PM	20/4/21 4:00 PM
5		Reviewing literatures	8 days	20/4/21 3:00 PM	30/4/21 3:00 PM
6		Analysing Research	10 days	30/4/21 8:00 AM	13/5/21 5:00 PM
7		Documentating Research	3 days	14/5/21 8:00 AM	18/5/21 5:00 PM
8		Developing Conceptual Framework	15 days	19/5/21 8:00 AM	8/6/21 5:00 PM
9		Validating Framework	15 days	9/6/21 8:00 AM	29/6/21 5:00 PM
10		Testing Framework	20 days	30/6/21 8:00 AM	27/7/21 5:00 PM
11		Framework Implementating	15 days	28/7/21 8:00 AM	17/8/21 5:00 PM
12		Updating Curriculam	30 days	18/8/21 8:00 AM	28/9/21 5:00 PM
13		Analysing Results	20 days	29/9/21 8:00 AM	26/10/21 5:00 PM
14		Final Reporting	10 days	28/10/21 8:00 AM	10/11/21 5:00 PM
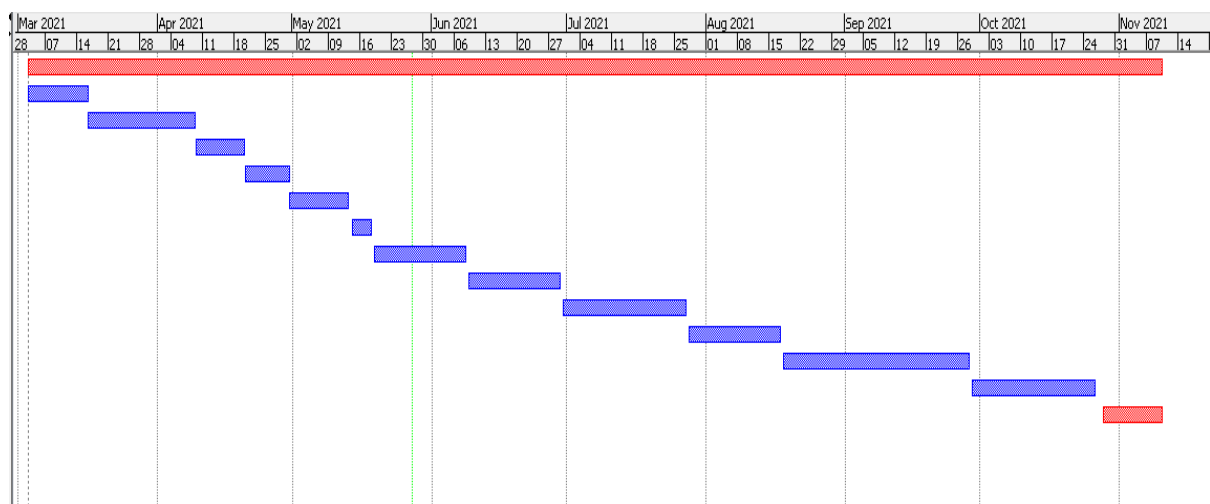
Figure 7: Time horizon

(Source: Project-libre)

3.12 Conclusion

The study discusses various parameters of using open-source software and programming language developing a computer system in order to keep open the scope for future development. The study has found that effective data collection and proper strategy for the research help to perform effective research. Hindi study the main objectives of the methods used to find the way of utilising the Mega 65 that is compatible with the c 64 and c65 design and also 40x faster, and to be used as a teaching tool in Australian ICT curriculum. While developing the methodology, this study has identified that positive research philosophy along with an inductive research approach and secondary data collection method can be effective in order to perform the research effectively.

CHAPTER 4: DATA ANALYSIS

4.1 Introduction

This part of the study is focused on analysing the various aspects of the MEGA65 and also investigating whether involving these Computer technologies in the Australian ICT Curriculum in order to allow the students to get much interest and knowledge about the early phase of the IP computers and also simultaneously providing students with simple but effective programming lessons. Therefore, in this section, the study is aiming to address the various features of the 8-Bit computer programming languages through analysing the salient features of the MEGA65 Computers and many other aspects regarding the MEGA65, such as Compatibility, Performance, Popularity, additional benefits and many more. The methodology chapter has discussed the data collection process in the study, which is based on collecting secondary information, and in this chapter, the study is going to interpret/ discuss the findings from the collected information as well as summarising those findings into graphical and textual form in this study. The various secondary data can be either qualitative or quantitative, but in this study, the most desirable data that are going to be needed are those pseudo-codes and algorithms used in the MEGA65 Computers, which is an 8-bit computer mostly similar to the modern computers but with fewer specifications and features as well as a simpler programming language.

4.2 Data analysis

In this study, the following Mega 65 is a type of open-source 8-bit computer that is compatible with the 8-bit commodore65 and commodore 64. The following Mega 65 device has various other components, including display, support Ethernet port, micro-SD card as a storage device and also a slot for inserting the floppy disk. The Mega 65 is a compact computer which can be seen as a keyboard but having all of these features in it. This allows the Mega 65 computer in compact form. From various studies, it has been found that the Mega 65 is 40 times faster than the commodore 65 and 64 (Sung, 2020). Though in modern days do computers are very rare to find as I was first launched in the 1980s and so in the 21st century, these systems may not have significant values in terms of their operation, but due to its open-source programming structure and compact design, there are various possibilities to make modifications in the Mega 65 board. In simple words, the Mega 65 computers are modifiable. In the early 80s, the demand for 8-bit home computers was very high, and people are having an interest in online learning programmes whether it is in school,

homework or any other places these 8-bit computers had significantly provided support for learning a programming language (Vaportzis et al. 2017). Due to this reason, people in that time had some sort of Idea on programming 8-bit computers or simply microprocessors.

Image removed due to copyright restriction.

Figure 8: MEGA65

(Source: https://www.trenz-electronic.de/media/image/dd/a6/9d/30390_MEGA65_Devkit_01_trenz_electronics.jpg)

The above figure shows the MEGA65 computer in which the board where all the different ports are installed is under the keyboard. All the keys are mechanical, which gives another type of experience while typing this type of keyboard. The figure also shows that the MEGA 65 has a dedicated Floppy drive for inserting floppy disks as in the 1980s, the floppy disk was pretty much popular as it was first introduced in the market in 1972. The CD disk was not so popular these days as the CD disk was first introduced in 1979 (Sharma, 2019). The MEGA 65 computer being an open-source computer platform, there is various scope for further modifications in the future. Before the MEGA 65 was available in the market, the Commodore 64 and 65 was very much popular, and it took the record regarding the highest-selling 8-bit computer platforms. The commodore 65 was basically an improved version of the following Commodore 64 Computers, and Commodore 65 was basically a prototype computer.

The Commodore 64 is still the best-selling computer in the history of Computers. These computers are based on MOS Technology that is included with the 6502 built-in processor in the 1980s. The reason behind the success of the Commodore 64 Computers was the ability to perform different

types of tasks such as financial and business applications, scientific and technical applications, educational purposes, Statistical and mathematical applications and even gaming applications (O'Regan, 2018). These computers are also able to connect with the internet by using the "Contiki", which is an open-source operating system and also allows it to be connected with the internet being an 8-bit machine.

Image removed due to copyright restriction.

Figure 9: Number of sales of Commodore 64

(Source: https://www.pagetable.com/docs/c64_sales/13-17-19.png)

The above figure showed the number of sales of the Commodore computers of the 8-bit family computers from 1982 when this technology was first launched in the market to 1993. After that, these computers started to lose their market because of the availability of other types of computer systems (Steiglitz, 2018). From the figure, it can be seen that in early 1982 the sale of these computers increased at very high speed and within one year the number of sold Commodore 64 reached 13.5 million, and this started increasing more due to its multiple types of operations as well as it supports a wide range of software's including around 10000 published games those are released officially. At the end of the year 1984, the number of computer sales reached near about 20 million. But after 1986, the number of sales started decreasing as there were other 8-bit computers also started launching by many different companies at less cost (Bolhasani, 2017). But due to the ability to perform a wide range of operations and also having scope for further modifications because of the open-source operating system, the popularity of Commodore 64 was very high, and the number of sales is still at the top.

Security and Complexity-

Security of computer systems is a very crucial factor. There's a larger consensus in the field of computer security regarding the complexity of the system that can be considered as the enemy for or security. In simpler meaning is that with the increasing complexity in a computer system, the chances of security flaws also increase. The study in the previous section has all those different complex computer systems. We have more security bugs. A system becomes complex when there are more lines of code as well as larger amounts of interactions (Asaad, 2021). Therefore, the possibilities of potential security bags can be present within a computer system as the complex systems are pretty much harder to fully, and thus there can be a possibility that some portion of the line of code can be left untested. Designing, implementing, configuring as well as securing a complex system can be harder. And the most important part is there the complete system is pretty much harder as the user may not fully understand the system. For this reason, in order to make a computer system or any software potentially secure, the complexity needs to be reduced.

Testing security of a computerised system or computers, the most popular method of testing security is to perform functional testing (Glowacka, 2021). but functional testing cannot give an accurate idea about any system that is secured or not as the different security features are used in most of the computer in order to prevent security breaches from happening. Therefore, the listing of security in computers is mostly focused on testing the vulnerability in the system and the working posts that may have some error. Depending upon the identification of these security issues, the proper mitigation techniques can be used, but whenever it is a complex system, it is very much problematic to identify the vulnerable areas or coding pattern as well as observing the system performance and working procedure (Alexander, 2020). However, reduce the effort that is required in order to evaluate and analyse the security of any computer system by making the system simple and also using simple coding patterns. For example, the central processing unit of the commodore 64 has around 35 10 transistors, whereas modern computers such as the "2017 desktop-class central processing unit" from the AMD has around 5 billion transistors. From this data, it can be seen that the 8-bit computer systems like commodore 64, commodore 65 and Mega 65 are not complex computer system compared to modern computers. Therefore, it can be understood that early age computers are more secure than modern computers and early retro computers also have more security because these systems utilise open-source software operating systems.

Image removed due to copyright restriction.

Figure 10: Limitations of the "Von Neumann Architecture"

(Source: https://media.springernature.com/lw785/springer-static/image/chp.jpg)

The above figure shows the various limitations regarding the security and complexity of computer systems. In the figure, the x-axis shows the timing of development regarding computer systems the y-axis shows the operational and physical characteristics of this kind of systems (Csordás, 2019). The operational physical characteristics can be connected to the security of computation. Figures describe the four different timings regarding the development of computers. What time zone is before 2008, from 2008-2017, from 2017 to 2025 and beyond? Before 2008 the computer system was comparatively simpler than the modern days of computers. It can be seen that the early computers before 2008 are based on "Von Neumann architecture", and computers developed after are mostly based on the "advanced cognitive computation system" (Şapçı et al. 2017). According to the monument architecture, these computers store programs instruction and also data random Access memory and read-write format and this architecture is all the concept of a stored program in computers where the program data, as well as instruction data, are stool same memory device. The figure also shows that at the early age of computer development, such as for commodore 64, commodore 65 and Mega 65, the performance of the computer increases, including increasing Memory capacity and also computational complexity (Jones, 2019). From the figure, it can be seen that the early age of computers developed in 1986 used compatible sim player coding patterns, and thus the performance and memory capacity of the system also increased sharply. At the same time, the functionally and structurally offered computer system can be complex when there are large amounts of quotes on algorithms being used. Due to the complex nature of computer systems, the

performance curve does not increase like simple computing systems. A dissimilar phenomenon also occurs in the evolution of the cognitive computer. Due to the complex nature of programming language and algorithms, the "performance curve, memory capacity but linearly which is similar to the early age of computers in which performance is very high.
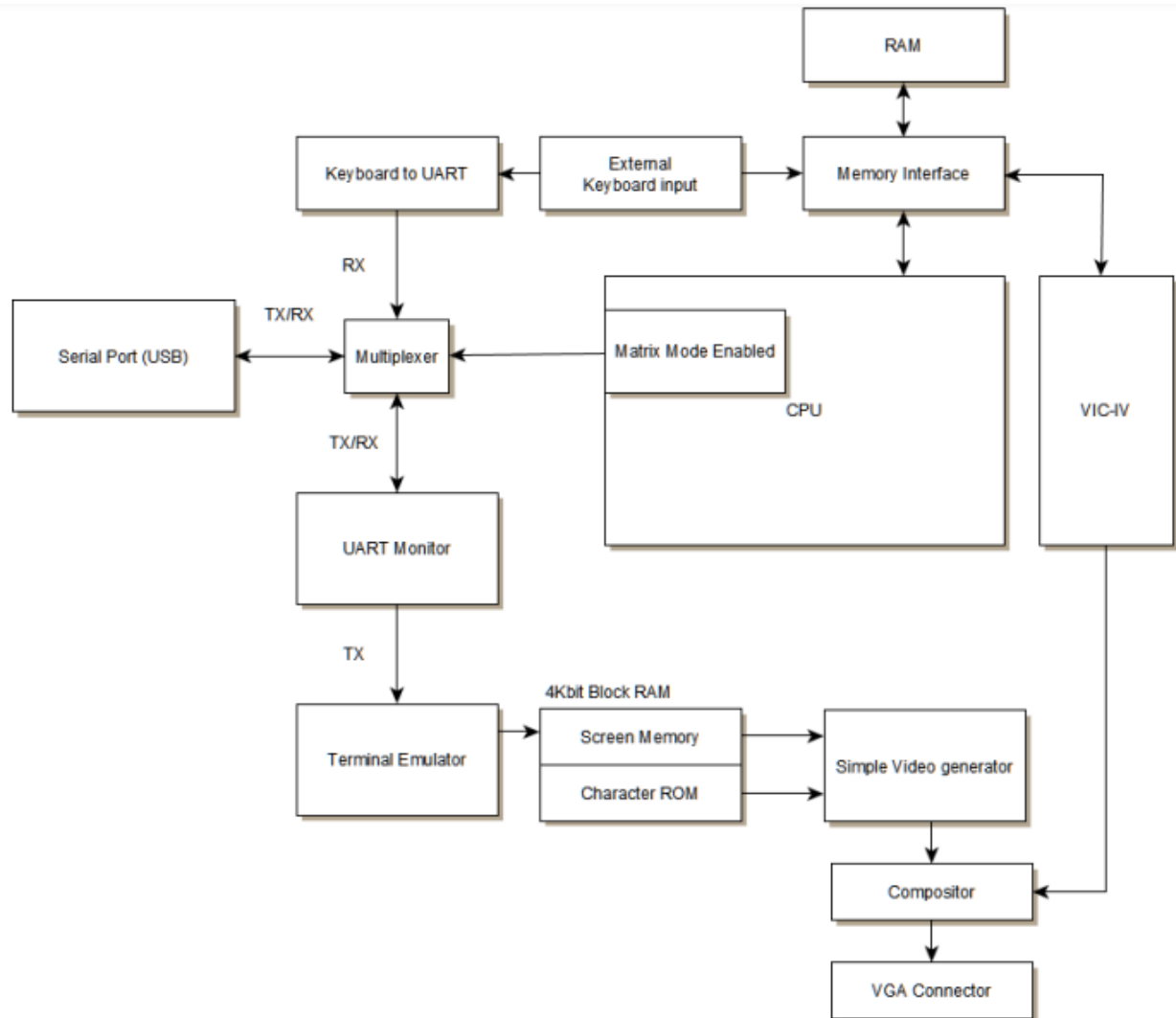
Figure 11: Component Block diagram of MEGA 65

(Source: https://flex.flinders.edu.au, 2017)

The above figure shows the Block diagram of the MEGA 65, including the various components used in this 8-bit Computer (Pyle et al., 2021). The goal of this study is to discuss the various features of the MEGA 65, an 8-bit open-source operating system based retro computer that was introduced in the 1980s, but with the advancement of modern computers and processors, these technologies have become less popular. Hence, the study is focused on identifying the various areas of this Retro Computer that will enable to widen the scope for implementing the Mega 65 Computers in the Australian ICT curriculum as an effective teaching tool, and this will allow the students to satisfactorily learn 8-bit computer programming (Gidney, 2021). From the above figure,

it can be seen that the CPU of the Mega 65 is connected to the memory interface, and a RAM and External keyboard interface is connected to the memory interfacing device. Serial ports are connected to the processor via a multiplexer, and they can both transmit and receive signals from the Serial ports. The multiplexer can only receive signals from the keyboard in order to fetch the UART monitor, which then transmits data into the Terminal Emulator and a 4k bit RAM block. This 4Kbit RAM performs two different functions, such as Screen memory as well as Character ROM, in generating Simple video. The VIC-IV module acts as a Security device that helps to increase the safety features of the output from the Spoofing of Malicious Software (Fialko, 2021). The output of the VIC-IV and the simple video generator are "Alpha Blended" through the use of Compositor before sending the data to the monitor through HDMI or VGA connector.

The above figure shows the interface for the Mega 65 keyboard. In the Mega 65 computer it uses a PS2 keyboard in which the interface sends a scan code every time a key is pressed or released. In the Mega 65 two types of code are generated depending upon the type of use of the keyboard. for instance whenever a key is pressed the system generates "Make" codes where whenever a is being released it generates "Break" code. all these codes are hexadecimal. In the Mega 65 8 bit computer after the normal reading of the scan code from the above-mentioned PS2 keyboard, the system updates the "complex interface adapter". This is basically a microchip used for or the input and output in the previous commodore 64 computers. This cheap support joystick keyboard and also internal timer.

the figure shows the interface for the art transmission module.

```
entity UART_TX_CTRL is
    Port ( SEND : in  STD_LOGIC;
           DATA : in  STD_LOGIC_VECTOR (7 downto 0);
           CLK : in  STD_LOGIC;
           READY : out  STD_LOGIC;
           UART_TX : out  STD_LOGIC);
end UART_TX_CTRL;
```

Figure: 12 Interface for art transmission mode

The above figure shows the transmission module of the UART. The above module general ready signal at the ideal state in which data can be sent as a data signal whenever the SEND signal is being generated. After receiving the send signal the system will initiate serial transfer of the data during simple state machine. This machine helps to control the flow of data during waiting for the

key as well as outing the said key. At the time of waiting for the key the last scan code helps to check whether the beat 12 is in the law state and this indicates to make code.

Video Generator

The main function of the video generator is overlying the "terminal emulator" on top of the output from the Mega 65 computer. In order to do this the modified Mega 65 module needs to read the memory of the screen that is being generated by the terminal emulator and also retrieve the pixel data from ROM. After this process the output is then alpha blended with the original output of the Mega 65.

In the Mega 65 computer there are three types of pixel scaling available and these are called scaling mode. The purpose of the 3X scaling mode is to feel the screen with an overlay where the mode 2x and 1X are healthy to provide a smaller window. The smaller window can be moved throughout the screen with the help of an arrow key. these are rookie flexibility to the uses of Mega 65 computers in accessing different type of information which is behind the overlay
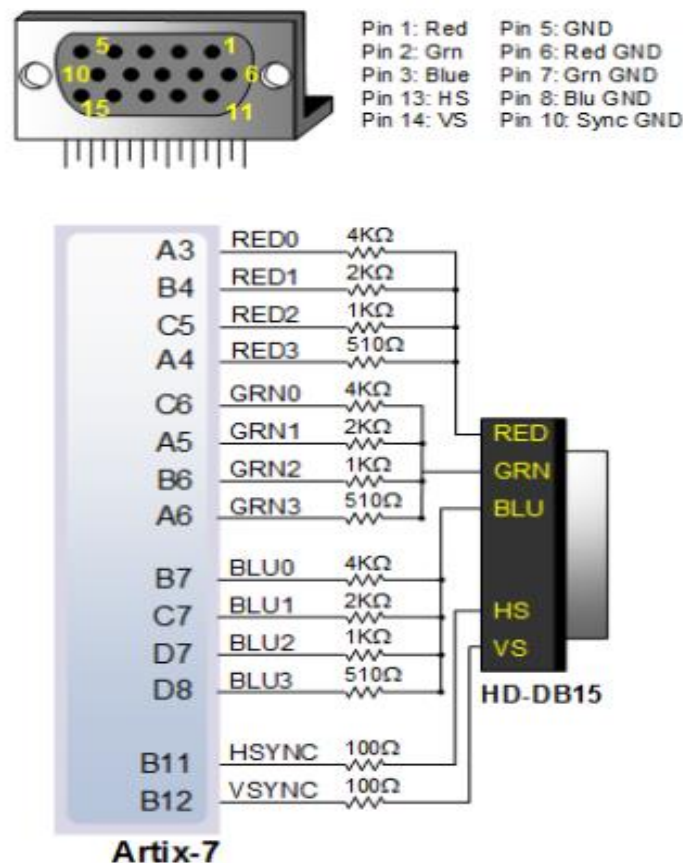

Figure 13: Artix-7 configuration

On the FPGA board there is a VGA port which can be seen in the above figure where the boot provides analogue video output of USB using the digital to analogue converter. Each colour is

defined by 4 bits. For this reason, there are 12 lines of connections, and some registers are connected in series. The A3, B4, C5 and A4 are responsible for showing the red colour on the monitor screen of the Mega 65 computer board. C6, A5, B6 and A6 lines are responsible for showing the green colour whereas the B7, C7, D7 and D8 show the blue colour. The B11 and B12 of the Artix-7 are used for providing Power and ground. The central processing unit of the Mega 65 computer has 28-bit address space where is in commodore 65 computer the CPU has 20-bit address space and in commodore 64, the CPU address space is of 16-bit. For this reason, the memory in the modified Mega 65 computer can be of 256 MB. The figure below shows artificial memory addressing for Mega 65 including ram ROM and colour RAM.

4.3 Conclusion

Firstly, there is a brief introduction about the upcoming studies of the chapter. After that there is detailed analysis of the Mega65 computer from this analysis the present features of the computer can be understood. As per the analysis the features are like; dedicated floppy driver, open source, etc. Another thing that has been understood from the analysis section is the rate of sales made of C64 throughout the years. The highest number of sales was made in between 1984 to 1986. The analysis action has also provided the limitations of architectural elements in 8-bit computers.

CHAPTER 5: RECOMMENDATION AND CONCLUSION

5.1 Introduction

Recommendation refers to the required stages to improve a system, and the conclusion implies the ultimate justification of research. These parts of the study focused on providing the ultimate conclusion and recommendation of the research. Through these sections, a clear understanding of the improvement procedure regarding the utilisation of Mega65 as a teaching tool can be gathered. These sections will also provide the future scope of this research. Along with that, the relationship between the objects can also be understood properly through this research. The importance of those objectives in doing the research can also be justified properly through these sections.

5.2 Linking with objectives

Linking with objectives to the process of setting up relationships among two or more objectives. In these sections, the relationship among the objectives will be displayed (Hicks et al., 2021). The initial objectives of the research have been focused on finding out the features of the Mega65 Computer and the required features of a teaching tool in the Australian curriculum. Through these objectives, the required improvement in a Mega65 computer for operating as a teaching tool in the ICT circular can be understood. The next objective of the research is to find out the required resources and identify the future possibilities of the computer. Through these objectives, proper identification of the required elements for the improvement of Mega65 Computer can be processed.

5.3 Future scope

Future scope refers to the possible future circumstances and events of research. Through these sections, the future of the Mega65 Computer can be identified. As per analysis, it can be stated that the Mega65 Computer can be used as a teaching tool in future times (Amoretti, 2021). Besides that, these computers can also be usable in several other functions also, such as playing games, watching movies, etc. Along with that, crucial information can also be maintained safe and secure through these computers, as it contains lower security bugs.

5.4 Recommendation

This part of the section has been focused on providing required recommendations to develop the Mega65 Computer as a teaching tool in the Australian curriculum. Some of the recommendations that have been identified are the improvement on interaction procedure, improvement on security measurements, etc. The detailed discussions of the recommendations are below.

Improvement on communication system:

A well-maintained communication system is one of the most crucial requirements of the Australian curriculum in terms of teaching procedure (Deveci et al., 2018). Through an effective communication tool, a proper interaction between a learner and a teacher can take place. In these Mega65 computers, there is also a requirement of maintaining an effective communication tool within the system. As per analysis, it can be stated that the new communication measurement of the computer should be maintained with a textbase interaction, face to face interaction, etc. With this maintenance, the teaching tool will also be effective during these pandemic situations.

Improvement on security measurements:

The mega65 computer also lacks security measurement in spite of the fact that the computer has lower complexity. The security measurements of the system should be improved in such a way so that datasets can be transferred in a proper way. The security measures of the system should have maintained a popup blocker so that the IP address can't be traceable for hackers (Murali et al. 2020). Along with that, Mega65 Computer is required to implement firewall protection, which will provide additional support towards the maintenance of secure data sets as the computer has maintained an open spice platform, so upgrades of the software are also required a daily manner. The system should have a daily scanning facility for protecting the system from spyware irregularities. Besides that, the system requires it to be protected from the deadliest virus injections such as malware and DDOS attacks.

5.5 Conclusion

This research may be summarised as a concise explanation of the Mega65 Computer's development process. In the Australian curriculum, there is a lot of potential for using the Mega65 Computer as a teaching tool. This usage may be achieved with certain precise changes to the current architecture of Mega65 machines. The computer's current features have the potential to boost user satisfaction in a more significant way. In the second part of the research, numerous hypotheses have been presented

in relation to the research's ultimate goal. Through such theories, a valid justification for the Mega65 Computer's usage procedure may be supplied. The research's offered conceptual framework aids the reader in forming precise concepts about the research's dependent and independent variables. The research's recommendations will give extra guidance in identifying portions of the Australian curriculum that require improvement.

The prospective aspects of Mega 65 that can be adopted in Australian curriculum were explored in this study. Security methods, learning BASIC programming language, and creating a modest, encrypted communication system are the key elements presented. The research also includes a draft of a manual for learning how the Mega 65 and BASIC programming languages operate, which may be used as a starter kit to assist students learn how the Mega 65 and BASIC programming languages functions. In the future, this research will be expanded to integrate the results of the current study in the Australian curriculum, with the goal of determining the most appropriate year to add Mega 65 as a teaching tool, resulting in efficient output and the most desired motivation.

The paucity of study is mostly owing to the Mega65 computers' limited resources. Because of these flaws, the study came to an inaccurate result. Aside from that, owing to resource limits, the specific criteria for developing a Mega65 computer have not been presented sufficiently. The key areas for improvement, according to the recommendations, are the interaction method and computer security issues. The computer's security settings should be kept up to date so that data sets may be sent in a safe manner. A proper idea of the adoption of the computer among the students may be gained from the methodology section.

NOTE: Has Created a manual to understand working of Mega65 and a manual to understand basics of BASIC programming Language. This Manual can be found at

https://docs.google.com/document/d/1JUWyfFEA7EFRygAquqkhR4lWl_IvaYJ8/edit?usp=sharing &ouid=103857003262783243248&rtpof=true&sd=true

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