CONQUERING THE DIGITAL DIVIDE: WITH A DIGITAL NATIVE WHO NEVER WAS

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This thesis is submitted in fulfilment of the requirements for the degree of
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"Access without support is not opportunity"
Vincent Tinto, Syracuse University

Research Outputs

From Thesis

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Russo, K., Low, D., & Eagle, L. (2017) The Death of the Digital Native. Proceedings of the Australian and New Zealand Marketing Academy Conference. In: *ANZMAC 2017: Australian and New Zealand Marketing Academy Conference: marketing for impact*, 4-6 December 2017, Melbourne, Vic., Australia

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Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet the requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the material included in this thesis is original and is an intellectual product of the author of this thesis. Proper citation/ acknowledgment has been made to the work of other authors contained in this thesis.

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31 October 2019

Acknowledgments

A PhD was always part of my life plan. But like many rural women from farming families, finding a way in which to achieve such a feat was challenging. One cannot just move a farm closer to a university. One cannot ask a third-generation farmer to leave the land and relocate near a university. So as one must, I waited until my sons, Jack and Harry, had finished their schooling then obtained a position at a university 120km from home. I lead a fragmented life, working as an academic at a regional university during the week and being a farmer's wife on the weekends. But this is what farming families do. We make sacrifices to access opportunity.

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I dedicate this thesis to my grandmother
who lived a long life filled with many friendships, laughter and love of her family.
Kerry Kanakis
1914 - 2012

Statement of Contributions of Others

Name of Assistance	**Contribution**	**Names, Titles and Affiliation of Contributors**
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Abstract

As higher education moves to blended learning environments, a digital divide is emerging in the Australian higher education sector. This divide is predicated on differing digital skills and usage patterns, not access to digital devices. Access is not perceived to be the issue as numerous Australian secondary schools offer a school-issued laptop scheme. Yet many students transitioning to university are grappling with the necessary digital skills required to participate in a digital setting. Referred to as "digital natives", these young people were expected to be digitally proficient. This thesis challenges the existence of Mark Prensky's (2001) Digital Native and provides an analysis of how differing digital fluency stages influence perceived preparedness for university study. Conceptualising the growing inequalities arising from a widening digital divide, the thesis investigates impacts on the student experience, digital fluency and secondary schooling digital opportunities. The thesis reports on three studies drawn from three research questions. Using a mixed-mode approach centred on Critical Theory and Ajzen's Theory of Planned Behaviour (TPB), the thesis provides an analysis of the digital divide in Australian higher education. Study 1 reports on RQ_1: "What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide?" Four hundred and nine first-year business students were surveyed at regional and urban Australian universities. This study provides empirical data on the digital divide and determines a link between digital fluency, socioeconomic status, sociocultural capital, digital identity and student self-reported preparedness and digital skills. Study 2 reports on RQ_2: "Is digital fluency a precursor to preparedness for university study?" Fifteen of the surveyed respondents completed a digital test with usability testing software prior to an in-depth interview. Study 2 provides a link between access and application of digital environments in schooling and the development of digital fluency. This study presents data showing disadvantage indicators can be alleviated through access to digital learning environments during schooling. Study 3 reports on RQ_3: "What enhances and develops digital fluencies?" and examines the digital divide from a student's perceptive. Case studies were developed from in-depth interviews and presented as techno-biographies to determine respondents' digital fluency stage. These techno-biographies outline differing experiences and opportunities for digital skills development between secondary schools. Study 3 explores prior digital experience to identify digital influences, skills, knowledge, attitude and mindset. The study suggests that influences and prior digital experiences contribute to digital fluency and perceived preparedness for university study. The three studies are intertwined in their investigation of an association between disadvantage indicators, prior digital experience and stages of digital fluency. Particular attention is placed on examining the distribution and allocation of digitally resourcing in secondary schools. The three studies culminate in a

concept model to illustrate the link between the distribution of resources, digital fluency and preparedness for university study. The thesis demonstrates a link between access to a learning management system (LMS) or digital curriculum during secondary school and disadvantage indicators. Access to a school LMS consistently produced higher self-reported digital skills than those without, even when disadvantage indicators were present. The issue of perceived preparedness for university study and/or a digital learning environment was also linked to participants who had access to a school LMS. Rural, regional, low socioeconomic, low sociocultural capital and state-school participants were less likely to have had access to a digital curriculum during secondary schooling and therefore less likely to report preparedness for university study. Conversely, these disadvantage indicators were overcome if participants had access to an LMS or digital curriculum. The thesis identifies a digital divide in higher education emanating from the distribution, use and allocation of secondary schooling digital resources and prior experience. The resourcing of secondary schools with school-issued laptops did not increase digital fluency or perceived preparedness for university study. However, the implementation of a digital curriculum or LMS produced significant outcomes in the development of digital fluency. These findings illustrate the influence of digital immersion in the formation of fluency. Resourcing schools without a clear digital curriculum does not increase digital fluency. If the digital divide is to be conquered, the appropriate application of digital resources in secondary schools must be implemented to enable the development of digital fluency.

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Glossary of Terms

21st Century Skills	Critical thinking, collaboration, digital literacies, information literacies and media literacies
Andragogy	The science of teaching adults
Australian Tertiary Admission Rank (ATAR)	Since the late 1990s, all Australian states and territories (except Queensland until 2019) have used a common measure to rank Year 12 students relative to their peers for university admission
Blended learning	The use of multi-modes of delivery including digital technologies and face-to-face teaching
Constructivism	A learning theory related to the construction of knowledge through meaningful experiences
Digital curriculum	A curriculum designed to enable opportunities to learn in a digital environment
Digital equity	Access to digital devices, broadband and networks
Digital divide	Previously the divide was focused on digital access and ownership. In this thesis the digital divide refers to the gap between those who know how to use digital technologies and those who do not.
Digital harms	Negative digital experiences
Digital fluency	The ability to move with ease in a digital environment
Digital Knowledge	Ability to use digital technologies to create knowledge
Digital Native	A term used to describe young people who grew up using digital technologies
Digital Pedagogy	A pedagogical approach to the science of teaching and learning using digital technologies
Generation Y/ Millennials/ Net Generation	The generation born between 1980-2000, also called Millennials or the Net generation
Instructivism	A pedagogical theory relating to didactic instruction
Learning Management System (LMS)	An online platform for accessing and using learning material
Massification	A significant increase in access and participation in higher education is often referred to as the massification of higher education
Meta-cognition	Thinking about thinking

Platform	A technology-enabled combination of hardware and software to provide a digital media service
Pedagogy	The science of teaching
Social constructivism	A pedagogical approach based on Vygotsky's Zone of Proximity and the Theory of Social Learning
Social justice framework	A framework of social justice and human rights
Social learning	Vygotsky's Social Learning Theory based on the scaffolding of knowledge
Zone of Proximal Development	Vygotsky's Social Learning Theory refers to the zone of proximal development, an area of individual learning and where guidance may be required

Table of Acronyms

ACARA	Australian Curriculum, Assessment and Reporting Authority
ATAR	Australian Tertiary Admission Rank
BYOD	Bring Your Own Device
CAI	Computer Assisted Instruction
CCR	Creative Classroom Research
CMS	Content Management System
COAG	Council of Australian Governments
DEEWR	Department of Education, Employment and Workplace Relations
DER	Digital Education Revolution
DigEULit	A European Framework for Digital Literacy
HEPPP	Higher Education Participation Program
ICT	Information and Communications Technology
IPTS	Institute for Prospective Technological Studies
IRRRRE	Independent Review into Regional, Rural and Remote Education
IT	Information Technology
LMS	Learning Management System
NAPLAN	National Assessment Program – Literacy and Numeracy
OLT	Office of Learning & Teaching
OP	Overall Position
QCS	Queensland Core Skills
PISA	Program for International Student Assessment
SES	Socioeconomic Status
SNS	Social Networking System
UAC	University Admissions Centre

Chapter 1 Introduction

1.1. Introduction

If education is to be transformative it needs to be accessible. This thesis investigates whether a digital inequality exists within the Australian higher-education sector. This chapter provides an outline of the scope of the thesis, introduces the research rationale and identified research gaps and presents the overall thesis structure. The thesis aims to examine the impact of a digital divide on business students in higher education and ascertain whether the student's prior experience influences digital fluency. The digital divide is defined in this thesis as a gap in digital knowledge and a gap in opportunity, ability and efficacy. Commencing with a discussion of the concepts of the digital divide and digital fluency, the research rationale and gaps in research on the digital divide from an Australian higher-education perspective form the body of the first sections of this chapter. The chapter then discusses the magnitude and impact of the digital divide challenges before concluding with the theoretical and practical contribution of the thesis.

The notion of a digital divide was first brought to the researcher's attention when employed at James Cook University, a regional Australian university, as an online educational designer. In 2013, the university's Bachelor of Business moved to an online/ blended delivery mode. It was assumed the students would respond positively to the digital learning environment. However, students began to flounder with their digital learning tasks. Students had difficulties accessing online tutorials, uploading assignments to the Learning Management System (LMS), recording/editing videos and presenting in an online conference format. A team was employed called Business Online to help support the students. The Business Online team assisted internal and external students to engage with the digital learning environment and troubleshoot problems for students as their problems arose. In 2017 the Business Online team responded to more than 10,000 email requests for assistance from students and staff. This was an astonishing number of requests when one considers fewer than 2000 students were enrolled in the Bachelor of Business during 2017. It became evident that navigating the digital divide with students ill-equipped to participate in a digital environment was fraught with challenges. The Bachelor of Business LMS had been designed to encourage easy navigation and numerous help instructions and videos were available to assist students. Nevertheless, external and internal students enrolled in the online/blended program continued to seek assistance from the Business Online team.

A review of the available literature revealed real concern was being raised that while digital technologies are becoming increasingly accessible, a new digital divide is emerging (Ragnedda & Muschert, 2013; White, 2013; Bartlett & Miller, 2012 and Resnick, 2002). Rather than a divide centred only on access to digital tools, this new digital divide is based on ability to use those tools effectively. The ability to create knowledge using technology

rather than passively consuming knowledge created by others has been identified as vital for social inclusion (Warschauer, 2004). Many researchers now acknowledge a digital divide is contributing to societal inequity and impacting on social inclusion, communities and education (White, 2013; Bartlett & Miller, 2012; Resnick, 2002). An analysis of the influence this divide is having on business education in the Australian higher-education sector is the focus of this thesis.

Terms such as “disadvantage”, “social exclusion” and “isolation” set the narrative for the divide in an Australian study (Broadbent & Papadopoulos, 2013) on the digital divide. The study asserted that “being a part of the digital divide in the twentieth century disconnects you from a part of your world that now exists for others” (p.4). The digital divide is changing from one of accessibility to one of a knowledge gap generated by differing levels of digital competencies (Q. Wang, Myers, & Sundaram, 2013).

The definition of the digital divide in this thesis is therefore centred on the meaningful use of technology to create knowledge, rather than a narrative of computer ownership or accessibility and connectivity. There are three components within the new digital divide: digital access which incorporates digital ownership and internet access; digital literacy which focuses on the use of technology tools; and digital fluency which is knowledge creation through digital environments (Figure 1).

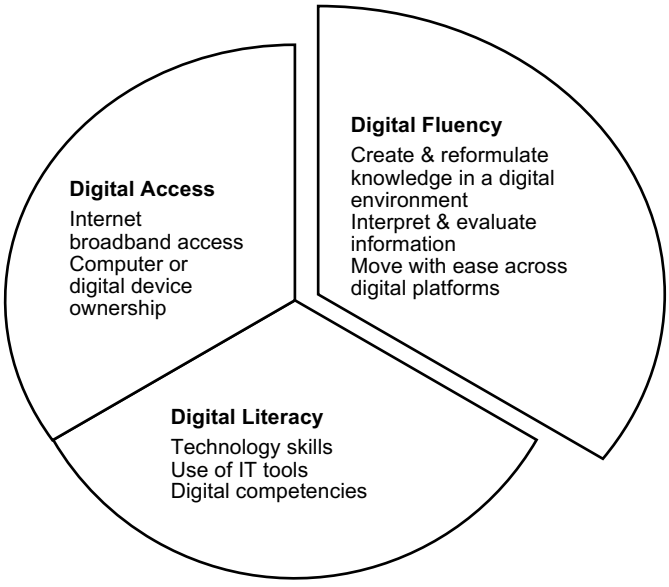
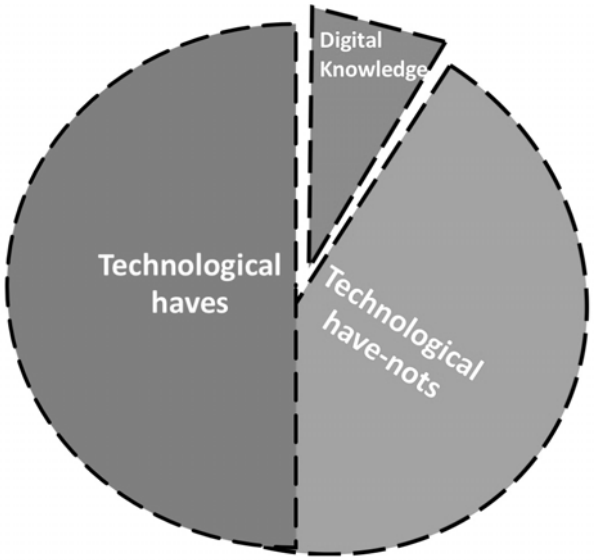


Figure 1. The Digital Divide

Source: Author Originated

The digital divide is a range of these competing elements that is greater than access to computers, internet and digital resources. This divide has broadened to encompass social relationships, communities, education and the meaningful way we use information technology and communication (Broadbent & Papadopoulos, 2013; Peña-López, 2010; van

Dijk, 2006; Warschauer, 2004; Wei & Hindman, 2011). While digital access, defined in Figure 1 as access to digital resources, remains an issue in rural and remote locations and individuals from low socioeconomic backgrounds, it is the gap in digital knowledge and usage that is the thesis's focus (Hasley, 2018). It is now acknowledged that access to and/or ownership of technology alone does not generate knowledge. This rise of the digitally fluent who can move with ease across digital platforms is creating a digital divide, leaving behind those who cannot effectively navigate across these platforms.



(Wei and Hindman (2011) adapted by author)

Figure 2 The Digital Divide

Figure 2 illustrates division between technological haves and have-nots as a gap in digital knowledge (Wei & Hindman, 2011). This gap in digital knowledge is the digital divide. Tertiary institutions continue to grapple with levelling the playing field, particularly with students who are the first in their family to study at tertiary level and those who are from low socioeconomic backgrounds (Johnston, Lee, Shah, Shields, & Spinks, 2014; Luzeckyj, Scutter, King, & Brinkworth, 2011; O'Shea, 2015).

Robert Randall, CEO of the Australian Curriculum Assessment and Reporting Authority (ACARA), stated that student's digital skills should not be assumed (ABC report, November, 2015). In comparing the computer technology literacy of Year 6 and Year 10 secondary-school students in the Australian National Assessment Program Literacy and Numeracy (NAPLAN) annual competency assessments, ACARA identified a fall in Information Computer Technology (ICT) proficiency levels from 2011 to 2014 (Figure 3).

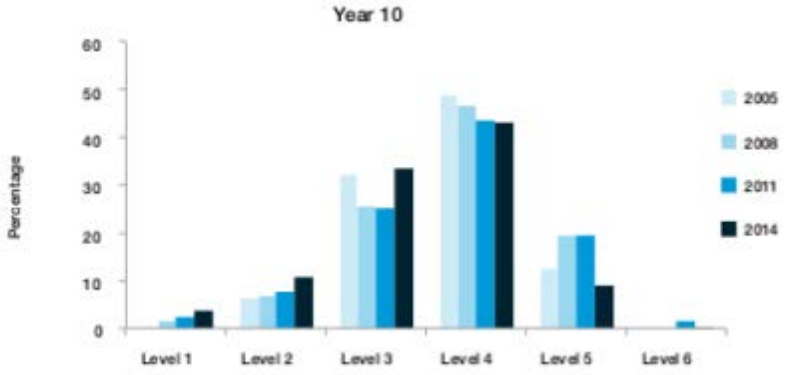


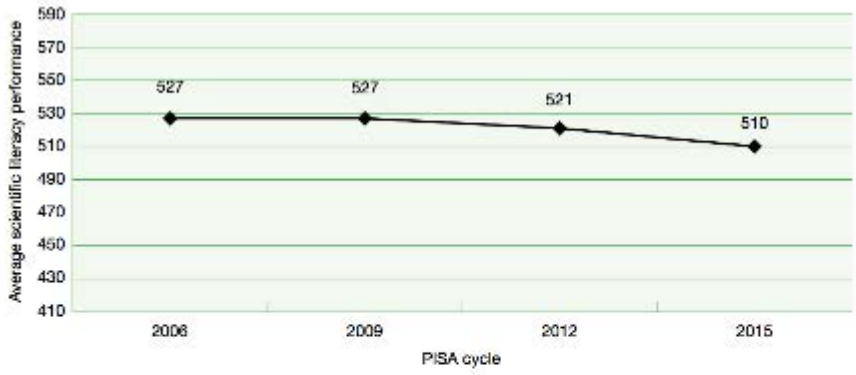
Figure 3. Distributions across proficiency levels for Year 10 students from 2005 to 2014

(Key: Level 1 lowest level of ICT proficiency to Level 6 highest level of ICT proficiency)
Source: (Fraillon, Schulz, Gebhardt & Ainley, 2015) *NAPLAN ICT 2014 Public Report* (p.32)

The NAPLAN *ICT 2014 Public Report* demonstrates a 13-percentage point fall in ICT proficiency standards between 2011 to 2014. The 2014 proficiency standard was the lowest recorded of all NAPLAN ICT tests. This reduction in digital literacies is significant and raises concern about the preparation of students entering higher education.

A decline in other literacies was also evident in the Australian Program for International Student Assessment (PISA). Thomson, De Bortoli, and Underwood (2017) discuss the ramifications of the decline in PISA scores within Australia. The PISA scientific literacy assessment framework is comprised of three competencies that link to digital fluency. Competency is based on "logic, reasoning and critical analysis" and includes the ability to scientifically explain, evaluate, design and interpret data and evidence (Thomson et al., 2017, p. 18).

Figure 4 illustrates a significant 17-point decline in the Australian PISA average score in scientific literacy performance between 2009-2015. A further breakdown of factors such as socioeconomic, geographic and socioeducation relating to the Australian PISA results is provided in Chapter 2.



	Difference between years		
	2012	2009	2006
2015	−12 ▼	−17 ▼	−17 ▼
2012		−6	−5
2009			0

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.

Figure 4. PISA Australian average score in scientific literacy

Source: PISA 2015 Reporting Australia's results (Thomson et al., 2017)

The literature review examines past and recent scholarly thought on barriers to navigating the digital learning environment and digital fluency. This digital competence or efficacy is known as digital fluency and differs from digital literacy in that digital literacy is defined in this thesis, drawing on the available literature, as the ability to use technology tools. Digital fluency is the ability to reformulate knowledge through the use of technology. This thesis argues that unless appropriate effective student support structures which build digital fluencies are embedded in both secondary and tertiary educational practice, digital inequity across the student body will continue to increase.

1.2. Research Rationale

As noted in the introduction, Haycock (2004) contends differing digital proficiency levels are creating inequality within our society. Leading Wei and Hindman (2011) to state that "the social consequences of the digital divide have not yet received adequate attention" (p. 216). A widening gap between those who have knowledge and those who do not is beginning to emerge with the technological haves and have-nots in terms of the ability to effectively utilise technology (Wei & Hindman, 2011). Selwyn (2009) reinforces this gap or divide with the assertion:

> concerns are beginning to be raised that digital technologies may be contributing to an increased disengagement, disenchantment and alienation of young people from formal institutions and activities (p. 369).

Is this widening societal gap in the use of digital environments reflected in the higher education sector? The rationale for this research is to investigate whether a widening gap in

the ways in which students use technology to generate and create knowledge is impacting students' preparedness for higher education. The research examines three factors: Whether a digital divide exists in higher education and if so, whether the divide is related to socioeconomic, sociocultural and/or geographic status; Whether the divide is predicated on the distribution of secondary-school digital technologies resources e.g. school-issued laptops, LMS provision and the development of digital fluency; And whether digital fluency leads to self-reported or perceived preparedness for university studies. From these investigations, the thesis provides evidence to suggest that the lack of digital fluency is creating a barrier in higher education. The thesis concludes with recommendations for further research on bridging the digital divide to improve the student learning experience and promote positive student opportunities.

1.3. Research Gaps

The researcher has identified two gaps in extant literature that the thesis addresses.

1.3.1. Research Gap 1: The Digital Divide

The research addresses whether online and blended learning business undergraduate programs are impacting the student experience due to unrealistic assumptions regarding students' digital fluency. Blended learning is defined as bringing together face-to-face teaching with learning technologies to deliver a program in one or more delivery modes (McGee & Carmean, 2012). In the context of university undergraduate degrees, the research reported in this thesis aimed to:

a) Identify whether and in what ways socioeconomic, sociocultural and/or geographic status influences students' digital readiness to participate in tertiary business studies
b) Research the development of digital fluencies through student self-reporting and testing of digital skills
c) Establish whether digital fluency impacts on university students' experience in business education.

The overall aim of determining whether the use of digital technologies in education has contributed to inequality and a broadening of a digital divide into the tertiary sector underpins this research. Inequality in this context is not just access to digital resources but also access to the development of digital knowledge and skills.

1.3.2. Research Gap 2: Digital Fluency

Minimising the negative impact of the digital divide on the student experience is another aim of this study. The research investigated factors that influence the development of digital

fluency to ultimately improve student preparedness for university study, enhance the student experience and enable students to cross the digital divide. The research aimed to:

a) Examine the digital divide from a student's perspective to give insight into the impact of the divide in higher education and the development of digital fluency
b) Investigate factors that influence the development of digital fluency.

1.4. Research overview

The research design and methodology overview shown in Table 1 outlines the research questions, research methodologies and analysis techniques used. The three studies and methodological approaches are expanded on in Chapter 3.

Table 1. Overview of research design and methodology

Research Question	Study	Research Methods	Analysis programs	Methodological approach
RQ_1. What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide?	**Study 1** **The Digital Divide** *n*=409	Quantitative – Questionnaire Compare first-year Bachelor of Business cohorts • Self-reported digital skills, information fluency and online enrolment experiences • Correlate against location, demographic factors & access to digital devices	SPSS	Critical Theory Theory of Planned Behaviour (Ajzen, 1991)
RQ_2. Is digital fluency a precursor to preparedness for university study?	**Study 2** **Digital Fluency** *n=15*	Mixed mode Quantitative –15 x Digital tests Compare participants' digital test results against Study 1 and 3 responses • time on task • mouse clicks • mouse movements	TechSmith Morae	
RQ_3. What enhances and develops digital fluencies?	**Study 3** **Digital Influences** *n=15*	Mixed mode Qualitative – 15 x Individual in-depth interviews • Determine digital influences • Case studies • Build a techno-biography of each participant • Identify digital harms • Analysis of secondary data collected from Study 1 and 2 • Compare participants' responses against Study 1 and 2 results	SPSS	

The digital tests in Study 2 were conducted with TechSmith Morae. Morae is an online usability testing platform. This platform enabled the researcher to track participants' progress through the digital test and is described in Chapter 3.

1.5. Theoretical and practical contribution of the thesis

Chapter 2 provides an overview and critical evaluation of existing theories, noting that they do not provide a comprehensive means of analysing the impact on academic participation and performance of the range of factors within the digital learning environment as identified in this chapter.

Building on the widening participation and social justice work of Gale and Tranter (2011) and Devlin (2013b), the thesis is situated in a social justice framework. Australia's focus on access to higher education has not been matched with attention to student participation and success (Devlin, 2013b). This disconnect between access in higher education and student participation and success will be discussed in further detail in Chapter 3 (Devlin, 2013a). Gale and Tranter (2011) describe social justice in terms of "distributive, retributive and recognitive" and perceive recognitive justice as missing from Australian higher-education policy *(p. 29).* They conclude that:

> To be socially just in recognitive terms, higher-education policy must recognise the interests of the least advantaged by developing a deeper understanding of the knowledges, values and understandings of those who are underrepresented and excluded from higher education, especially people from lower socioeconomic backgrounds (Gale & Tranter, 2011, p. 30).

The social justice framework and its implications are discussed in more detail in Chapter 3. Two key theories are introduced: Ajzen (1991) Theory of Planned Behaviour (TPB) and Critical Theory with its origin in sociology and Marxist philosophy, enable the consideration of structural inequality and they provide the thesis' foundation. Applying the aforementioned theories and perspectives, the thesis provides theoretical contributions to create a critical consciousness of the digital divide and to inform the narrative of inequality in higher education.

1.5.1 Theoretical Contribution 1

a) Provides an analysis of a digital learning environment's impact on the student experience.
b) Conceptualises the growing inequalities arising from the widening digital divide within a social justice framework.

c) Applies Critical Theory to the examination of the distribution and allocation of resourcing in secondary schools.
d) Applies TPB to the examination of the distribution and allocation of resourcing in secondary schools.

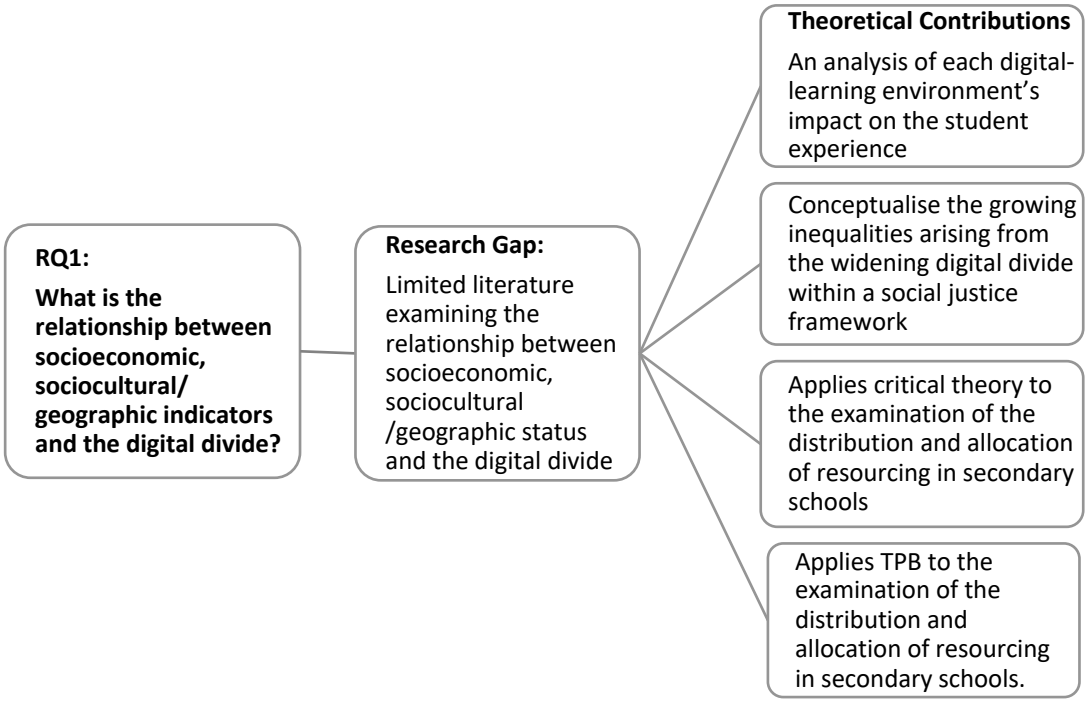


Figure 5 Research Question 1 Map

Figure 5 maps Research Question 1 to the research gap and illustrates the thesis's first theoretical contribution.

1.5.2 Theoretical Contribution 2

a) Provides empirical data on the link between digital fluencies, socioeconomic and geographic status and positive student experiences and opportunities.
b) Examines the digital divide from a student's perspective.
c) Develops a critical consciousness of the impact of the digital divide on student preparedness.

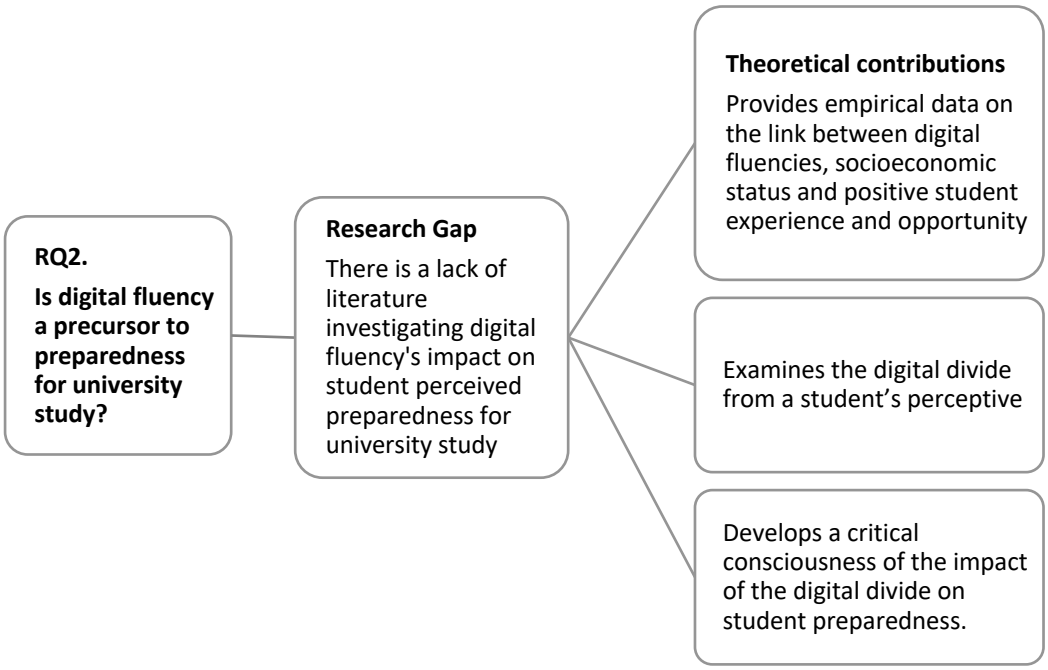


Figure 6. Research Question 2 Map

In Figure 6 Research Question 2 is mapped to the research gap and illustrates the theoretical contribution of the thesis.

1.5.3 Theoretical Contribution 3

a) Applies a student's perspective to identify purposeful support strategies.
b) Recommends approaches to build student digital capacities.
c) Situates the work of Devlin (2013b) and Gale and Tranter (2011) on social justice in higher education and the widening participation agenda in the digital divide.

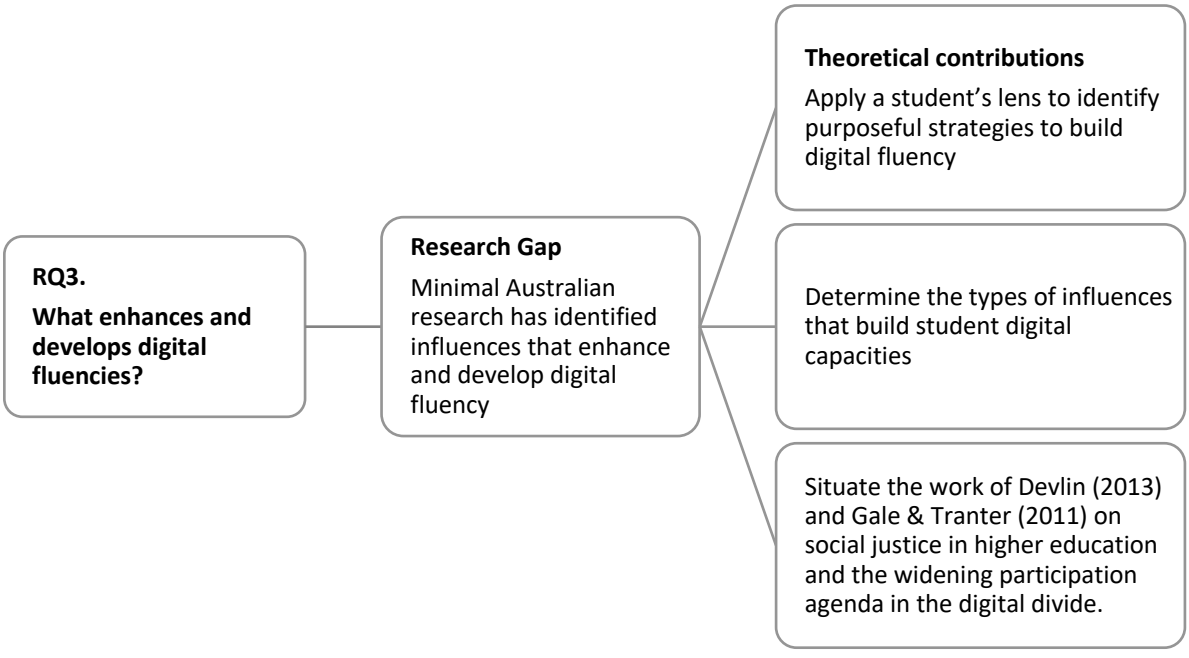


Figure 7. Research Question 3 Map

Figure 7 addresses how Research Question 3 is linked to the research gap and mapped to the theoretical contribution of the thesis.

The thesis's practical contributions are listed below and link to the theoretical contributions above. The thesis' intent is to draw on theoretical conceptualisations, tested using a series of studies, to then develop a set of recommendations for both further research and possible actions to mitigate negative influences from the digital divide on the Australian higher-education sector.

1.5.4 Practical Contribution

a) Contributes to the development of strategies within the "widening participation" agenda.
b) Contributes to the improvement of preparation of students with 21st century skills to take their place in a globalised business world.
c) Provides recommendations for further research on effective structures to enhance digital fluencies and improve the student experience.

In Figure 8 all three research questions are mapped to practical problems to illustrate the practical contribution of the thesis.

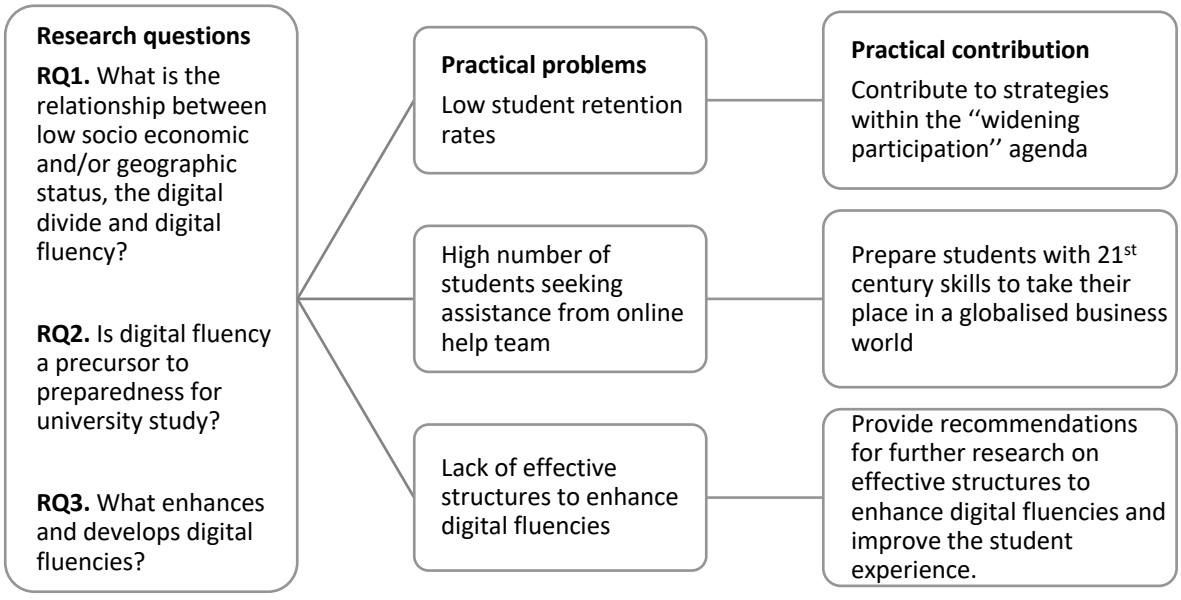


Figure 8. Research questions mapped to practical contributions

1.6. Outline of the Thesis

The thesis has seven chapters: the structure of these is outlined below in Table 2.

Table 2. Outline of Chapter Structure

Chapter 1 Introduction	Introduction Research Rationale Research Gaps Research overview Theoretical and practical contribution of the thesis Outline of the Thesis Conclusion
Chapter 2 The Digital Native	Introduction Historical perspective The Digital Native Student learning expectations Learning as a Social Construct Digital literacy Digital fluency 21st Century Skills The digital divide and disadvantage Widening participation Impact of geographic location Conclusion
Chapter 3 Research metho-dologies	Introduction Philosophical Perspective Social Justice Perspective Theory of Planned Behaviour Research conceptual map Methodological and Analytical Approaches Data Collection Tools Study 1 – The Questionnaire The survey sample group Survey questionnaire Digital fluency test Techno-biography Grid Case studies: Techno-biographies Techno-biography concept map Staging and measuring Fluency Conclusion
Chapter 4 The Digital Divide	Introduction Statistical tests The Digital Divide: Study 1 - Results Demographic and digital access results Comparison of University Demographics Participants' access to digital technologies Comparison of university online enrolment experiences Summary of univariate tests of relationships between demographic, geographic and school variables Factor analysis overview Reliability Scales Final Factor Analysis after reliability testing Digital Fluency Scales Profiles Group Profiles Conclusion

Chapter 5 Digital Fluencies	Introduction Digital test format and design The study 2 sample group Study 2 – digital test Comparison of digital test participants Study 2 – digital test results Study 2 – participants' digital access Conclusion
Chapter 6 Digital Influences	Introduction Study 3 – The Interview Study 3 – Case studies School digital experiences Study 3 - participants' access to digital technologies Comparison of university online enrolment experiences Demographics and digital access Techno-biography outcomes Study 3 - Results and Implications Conclusion
Chapter7 Conclusion	Introduction Discussion and results Key findings of the thesis Theoretical and practical contribution Limitations of thesis Areas for further research Implications for theory and practice Conclusion

An overview of the thesis contribution is provided in Table 3. This overview maps the practical problem to the research gaps and research questions before moving to the theoretical and practical contributions.

Table 3. Overview of thesis contribution

Practical Problem	Research Gap	Research Question	Theoretical Contribution	Practical Contribution
Low socioeconomic and "first in family" student cohort	There is a lack of literature examining the interplay between socioeconomic, sociocultural and geographic indicators and the impact of the digital divide	**RQ_1. What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide?**	a) Provide an analysis of a digital learning environment's impact on the student experience b) Conceptualise the growing inequalities arising from the widening digital divide within a social justice framework c) Apply Critical Theory to the examination of the distribution and allocation of resourcing secondary schools d) Apply TPB to the examination of the distribution and allocation of resourcing secondary schools	Contribute to strategies within the "widening participation" agenda Support the need for the establishment of a digital curriculum in secondary schools Support the need for the introduction of learning management systems in secondary schools Support the need for professional development of secondary school teachers in technology pedagogies.
High number of students seeking assistance from the online help team	There is a lack of literature investigating whether digital fluency prepares students for university study	**RQ_2. Is digital fluency a precursor to preparedness for university study?**	a) Provide empirical data on the link between digital fluencies, socioeconomic status and positive academic achievement and opportunities	Prepare students with 21st century skills to take their place in a globalised business world.

			b) Examine the digital divide from a student's perceptive c) Develop a critical consciousness of the impact of the digital divide on student preparedness	
Lack of effective structures to enhance digital fluencies	Minimal research has identified the types of approaches that build students' digital fluency	**RQ_3. What enhances and develops digital fluencies?**	a) Apply a student's lens to identify purposeful strategies to build digital fluency b) Determine the types of approaches required to build student digital capacities c) Build on Devlin (2013a) and Gale and Tranter (2011) work on social justice in higher education and the widening participation agenda	Provide recommendations for further research on effective structures to enhance digital fluencies and improve student preparedness for university study.

1.7. Conclusion

The studies that form part of this thesis aim to identify whether a digital divide exists in higher education and to investigate the impact of digital fluency on student preparedness and learning experience. The thesis's proposition is that digital fluency, not access or connectivity to digital devices, is contributing to a widening gap between the technological "haves" and "have-nots" (Wei & Hindman, 2011). This thesis expects that its findings will enhance online/blended tertiary business education programs by identifying the impact of the digital divide on the student experience and perceived preparation for university study. The findings can be used to strengthen and expand existing theoretical foundations, with implications for a range of academic institutions and policymaking bodies. The analysis of the digital learning environment focusing on the students' perspective can assist in identifying barriers to student success.

Chapter 2's literature review provides an historical perceptive of learning technologies, identifies gaps in the current body of knowledge and examines the digital divide. Chapter 3 then discusses research methodologies and the study design with further discussions on the contributions of the thesis to existing knowledge.

Chapter 2 Literature Review

2.1 Introduction

Chapter 2 begins with an historical perspective focusing on the digital native. The digital native is a term coined to describe people born after 1980 who grew up with technology (Prensky, 2001). It was predicted the digital native would be able to use technologies and would demand a technologically advanced learning environment. This chapter explores gaps in the digital native research and discuss the pedagogical complexities that have arisen from the use of a digital learning environment and the students' learning expectations. A focus on 21st century skills and the need for a digital pedagogy forms part of this discussion before moving to a focus on digital literacies and student retention models. The chapter concludes with discussion on the digital divide and disadvantage.

Pedagogy is defined in this thesis as the overall science of teaching. The term andragogy, described as the theory and practice of teaching adult learners, is not used in this thesis. The term digital pedagogy does not refer to a new form of pedagogy but rather to a pedagogical approach utilising digital technologies. Pedagogical approaches could include projected based learning, collaborative learning, real world simulations or authentic assessment (Scott, 2015). Often more than one pedigogical approach would be used in education.

2.2. Historical perspective

The explosion of digital device ownership and social media in the first part of this century was to lead to a wired and connected student cohort (D. G. Oblinger, 2010; Palfrey & Gasser, 2008). This student cohort, born after 1980, grew up with technology and were identified by Prensky (2001) as "digital natives". However, ownership of an array of digital devices and social media engagement does not of itself develop digital fluency, nor does it provide the skills necessary to complete tertiary studies successfully (Bennett & Maton, 2010).

The assumption in the early "noughties" (2000-2009) was that students had been radically changed into hyper-connected and experiential learners by society's fast uptake of digital technologies. This meant that schools, universities and workplaces expected to be inundated with students who had grown up immersed in technology (D. Oblinger, Oblinger, & Lippincott, 2005; Palfrey & Gasser, 2008; Prensky, 2001). These students were variously called Generation Y, the Net Generation or Millennials but it was Prensky's term "the digital native" that struck a chord with educators. Prensky (2001) defined the digital native as "our students today are all 'native speakers' of the digital language of computers, video games and the internet" (p. 2).

2.3. The Digital Native

The concept and predicted consequences of the emergence of the "digital native" (Prensky, 2001) was formed against a backdrop of rapid change and emerging technologies that challenged educators. Suddenly educators were to be strangers in their own land, referred to as immigrants (Prensky, 2001), the "digital immigrant". These digital immigrant educators were purported to be the biggest problem facing education (Prensky, 2001). Educators needed to develop digital learning environments to meet the needs of these digital natives (Prensky, 2001). It seemed to make sense: navigating a digital environment would require a level of digital ease that the digital native would achieve because, after all, the digital native grew up immersed in technologies.

The digital native's arrival was claimed to be about to revolutionise education but the uprising did not occur (Bennett & Maton, 2010; Margaryan, Littlejohn, & Vojt, 2011; Selwyn, 2009). There was little or no empirical evidence to support the digital native rhetoric (Margaryan et al., 2011; Selwyn, 2009). In the flurry to prepare for the arrival of the digital native, the lack of empirical data to support the existence of the digital native or the assumptions on which the term was based were not considered by many educators (Bennett & Maton, 2010).

The concept envisioned of the digital native was based on generational factors and did not take into account socioeconomic, geographic, cultural, education backgrounds nor critical thinking skills (Selwyn, 2009). Sharpe, Beetham, and de Freitas (2010) refer to Prensky's digital native and digital immigrant terms as an oversimplified "classification scheme" and note that sometimes there is not enough information to assign a category label (p. 66). Consequently Prensky (2001) assumption of the digital native with superior technology skills based on their generation was deemed to be flawed, with critics such as Bennett and Maton (2010) proclaiming that visions of a brave new world in education have not been realised. Nonetheless, the term digital native continues to drive debate in education (Bennett & Maton, 2010). A cursory glance at educational research literature and multiple media modes reveals continued use of the term digital native. For example, a search of scholarly articles revealed more than 363 results from 2018 of the term "digital native". While a search of news articles in 2018-2019 showed more than 9000 results for the "digital native". Even when Prensky began to distance himself from the term after 2009 Jones, Ramanau, Cross, and Healing (2010), the concept of the digital native continued to be reproduced at conferences, policy and literature. Jones et al, (2010) cites Bayne and Ross (2007) in reference to the persistence of the term digital native and suggests the marketing and cultural enterprises around the concept maintained its relevance.

In advancing an examination of digital natives Bennett and Maton (2010) refer to an "academic moral panic" surrounding the term and suggest that the supposed technological transformations of students continue to drive policy debate in education (p. 328). Bennett and Maton (2010) go on to equate this moral panic to the policy debates of the 1960s about the introduction of large numbers of working-class students to higher education.

> The lack of evidence for the existence of an entire generation of digital natives seriously undermines arguments made for radical change to education because of a proclaimed disjuncture between the needs of young people and their educational institutions. This is not to say that education should not change at all, but merely that the basis of the argument, as it is currently made, is fundamentally flawed (Bennett & Maton, 2010, p. 325).

Therefore, the alarm created by the prediction of the education sector not being ready for an influx of digital natives had not been realised (Bennett & Maton, 2010). It appears that many students are not ready to study in a digital educational environment. Even in the latter years of the second decade of the 21st century, many university students are still neither prepared for, nor proficient at, navigating the digital environment and lack the technical skills to effectively participate in online and blended educational programs (Manca, 2013; Kirschner & DeBruyckere 2017)

Further evidence has arisen that the use of social networking technologies does not prepare students to participate in the academic sector (Bennett & Maton, 2010). Manca and Ranieri (2013) conducted a thematic analysis to investigate the continued focus by many authors on students' presumed desire to be immersed in a digital learning environment. What emerged from this study was that students' expectations differ according to cultural and local educational contexts. Manca and Ranieri (2013) call for the focus to be on encouraging new roles for both educators and students in a digital education environment.

2.4. Student learning expectations

A paradigm shift is needed to upskill the student and the educator to effective digital fluency levels. A study by Margaryan et. al. (2011) found an association between learning disciplines and the use of technology. In comparing engineering with social work studies, engineering students made greater use of technology tools across different learning and social contexts (p.435). These authors noted that social work students had clear boundaries between learning technology and social or recreational technologies. Research D. Oblinger et al. (2005) indicates engineering and business major students prefer the use of learning

technologies to promote understanding and enable “opportunities for practice and reinforcement” (p. 92).

The principal finding of the Margaryan et al. (2011) study is that students continue to conform to traditional pedagogies with limited use of learning technologies. Students in the Margaryan, et al. (2011) study:

> emphasised that they expected to be ‘taught’ in traditional ways. On this basis, previous claims of a growing and uniform generation of young students entering higher education with radically different expectations about how they will learn seem unwarranted (p.439).

Coldwell-Neilson (2018) found that there is a significant mismatch between academic staff expectations and their observations of students’ digital literacy capabilities. Student learning expectations appear to be vastly different to what was foretold to be digital natives’ expectations (Prensky, 2001). Further evidence regarding the complex relationship between students and learning technologies can be found in *Educating the Net Generation*, the Australian Government Office for Learning and Teaching (OLT) report which states:

> students appear to hold fairly traditional views of teaching and learning, preferring face-to-face interactions with teachers and other students, and valuing teachers’ expertise as the primary source of information (Lohnes & Kinzer, 2007 as cited in the OLT Report, p. 9).

The OLT Report case study found successful integrated learning technologies required “pedagogical, technical and administrative components” to be “designed, managed and integrated” within a learning task (Gray, 2009, p.19). Educational relevance and support for the development of technical-based skills underpinned successful programs and enabled a positive learning experience for both the student and the educator (D. G. Oblinger, 2010). The report also found alignment of task to technology used, integration within the educational design, and clear communicated student responsibilities and expectations were some of the significant challenges facing education in the digital space (Gray, 2009). Confirming that new technological skills were required for students and staff to engage with the digital learning environment, the OLT Report states:

> … there are significant challenges associated with clearly communicating what is expected of students and what their responsibilities are when using new learning technologies, particularly when unfamiliar technologies and learning activities are being employed (Gray, 2009, p.19).

The OLT report asserts the time and effort required for students to engage with a digital learning environment should not be underestimated.

> Guidance and time is needed to develop these two sets of skills; both in the design and development of learning tasks that employ new and emerging technologies and also in their implementation in undergraduate studies (Gray, 2009, p. 19).

These findings are further summarised in the Australian universities research Technological Pedagogical Content Knowledge (TPACK). TPACK is a framework for incorporating technology in teachers' training (Mishra & Koehler, 2006).
Sharpe et al. (2010)'s discussion on the satisfaction levels of the Net Generation's relationship and interaction with technology is "one of the most active research agendas in online learning" (p. 57). Certainly, student satisfaction needs to be a consideration within digital pedagogy but is it the driver? In Figure 9, Lee, Srinivasan, Trail, Lewis & Lopez's (2011) framework of student support incorporates instructional support, peer support and technical support and illustrates the collaborative nature of the new learning pedagogies The results from their study demonstrated a strong relationship between the students' perceived support and their overall satisfaction (Lee, et al., 2011).

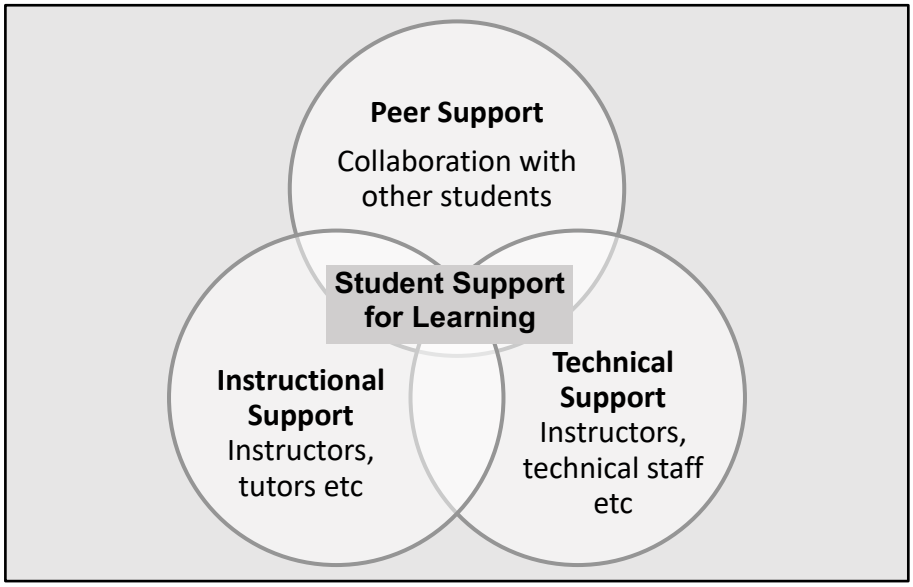


Figure 9 Student Support for Learning
Source: S. J. Lee et al. (2011) adapted by author

Lee (2010) also concluded that communication remains the central premise for establishing student support. Students' awareness of what is available and how to access these supports is perceived to be a basic tenet for online educational practice. Furthermore S. J. Lee et al.

(2011) confirm the need for “constructive feedback, responsive communication, tailored review/help sessions, and relevant instructional resources and activities” (p. 162).
This ability to individualise support, responsiveness and communication is clearly reiterated in a literature review (J.-W. Lee, 2010) of the quality of online education services. Technical support, feedback and flexibility all contribute to student’s satisfaction (J.-W. Lee, 2010).

2.5. Learning as a Social Construct

The discussion in the previous sections indicates that, though change continues to be ever present with widespread adoption of technologies and cultural change, students continue to expect traditional learning opportunities (Coldwell-Neilson, 2018 ; Dahl, 2015; Margaryan et al., 2011). The rise of social media platforms such as Facebook, Twitter, Tumbler and Snapchat has fundamentally changed the way in which people communicate but not necessarily how we educate. Dahl (2015) refers to the adoption of information technology as a “lucky combination of technological advancement combined with postmodern consumption behaviour” (p.12). Perhaps students wanting to engage with learning technologies are still holding on to traditional passive learning behaviours because of the perception that social media is consumption or personal and therefore not part of the formal learning process.
Several authors highlight the social characteristics of learning, such as peer-to-peer/lecturer interaction, building relationships and establishing trust (Hoskins, (2013); (Garrison, Anderson, & Archer, 2010; Palloff, Pratt, & Stockley, 2001; Salmon, 2013). However, many authors perceive a role for social networking systems (SNS) as a support tool rather than as a primary delivery mechanism (Khan, Wohn, & Ellison, 2014) .
In the early part of the 21st century, digital pedagogy, social constructivism, social presence and collaborative learning dominated research in the tertiary education sector. Hoskins (2013), Garrison (2011), Palloff & Pratt (1999), Salmon (2005) all speak to the social characteristics of learning such as peer to peer/lecturer interaction, building relationships and establishing trust.
Digital pedagogy was to create meaningful, authentic learning opportunities within a social construct and cultivate self-directed learners and learning ownership (Porcaro, 2011). But what if this digital pedagogy created inequality in the higher education sector? Minimal attention was still being applied to digital literacy or fluency. It was assumed the digital native could navigate the digital learning environment with ease.

2.6. Digital literacy

Digital literacy, the foundation for digital fluency, is the ability to identify and use technology confidently, creatively and critically to effectively meet the demands and challenges of living, learning and working in a digital society (Coldwell-Neilson, 2017). The term “digital literacy”

was first defined by Gilster and Glister (1997) as “mastering ideas not keystrokes”. Terms such “digital literacy” and “digital fluency” began to gain currency in higher education around 2010.

Definitions of digital literacy now abound. However, the Joint Information Systems Committee (JISC), a United Kingdom Higher, Further Education and Skills Sectors’ not-for-profit organisation, provides the seminal work on digital literacies. JISC describes digital literacy as “those capabilities which fit an individual for living, learning and working in a digital society” (JISC, 2014). The JISC digital literacies definition goes beyond information technology skills to depict digital literacy as a “richer set of digital behaviours, practices and identities” (JISC, 2014). The JISC seven elements of digital literacies illustrated in Figure 10 include media literacy, communications and collaborations, career and identity management, ICT literacy, learning skills, digital scholarship and information literacy. These seven elements provide the base line for digital literacies and inform its definition in this thesis.

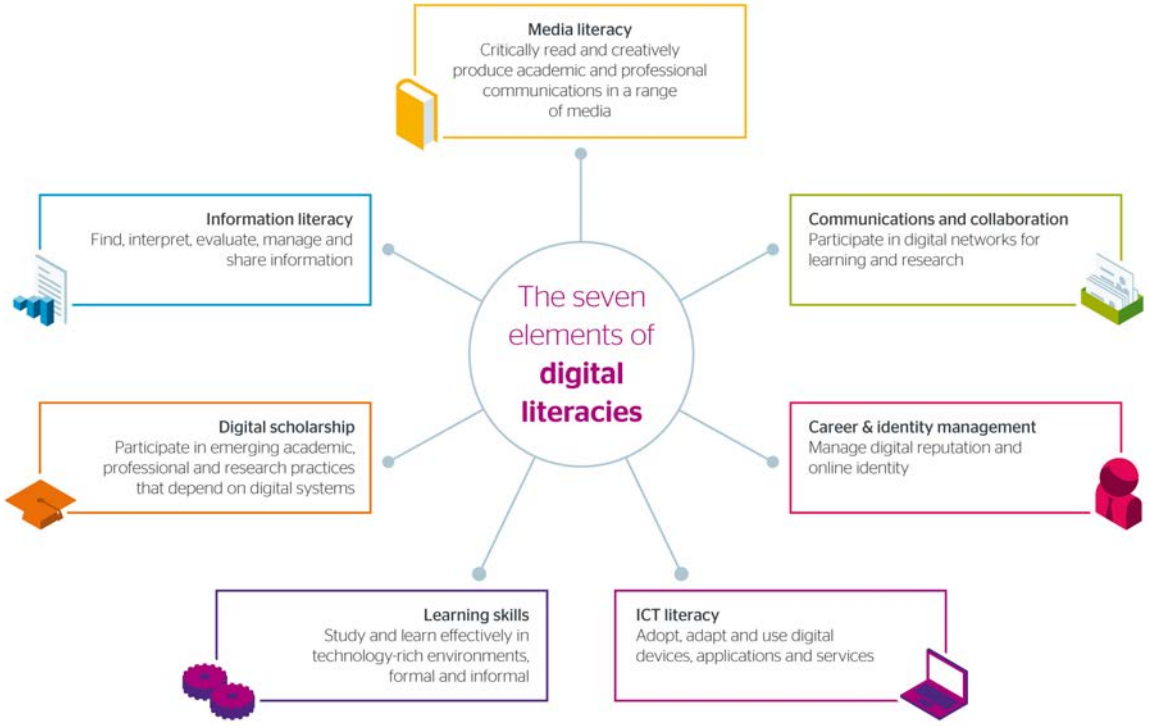


Figure 10 JISC Seven Elements of Digital Literacies

The JISC seminal work also presents a Pyramid Model framework of digital literacy development Sharpe et al. (2010) Figure 11 (JISC, 2014). This framework Sharpe et al. (2010) demonstrates that digital proficiency develops over time, similar to the development of fluency in a language. The framework rises from access and awareness, to skills and practices and culminates in identity. Nevertheless, as stated in Chapter 1, like a language, to maintain digital proficiency requires continued exposure and usage.

Figure 11. Sharpe, Beetham & de Freitas 'pyramid model' of digital literacy development model (2010)

Furthermore, opportunities for the development of digital literacies required a shift in pedagogical practice. The European Commission Institute for Prospective Technology Studies (IPTS) developed the Elements of the Creative Classrooms (CCR) model (Figure 12). Representing educational leadership on implementing innovative practice, this multidimensional concept has eight key dimensions and 28 reference parameters (Bocconi, Kampylis, & Punie, 2012). The CCR model also appears in the *NMC Horizon Report 2014*, which was the international peak publication for educational innovation and has been influential in setting the agenda for innovation (Johnson, L., Adams Becker, S., Estrada, V., Freeman, A., 2014; *NMC Horizon Report: 2014 Higher Education Edition*. Austin, Texas: The New Media Consortium).

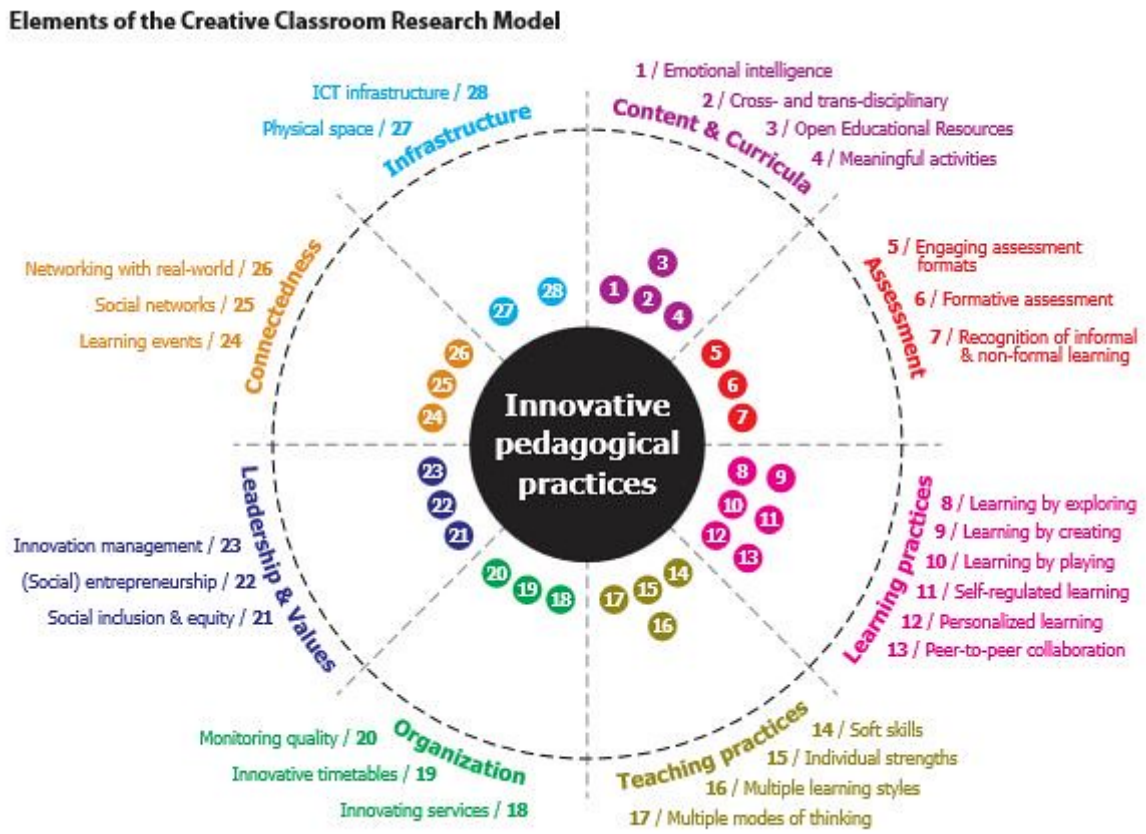


Figure 12. Elements of Creative Classroom Research Model (Bocconi et al., 2012)

Developing digital fluencies underpins the model through the creation of opportunities for students to develop problem-solving skills and collaborative inquiry (Bocconi et al., 2012). Nevertheless, though this pedagogical practice model is to be appreciated for the opportunities it creates in digital fluencies, 21st century skills and learning in the digital age, the model works on the premise that a digital divide does not exist. ICT infrastructure (number 28 on the elements of the creative classroom research model in Figure 12) does not include student support structures.

It was not until the *2017 Horizon Report* (Educause, 2017) that digital literacy and digital equity were identified as a significant challenge to the digital learning environment in higher education. However, the *2017 Horizon Report* defined digital equity as "unequal access to technology, particularly broadband internet" (Educause, 2017, p. 30). Further, the United Nations statement of Sustainable Development Goals includes a commitment to universal and affordable internet access in poorer populations. Digital equity is gaining substantial attention as a significant contributor to inequality. While this researcher acknowledges digital equity as a significant problem, particularly with poorer populations, this thesis's focus will remain on digital fluency as contributing to a digital divide. This divide is between those who use digital technologies to achieve their goals and those who use digital technologies in a remedial, reactive or passive manner.

2.7. Digital fluency

Navigating the digital learning environment requires a level of digital ease. This digital competence and self-efficacy is digital fluency. Similar to being fluent in a language, the digitally fluent can move from one digital platform to another and understand how to perform in the differing platforms with ease. In simple terms digital fluency means to create rather than consume in a digital environment.

The DigEuLit project, part of the eLearning Program of the European Commission, defined digital literacy as "the ability to succeed in encounters with the electronic infrastructures and tools that make possible the world of the twenty-first century" (Martin, 2005, p.130). Digital fluency is defined (Briggs & Makice, 2012)as "an ability to reliably achieve desired outcomes through use of digital technologies" (p.64). Therefore, digital fluency is achieving goals through a digital environment to create/reformulate knowledge, problem-solve and collaborate, and differs from digital literacy, which is the ability to use technology tools (Q. Wang et al., 2013).

The four stages of digital fluency are illustrated in Table 4 as defined by Briggs and Makice (2012, p. 120). Briggs and Makice (2012) study of 10 organisations was based on the Dreyfus model of skill acquisition (Dreyfus & Dreyfus, 1980) and the four stages of competence model. The study identifies knowledge, skills and mindset for each stage, to ascertain what needs to be achieved to transition to the next level.

Table 4 Stages of Digital Fluency (adapted by author from Briggs & Makice, 2012)

Stage	Definition	Knowledge	Skills	Mindset
Stage 1 Anti-Literacy	No awareness of the value in using technology	Technologies, not people, succeed or fail	Problems using mouse, typing and searching	Technology is play, not for serious purposes
Stage 2 Pre-Literacy	Awareness of the potential value of using technology but no ability to use digital technologies	Not aware of technology terms	Difficulties in using basic digital technologies	Oversimplifies or under-estimates the use of digital technologies
Stage 3 Literacy	Ability to use digital technologies; Knows what to do and how to do it	Successful use of social networking; Recognises the value of digital media	Understand the basic use of digital technologies but difficulties in solving technology issues	Feels mastery over tools or perceives only one way to use digital technologies

Stage 4 Digital Fluency	Ability to consistently use digital technology to accomplish goals. The digitally fluent knows the what, how, when and why of using digital technologies.	Uses technology in different ways. Knows the potential uses of digital technologies.	Able to move from one digital technology to another to achieve goals.	Embraces change and understands how digital technologies can be used in multiple ways.

Briggs and Makice (2012) assert digital fluency is not static. An individual will not achieve and retain fluency unless continuously exposed to new experiences. Digital technologies are continually changing therefore "the same abilities become less useful over time" (Briggs & Makice, 2012, p. 68). Q. Wang et al. (2013) refer to the concept of digital fluency as a continuum between digital natives and digital immigrants, whereby individuals move back and forth as skills in digital technologies are gained or lost. This continuum is also reflected in Briggs and Makice (2012) four stages of digital fluency (Figure 13). They identify anti-literacy and literacy as danger zones along the digital fluency continuum.

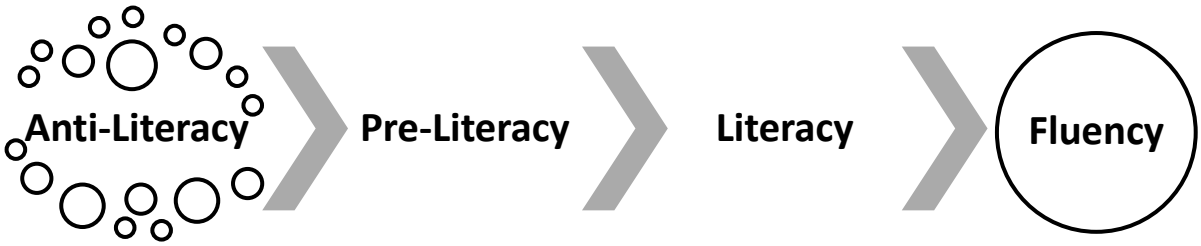


Figure 13. The four stages of digital fluency (Briggs & Makice, 2012, p. 75)

It starts with the anti-literate stage, where the individual may not see any value in digital technologies and therefore does not move forward with gaining digital skills ((Briggs & Makice, 2012). The next danger zone is the literate stage, where the individual may not see value in continuing to learn about digital technologies (Briggs & Makice, 2012). The digitally literate may have sufficient skills to participate in a digital environment and passively consume digital technologies, be they social media, internet banking or online shopping. Therefore, the digitally literate perceives no need to move to fluency. But in an information-rich digital society, the digitally fluent individual participates, negotiates and interprets the digital environment to engage in transformative practice. The digitally fluent can move within and across different digital environments and also interpret and evaluate information. Of interest is the delineation Briggs and Makice (2012) made between the digitally fluent and

the “techie”. The digitally fluent understand when and how to use technology and align their technology use with what is required when it is needed, while the techie is interested in the technology and keeps abreast of the latest digital technologies (Briggs & Makice, 2012).

2.8. 21st Century Skills

Adding to the intricacies of the development and maintenance of digital fluency is the new workforce reality that demands educators produce students with 21st century skills (Coldwell-Neilson, 2018). Described as “an emphasis on what students can do with knowledge, rather than what units of knowledge they have” (Silva, 2009, p. 630). Twenty-first century skills differ from 20th century skills due to technological advancement and the changing labour force (Dede, 2010): “Growing proportions of the nation’s labour force are engaged in jobs that emphasize expert thinking or complex communication – tasks that computers cannot do (Levy & Murnane, 2004, pp. 53-54). Today’s labour force requires skills in meta-cognition (thinking about thinking, including thinking about when and how to use specific strategies for learning or problem-solving), problem-solving, collaboration and critical analysis (Dede, 2010) (Silva, 2009).

A 21st century learning environment is required to create opportunities for higher-level thinking (Crockett, Jukes, & Churches, 2012). White (2013) calls for a focus on digital fluency as a way to address the digital skills gap. With change as a constant, educators in the tertiary sector are circumnavigating the digital divide and preparing students to take their places in a new workforce without appropriate support structures (White, 2013).

The creation of knowledge in the new world order of globalisation and technological change was to construct workers who could adapt to change, be self-directed and lifelong learners (Gee & Lankshear, 1995; Hayes, 1994; Pillay & Elliott, 2001). Summing up the changing times was this statement (Gee & Lankshear, 1995):

> Just as it is not enough for workers in the new capitalism to simply follow directions, as it was in the older, it is not sufficient (it is argued) for students or workers-as-learners to just ‘pass tests’. They must develop ‘higher-order thinking’, ‘real understanding’, ‘situated expertise’, the ability to ‘learn to learn’ and to solve problems at the ‘edge of their expertise’ (p. 7).

Educators have to build capacity in their students to critically evaluate complex information, to reflect, question but most of all their educational practice has to enable individuals to “construct personal meaning” (Pillay & Elliott, 2001, p. 20). Increased access to information is not education: individuals need to decipher, analyse, question and evaluate information and these are the matters that need to be considered when considering employability in the

21st century (Pillay & Elliott, 2001). Interaction and learning by doing is also the premise of the Net Generation (D. Oblinger et al., 2005).

A digital learning environment creates advanced learning processes in part by enabling the educator to step aside and enable learners to independently locate and acquire knowledge (Eyal, 2012). However, this may be unfamiliar territory for a student and not in keeping with their past experiences or current expectations, therefore it could contribute to growing inequity within the higher education sector (Coldwell-Neilson, 2018).

2.10. The digital divide and disadvantage

Teaching with learning technologies can be transformative for students from low SES backgrounds (Devlin & O'Shea, 2012). Research indicates various advantages in teaching with technologies within constructivist pedagogy. The focus on flexibility, variety and choice to connect, engage and support low SES students enables a connected and personalised learning experience (Devlin & O'Shea, 2012). However, the significance of these findings cannot overlook the barriers to the use of digital technologies in low SES students. They further argue that as digital learning environments become commonplace educators must review and evaluate their practice to "ensure it is inclusive and that it supports a wide range of learning preferences and individual circumstances" (Devlin & O'Shea, 2012, p. 10).

The relationship between achievement and disadvantage is further evident in the 2009 PISA data, where the COAG Reform Council (2010) denotes socioeconomics play an importance role in student success.

> Australia's 2009 PISA results show that across all literacy domains, the higher the level of student socioeconomic background, the higher the student performance. The data also reveals that one in four Australian students from the lowest SES backgrounds performed below the proficiency baseline across each of the PISA domains. In relation to the reading literacy domain, the gap between Australian students from the highest and lowest SES backgrounds was found to be equivalent to almost three years of schooling (COAG Reform Council, 2010, p. 1).

J. Goode (2010) asserts education systems are perpetuating the digital divide and increasing inequity. Becker's (2000) study cited in Goode (2010) identifies differences in technology usage along socioeconomic lines with middle-to-high socioeconomic students using technologies to research, analyse, produce and present. Low socioeconomic students tend to use technology at greater levels but primarily technology usage by this cohort veered towards remedial purposes. Warschauer's study (2000) concurred and comments "one school was producing scholars and the other school was producing workers. And the

introduction of computers did absolutely nothing to change this dynamic; in fact, it reinforced it" (2000, P.5). Multiple studies have indicated the higher the socioeconomic student cohort, the richer the curriculum is in digital technologies (Margolis et al., 2003; Valadez and Duran, 2007; Warschauer, 2000; Warschauer et al., 2004; Wenglinsky,1998).

Q. Wang et al. (2013)'s proposed model of digital fluency stresses the importance of demographic factors and influences on the use of digital technologies.

The diversity of digital technology usage and achievement is "neither well understood nor easily gauged" (Warschauer & Matuchniak, 2010, p. 182). A 1999 US study found low SES students with personal computers achieved less benefit in terms of academic testing than high SES students with personal computers (Battle, 1999). Almost all young people engage on some level with digital technologies, however, it is the accompanying social support that influences the development and mastery of digital skills (Warschauer & Matuchniak, 2010). These social supports are often peers and family members however, low SES youth have less access to digitally fluent users (Warschauer & Matuchniak, 2010).

An Australian study of culturally and linguistically diverse young people and digital citizenship suggest that differences in digital skills and knowledge are related more to socioeconomic status than ethnic group (Caluya, Bororica, & Yue, 2018). Digital fluency inequities between US schools is similarly perceived as socioeconomically driven (Warschauer, Matuchniak, Pinkard, & Gadsden, 2010). Teachers in many US low SES schools do not have access to technical support staff or professional development in technology, hence the reluctance to engage with digital learning technologies (Warschauer et al., 2010). (Castaño-Muñoz, 2010) reports a relationship between digital fluency and higher SES. Mominó, Migalés, and Meneses (2008) Spanish study, cited in Castaño-Muñoz (2010) note that in state schools in Catalonia, high levels of technological resources did not equate to higher digital skills among students due to the schools' ineffective use of the curriculum. Mominó et al. (2008) Spanish study found private schools produced students with higher digital fluency even with lower technological resources than their state school counterparts. Inequity in the use of digital environments to create knowledge or digital skills and activities was further identified by Eszter (2010) who reported that even when accounting for digital access and other variables, the primary indicator for high digital skills or fluency was socioeconomic status. The higher the level of parental education and SES, the greater the level of digital use and skills (Eszter, 2010). Given the limited amount of Australian research in this area, this thesis addresses that gap in the literature.

2.11. Widening participation

The widening participation discourse is another area under consideration in this thesis. The significant increase in student access and participation in higher education through a

demand-driven system during the 21st century is often referred to as the massification of higher education and has led to challenges. The 2008 *Review of Australian Higher Education* commonly referred to as the *Bradley Report* outlined the vision for higher education to 2020. The *Bradley Report's,* Bradley, Noonan, Nugent, and Scales (2008) vision for Australian higher education called for a fair, inclusive, productive and future-oriented country. Bradley et al. (2008) recommended targets for 2020 including:

- 40% Australian 25-34-year olds to hold a bachelor's degree
- 20% undergraduate enrolments from low socioeconomic backgrounds, and
- Increase indigenous, regional and remote higher education participation, success, retention and completion rates.

In 2009 the Australian Education Minister, Julia Gillard, adopted these targets and announced a demand-driven Australian university system. The attributes underpinning the Bradley recommendations were fairness and equity. Referred to as a fairness target by Marginson (2016), fairness was to be prioritised over the inclusion target set by the demand-driven system and was to be achieved well in advance of the 40% inclusion target.

> Likewise in the policy announcement, the hard edge was the statement about equity as fairness. It seemed the institutions needed little persuasion about the need to expand to meet social demand, but much persuasion on fairness (Marginson, 2011, p. 26) p. 26.

A further review of Australian university equity distribution illustrates the continued low level of rural and remote enrolments and low socioeconomic enrolments (Department of Education, 2017). A comparison of higher education enrolments from 2015 to 2016 demonstrates minor increases occurred then however low socioeconomic enrolments are still low at 16.3% of all enrolments and rural and remote student enrolments comprise only 19.3% (Department of Education, 2017).

2.12 Impact of geographic location

The underrepresentation of regional, rural, and remote students in Australian higher education continues despite the Bradley review and the Gillard Government's policy changes. Vichie (2017) maintains:

> Regional people hold the smallest number of university enrolments, which has been proportionately declining for some time. From 2007-2014, the regional proportion of all university enrolments has reduced from 1 per cent to 0.9 per cent (NCSEHE, 2015). The long-term decline has continued despite federal government funding

> offering provisions for universities to reach out to regional youth as part of the Higher Education Partnerships and Participation Program (HEPPP) since 2010. While more than a third of city youth are enrolled in university study, only 12.7 per cent of inner regional, 12.5 per cent of outer regional and 7 per cent of remote youths are currently at university (McKenzie, 2016) (Vichie, 2017 p. 30).

This underrepresentation is due to multiple issues including travel and relocation costs, social and cultural factors etc. (Hasley, 2018). The significance of this underrepresentation is of importance to any discussion of the digital divide. It is imperative that the digital divide is not merely examined from a socioeconomic perspective. The digital divide also exists between rural/urban with a "focus on the degree of usage and different usage patterns" (Salemink, Strijker, & Bosworth, 2017).
Halsey (2018)'s *Independent Review into Regional, Rural and Remote Education* (IRRRRE) literature review examines barriers to ICT use in rural and remote schools from poor internet connections, network breakdowns, poor teacher professional development, old and outdated computers and software and the lack of technical support.

> A longitudinal study of Queensland RRR senior high school girls' attitudes towards ICT not only noted negative perceptions but a range of barriers to use of ICT in RRR schools: 'Internet connections were slow; server/network breakdowns were high; technical assistance was poor; teacher expertise and competence was insufficient; computers were old and software dated, which was exacerbated by a long wait for repairs to be completed' (Courtney & Anderson, 2010, p. 8). Attempts at professional development of teachers to enhance the use of ICT in science in rural schools were hampered by lack of school support and online support (Hubber, Chittleborough, Campbell, Jobling, & Tytler, 2010) (p. 36).

Salemink et al. (2017) completed a systematic review of 157 papers on the rural/urban digital divide in advanced countries and discuss the twin issues of connectivity and inclusion. Connectivity is defined as access to ICT tools, broadband and digital environments while inclusion is the use of such tools and environments to achieve goals within a digital space (Salemink et al., 2017). The paper finds that access only to technology does not "promote digital inclusion" (Salemink et al., 2017, p. 366). However, Hasley's (2018) review established the need for appropriate access to ICT as fundamental to incorporating digital literacy skills into the rural and remote curriculum thereby enabling inclusion. The primary difference between the two papers is that Hasley (2018) IRRRRE report is a comprehensive

review of the Australian situation while the systematic review by Salemink et al. (2017) largely misses the Australian perspective.

Hasley (2018) concludes there are many possible uses for ICT in regional, rural and remote schools and identified the primary hindrances as the lack of expertise of teachers and restricted bandwidth. An issue that causes great frustration to senior students is the inability to do the work they are set because of filters, firewalls and prohibited sites.

This social, economic and educational exclusion of rural remote communities is not new. Kent and Alston (2009) provide a compelling argument with their statement:

> Drawing on largely qualitative research conducted in 2001 and 2005 exploring the employment and educational access of young people in rural and remote areas, this article argues that ongoing rural restructuring, drought and neoliberal policy have resulted in increasing numbers of rural and remote young people becoming socially excluded. While declining employment opportunities and a need to seek education and employment elsewhere has resulted in more young people out-migrating from rural and remote areas, for those staying behind, declining participation and a growing sense of alienation and disaffection are most evident in mental health indicators, suicide rates, substance abuse, high teen pregnancy rates and violence (Alston et al., 2004; Macgarvey, 2005). We argue that increasing levels of social exclusion for many 'staying-behind' (Ni Laoire, 2001) rural and remote young people requires significant attention at Australia's policy and community levels, and the incorporation of a stronger social focus in rural policy (p. 90).

This lack of participation in higher education by rural and remote people may have less to do with distance from university than to socioeconomic status (James, 2001) :

> The present rural-urban imbalance in Australian higher education participation is unacceptable. It has far-reaching consequences for the development of rural Australia and for the nation as a whole. The lower participation rates of rural and isolated people are an integral component in a cycle of rural disadvantage (p. 470).

The literature is clear: Australian rural and remote people face numerous obstacles in engaging with the higher education sector.

2.13. Conclusion

Chapter Two began with an historical perspective to construct a narrative of the digital native. Assumptions that the digital native would be digitally fluent have been challenged.

Differing levels of digital literacy and digital fluency are common across generations and could be contributing to a digital divide in Australian higher education. The rise of the digitally skilled student who can participate equally within a digital learning environment in Australian higher education may not be realised. The chapter has discussed the increasing inequalities digital learning environments are creating in low socioeconomic and geographically disadvantaged students. Using a social justice framework, the study seeks to make the preceding theoretical contributions in an effort to create a critical consciousness about the digital divide. The link between disadvantage and digital fluency is yet to be established in Australian higher education. The following chapters of the thesis consider these factors when investigating the presence and potential impact, of a digital divide.

Chapter 3: Research Methodology and Key Theories

3.1 Introduction

The previous two chapters have examined with a digital divide is developing in higher education between those who can and those who cannot use digital technologies to build and create knowledge and have challenged the existence of the digital native. Chapter 3 examines the research methodologies utilised in the thesis from a series of interconnected studies. The chapter discusses the use of a mixed-mode approach to identify whether the divide is more pronounced in students from rural and remote areas and/or low socioeconomic backgrounds. Applying Critical Theory as the research methodology, the chapter investigates the influence of socioeconomic status and geographic location on digital fluency in the business student.

Beginning with the study's philosophical perspective, discussion then moves to the research design, theoretical underpinnings and analytical approaches. The chapter concludes with a justification of the different approaches used to investigate respondents' prior experience on digital fluency.

3.2 Philosophical Perspective

The work of philosopher and educator John Dewey provides the philosophical foundation of the thesis. Dewey's Theory of Knowledge is cognizant of Piaget's Developmental Theory and as such situates the thesis's epistemology: "Dewey is known for his analysis of experience and its centrality to education" (Noddings, 2011, p. 78). Dewey's discussion of experience, emphasising constructing knowledge from prior experience and the development of personal meaning, is relevant to the study of the digital divide. In particular, Dewey's focus on experience and knowledge construction fits within the social justice framework of the thesis (Noddings, 2011).

The thesis draws on the principles of Critical Theory, thus enabling the consideration of the digital divide within socioeconomic and sociocultural contexts. Critical Theory sits in the alterative inquiry paradigm as a blend of postmodern and post structural substrands (Guba & Lincoln, 2005). The use of alterative inquiry paradigms is a response to the challenges of applying conventional quantitative methodologies to qualitative data (Guba & Lincoln, 2005). In Table 5 Denzin and Lincoln (2011) position Critical Theory as an alternative inquiry paradigm. A paradigm is a basic set of beliefs that represents a worldview which situates the research. This thesis applies Critical Theory to examine the digital divide and the distribution of resources.

Table 5. Basic beliefs of alternative inquiry paradigms

Issue	Positivism	Post positivism	Critical Theory et al	Constructivism
Ontology	Naïve realism – 'real' reality but apprehensible	Critical realism – 'real' reality but only imperfectly and probabilistically apprehensible	Historical realism – virtual reality shaped by social, political, cultural, economic, ethnic, and gender values; crystallized over time	Relativism – local and specific co-constructed realities
Epistemology	Dualist/objectivist; findings true	Modified dualist/objectivist; critical tradition/community; findings probably true	Transactional/ subjectivist; value-mediated findings	Transactional/ subjectivist; co-created findings
Methodology	Experimental / manipulative; verification of hypothesis; chiefly quantitative methods	Modified experimental/ manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods	Dialogic/ Dialectical	Hermeneutical / dialectical

Source: Denzin and Lincoln (2011, p. 98)

Critical Theory and Constructivism were both considered to underpin the research, however, the historical insight and post-colonial aspirations of Critical Theory was deemed the best fit for the study's aims (Denzin & Lincoln, 2011). Further, the thesis' dialogic's multi-voiced, emotional and ethical approach, together with the synthesis of the dialectical methodology, positions the thesis in Critical Theory (Denzin & Lincoln, 2011). As outlined in Table 5 and Table 6, Critical Theory's ontology is shaped by structural insights formed from political, social, cultural and economic perspectives, whereas Constructivism is situated in the local and co-constructed realities of the individual and collective consensus, not historical and structural insights (Denzin & Lincoln, 2011).

Furthermore, within the Critical Theory paradigm the researcher is held to be a "transformative intellectual" challenging predecessor paradigms (Denzin & Lincoln, 2011, p. 99). The researcher's social justice and equity values form part of the study as espoused in

Table 6, thereby facilitating the researcher's values of equity and just distribution to be included in the analysis.

Table 6. Paradigm positions of selected practical issues

Item	Critical Theory et al.	Constructivism
Inquiry aim	Critique and transformation; restitution and emancipation	Understanding; reconstruction
Nature of Knowledge	Structural/historical insights	Individual or collective reconstructions coalescing around consensus
Knowledge accumulation	Historical revisionism; generalisation by similarity	More informed and sophisticated reconstructions, vicarious experience
Goodness or quality criteria	Historical situatedness; erosion of ignorance and misapprehension; action stimulus	Trustworthiness and authenticity, including catalysis for action
Values	Included – formative	Included – formative
Ethics	Intrinsic: moral tilt towards revelation	Intrinsic: process tilt towards revelation; special problems
Voice	"Transformative intellectual" as advocate and activist	"Passionate participant" as facilitator of multi-voice reconstruction
Training	Re-socialisation; qualitative and quantitative; history; values of altruism, empowerment and liberation.	Same as Critical Theory
Accommodation	Incommensurable with previous two	Same as Critical Theory
Hegemony	Seeking recognition and input; offering challenges to predecessor paradigms, aligned with postcolonial aspirations	Same as Critical Theory

Source: Author Adaptation of Denzin and Lincoln (2011, p. 99)

3.3 Social Justice Framework

In seeking to establish a relationship between socioeconomic status, geographic status and the digital divide, the three studies undertaken were positioned in a social justice framework. The studies examined disadvantage indicators such as socioeconomic status, geographic location and sociocultural positions for example, and first in family to undertake tertiary study, within a social justice framework.

This social justice framework is best addressed by Noddings (2011):

> Distributing elite knowledge more justly will not in itself effect the redistribution of a society's material goods, and the effort may well act against redistribution by causing 1) a redefinition of elite knowledge, 2) deprivation of knowledge that could be

> genuinely useful to oppressed groups, and 3) a widespread sense that society has 'tried' and that the failure of groups who must do the ill-paid work of society is their own fault (p. 241).

Devlin (2013a) situates the debate in an Australian perspective with the assertion that the focus should not just be on access:

> but also on success and achievement for all students once they have gained access, pointing to the International Association of Universities (2008) who have adopted the principle that 'access without a reasonable chance of success is an empty phrase' (p. 939).

Positioning the study within a social justice framework addressed the issues of inequality driven by the digital divide and the development of digital fluencies. The focus remained on the unequal distribution of resources, classified in this thesis as access, connectivity, engagement, inclusion and opportunity to access digital fluency enablers. Of interest is that even with the barriers faced by first-in-family status and low socioeconomic status, these students often still succeed in higher education (Devlin & O'Shea, 2012; Gale, 2014; Luzeckyj, King, Scutter, & Brinkworth, 2011)

3.4 Theory of Planned Behaviour

Digital fluency and digital divide research are evolving fields and as such there was no validated scale or model on which to base the analysis. Therefore, the Theory of Planned Behaviour (TPB) developed originally by Ajzen (1991) and refined since then formed the foundation of analysis, specifically perceived behavioural control for actual behavioural intent and performance. The Technology Acceptance Model (TAM) states that technological intent to adopt is predicated on the perceived ease of use and perceived usefulness of a technological platform or tool (Davis, 1989; Venkatesh & Davis, 2000). The TAM was not considered appropriate as the development of digital fluency is based on the development of digital skills not on technology adoption per se (Chu & Chen, 2016). This research seeks to identity the existence and impact of a digital divide not on technology adoption.

Study 1 was constructed around the interplay of digital resource distribution, attitudes, influences, fluency and perceived preparedness for university study. Figure 14 illustrates the theoretical overview of the proposed concept model for preparedness for university.

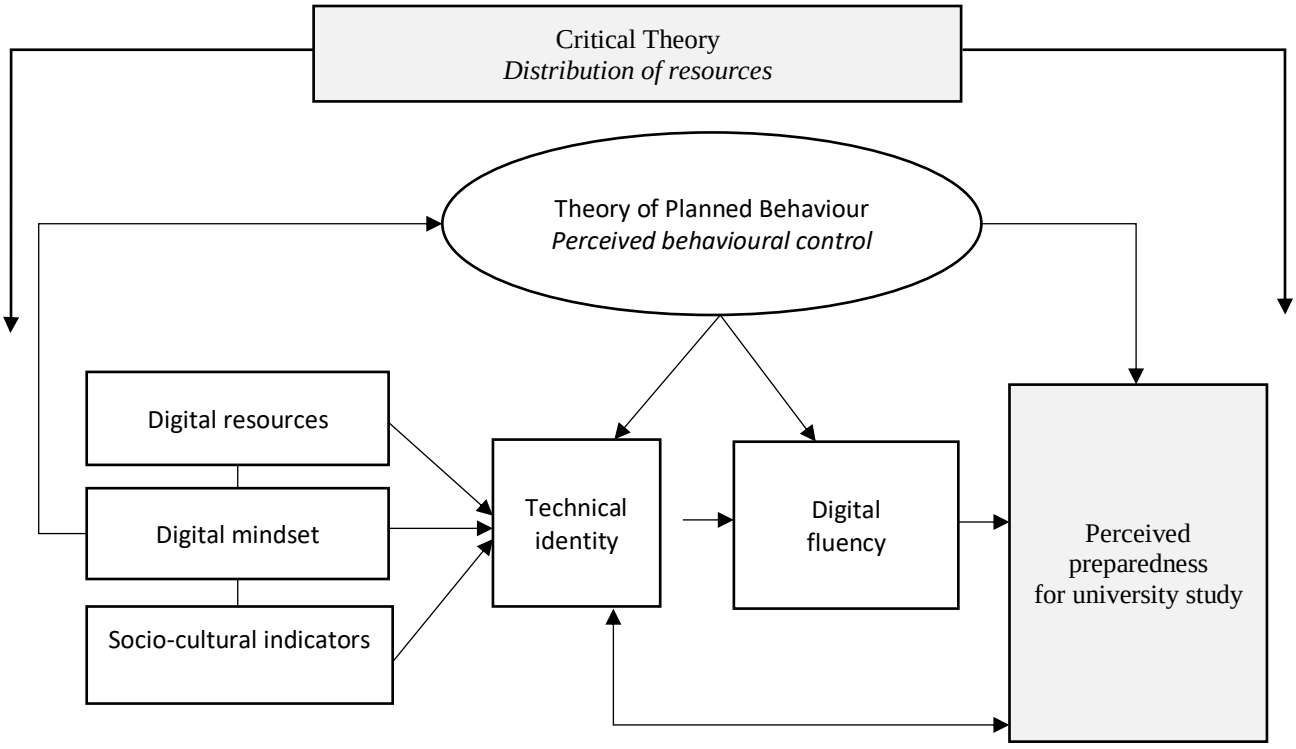


Figure 14 Preparedness for university proposed concept model

If an individual has limited access to resources, in this instance secondary school digital resources, they may perceive themselves as underprepared or to have insufficient competencies to succeed in a digital learning environment. Chu and Chen (2016) capture this with the assertion that motivational implications are paramount in TPB:

> That is, an unmotivated individual might have less intention to perform a particular behaviour as it is perceived as the individual has insufficient capabilities or resources, even though the individual holds a positive attitude towards that behaviour and perceives the support from important others (Ajzen & Madden, 1986; Chu & Chen, 2016, p. 39).

TPB espouses the likelihood of behavioural achievement based on access to resources and opportunities: “The importance of actual behaviour control is self-evident: The resources and opportunities available to a person must to some extent dictate the likelihood of behavioural achievement” (Ajzen, 1991, p. 183).

Critical Theory is also applied to investigate the influence of disadvantage indicators on digital fluency of the first-year business student in higher education. As noted earlier, Critical Theory’s philosophical paradigm focuses the study on socioeconomic and sociocultural contexts and is the overarching premise thesis. This positions the study to explore whether

an unequal distribution of school technological resources exists and if so, whether resources distribution impacts on digital fluency development and contributes to a digital divide.

3.5 Research conceptual map

The research conceptual map in Figure 15 provides an overview of the concepts that inform the research. Devlin (2013a) and sociocultural capital situates the research in the participant's prior experience with the interplay of demographic features included in the sociocultural factors. Briggs and Makice's (2012) stages of digital fluency of knowledge, skills and mindset form the other side of the map. This approach builds a Techno-biography and identifies the influences which build digital fluency by combining technical identity (Goode 2010), 21st century skills (Crocket et al 2012), social cultural capital (Devlin 2013a; Gale & Parker 2017) and digital skills development (Briggs & Makice 2012). This Techno-biography (described in further detail in Section 3.10) provides a visual representation of digital fluency influences and situates Study 2 and 3 participants according to their fluency level.

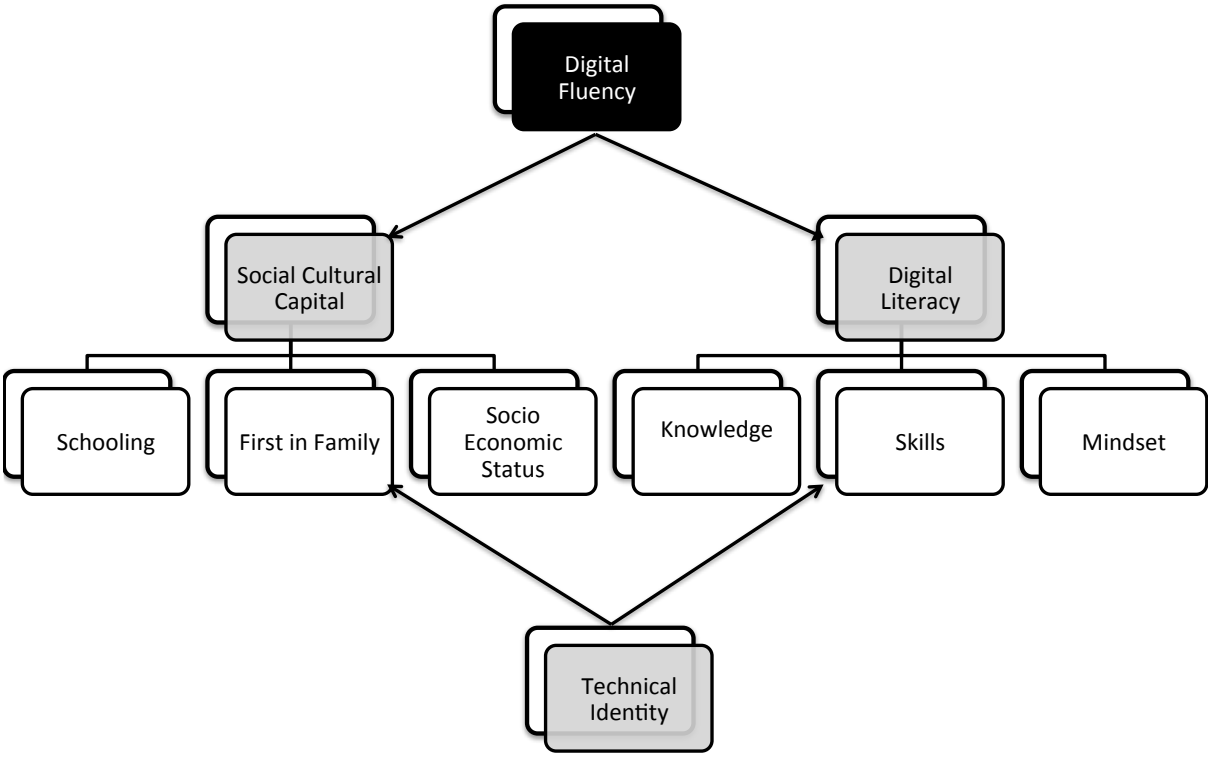


Figure 15 Research Conceptual Map Source: author originated

3.6 Methodological and Analytical Approaches

A mixed mode of qualitative and quantitative research methods was employed in three separate yet interconnecting studies. This enabled the researcher to identify whether sociocultural factors are contributing to a digital divide in higher education and to facilitate an investigation into respondents' prior experience and skills in digital technologies. This ability to observe each respondent's past experience and socioeconomic and sociocultural positions contributes to identifying influences in the development of digital fluencies. Grounded in Dewey's (1904) Theory of Knowledge, this methodological approach enabled the researcher to propose, design and test digital fluencies through the observation of past and prior experiences, and how these experiences have influenced each respondent's digital fluency and digital identity (Noddings, 2011). Muis, Bendixen, and Haerle (2006) address the rising prominence within educational research in their study of "individuals' beliefs about the nature of knowledge and knowing, or epistemic beliefs" (p. 4.). It is within this context of individual knowledge and prior experience that the research methods used provide data that contribute to the overall knowledge of the development and/or hindrance of digital fluency development.

Table 7 illustrates the research design methods. The mixed-mode method includes survey questionnaire, a digital fluency test and individual interviews.

Table 7 Study's Research Methods

Study	Research Methods
Study 1	Quantitative - Survey questionnaire - Self-reported digital skills
Study 2	Quantitative - Digital fluency test - Test digital skills and digital fluency
Study 3	Qualitative - 15 individual interviews - An analysis of secondary data collected from Study 1 and Study 2

The three interconnecting studies were grounded in theoretical concepts as outlined in Table 8. These theoretical concepts provide the underpinning analysis of the research and are explained further in this chapter.

Table 8 Research Design Methodologies

Theoretical Concepts	Sociocultural context	School technical identity	Stages of figital fluency (Briggs & Makice, 2012) adapted by author	Technical Identity Theory (Joanna Goode, 2010) adapted by author
Method	Survey Interview	Survey Interview	Survey Interview Digital test	Survey Interview Digital test
Indicators	Sociocultural capital Schooling First in Family Socioeconomic status	Connectivity Access to ICT Inclusion Usage Curriculum rich in digital technologies (Salemink et al., 2017) Pedagogical practice Digital learning opportunities Influences Digital opportunities and development Digital experiences	Anti-literacy Knowledge Skills Mindset Pre-literacy Knowledge Skills Mindset Literacy Knowledge Skills Mindset Digital fluency Knowledge Skills Mindset	Digital inequity Access to digital technologies Schooling Digital harms Sociocultural capital Digital immersion Techno-influences Attitude Digital experiences Digital ease Adaptive to change in a digital environment Fluency Digital influences
Outcomes	Quantitative research outcomes 409 survey results Fifteen digital test results Qualitative research outcomes Fifteen Techno-biography case studies			

3.7 Data Collection Tools

Data collection tools included a survey questionnaire, a digital fluency test and an individual interview. As noted in Table 8, quantitative and qualitative research methods were used to survey 233 students in a first-year business studies subject in a regional Australian university. Due to the lack of high socioeconomic student representation at the regional university, a further 176 students at a metropolitan Australian university were also surveyed. This also enabled comparisons to form between the two university cohorts.

Fifteen of the 233 regional and rural students undertook a digital fluency test using TechSmith Morae software to track their progress. The tests were followed by an interview.

The interviews were then compared with the digital fluency test results and their survey responses to develop 15 Techno-biography case studies.
As illustrated in Table 8 the survey instrument was informed by Technology Identity Theory J. Goode (2010); Information Fluency Indicators, Crockett et al. (2012) and the Stages of Fluency, Briggs and Makice (2012).

3.8 Study 1 – The Questionnaire

Both TPB and Critical Theory informed the survey instrument by focusing on access to and distribution of resources. These theories underpin the investigation of respondents' prior experience to observe whether past experience and socioeconomic/sociocultural positions influence the development of digital fluencies. Study 1 was split into two sections: 1A and 1B. Study 1A surveyed 236 students enrolled in a first-year Bachelor of Business subject at a regional Australian university. The survey was then replicated at an urban Australian university where 173 students who were enrolled in a first-year Bachelor of Business subject were surveyed. The key findings are reported in Chapter 4.

The concept of how sociocultural influences and access to quality education develops our technological identity (J. Goode, 2010). According to this theory, technological identity is based on:

> beliefs about one's technology skills, beliefs about opportunities and constraints to use technology, beliefs about the importance of technology, and beliefs about one's own motivation to learn more about technology (p. 498).

The identification of digital fluency indicators in the questionnaire was constructed around Briggs and Makice (2012) four stages of digital fluency: Anti-Literacy; Pre-Literacy; Literacy; and Fluency.

> Stage 1. Anti-Literacy: no significance or value is applied to digital technologies.
> Stage 2. Pre-Literacy: Digital technologies are seen to have value but no skill set have been developed in the use of digital skills.
> Stage 3. Literacy: A digital skill set has been developed but is rudimentary and focused on what and how to use digital technologies.
> Stage 4. Digital Fluency: The digitally fluent know what to use and how to use digital technologies. Fluency is achieved by being able to move from one platform to another with ease and to understand when and why digital technologies would be used. (Briggs & Makice, 2012)

Appendix 1 maps the study's theoretical contribution and digital divide and digital fluency theoretical concepts to the survey questionnaire.

3.9 The survey sample group

First-year business students from cohorts in 2017 and 2018 were chosen as the survey sample. This sample represents a cohort entering the Australian university sector who had been educated since the 2008 National Secondary School Computer Fund (NSSCF) which funded the introduction of school-issued laptops in secondary school from Years 9-12 (DEEWR, 2008).

This fund was part of the Australian Government Digital Education Revolution (DER) program. A review of the fund in 2011 concluded the following:

> The Digital Education Revolution (DER) is a substantial program aimed at changing teaching and learning in Australian schools, to prepare students for further education and training and to live and work in a digital world. The major component of the DER program is the National Secondary Schools Computer Fund (NSSCF), which provides funding to take all Australian secondary schools to a computer-to-student ratio of 1:1 for students in Years 9 to 12, by 31 December 2011. The NSSCF was initially devised to provide funding for new ICT in schools, before being extended to also provide for the on-costs associated with computers purchased, at a total cost of some $2.2 billion. In early 2008, at the outset of the NSSCF, 90 per cent of schools reported a computer-to-student ratio of worse than 1:2.(DEEWR, 2011)p. 17)

This sample was also the cohort educated during significant digital disruption, after the ubiquitous use of social media networks and the 2007 introduction of smart phones (D. G. Oblinger, 2010). The majority of this cohort were born just before or in the first years of the new millennium, had access to digital technologies and were expected to revolutionise the education sector. As the personification of Prensky (2001) "digital native", this cohort was chosen as the best sample to represent the digital environment in higher education.

3.10 Survey questionnaire

Eleven third-year business students from the regional university participated in a pilot group to review the survey questionnaire and information sheet. Members of the pilot group were informed that the survey questions had been developed to observe whether past experiences, socioeconomic and sociocultural positions influence the development of digital fluency. Feedback from the pilot group prompted the inclusion of Question 36: "I use Wikipedia to research my assignment". The pilot group said the majority of students

researched using Wikipedia. The group also sought clarity about some of the wording in the questionnaire and changed the following questions:

- Question 48: online tests was changed to include LMS quizzes, Wiley and Aplia.
- Question 53: the inclusion of a description of social networking
- Question 54: the inclusion of Facebook, Instagram, Snapchat.

The pilot group also wanted a definition of digital fluency in the information sheet and more information around the design of the research. Appendix 2 illustrates the questionnaire after pilot-group feedback.

Once the changes were made to the questionnaire and information, 409 students from regional and an urban university were invited to participate in Study 1. Self-reported digital literacy skills, information fluency and the respondents' online enrolment experiences were measured to find the level of digital fluency. Based on these indicators, the measurements were correlated against demographic factors and access to digital devices. Survey questions centred on each respondent's beliefs about the importance, motivation, constraints and opportunities of technology. Table 9 outlines the survey questions.

Table 9 Study 1 Digital Divide Questions

Survey Questions
Socioeconomic status & digital equity
Student Number:
What secondary school did you attend?
I had a school-issued laptop during my secondary schooling
I had a personal computer or laptop during my secondary schooling
I have used computers/digital technologies throughout my schooling
Sociocultural capital
My school had a learning management system
It was difficult to enrol online at university
I needed help to enrol online
I couldn't enrol online
I need help to enrol online. If yes, who helped you? Family/Friends/Staff
I needed to contact the student centre for help to enrol
It was difficult to set up my class registrations
Digital identity and fluency
I was well prepared by my school for university-level study
I was well prepared by my school to study in a digital learning environment
I would rate myself as having excellent digital technology skills
I grew up using computers/digital technologies
My parents/caregivers actively use computers/digital technologies in the workplace and home
My parents/caregivers keep up with the latest trends in technology
I would rate my parents/caregivers as having good computer/digital technologyskills
I feel it is important to be able to access the internet any time I want to

I think it is important to keep up with the latest trends in technology
I believe there is one “right way” to use digital technologies
I can quickly learn how to use a new technology
I am able to jump from one kind of digital technology to another to achieve my goals
I recognise the potential uses for digital technologies
I take comfort with the fact that there is no “best” way to use a technology
I think technologies, not people, always cause success or failure
I think high social media use always causes a decrease in face-to-face communication
I often oversimplify or underestimate the role of a new technology
I understand the types of potential value in using social media
I have a large number of followers on social media
I believe change is necessary
I embrace change as opportunity
Information fluency
I use the university Library One Search to research my assignments
I use university Lib Guides to research my assignments
I use Google or other search engines to research my assignments
I use Google Scholar to research my assignments
I use Wikipedia to research my assignments
I only use peer-reviewed articles for my assignments
I use online referengin tools eg. Endnote, Cite this for me or Easy bib
I critically evaluate information by checking the content is fair, valid and current
I evaluate and interpret online sources by checking for bias
Self-reported digital literacy skills
Microsoft Word or equivalent
Excel
PowerPoint
Email
Outlook calendar or equivalent
University learning management system
PebblePad
Online tests
Posting to Blogs and Wikis
Adobe Acrobat Professional
Graphics packages e.g. Adobe Photoshop, Microsoft Paint etc.
Post material to social networking sites e.g. Facebook, Instagram
Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat
Editing video and sound recordings.

Appendix 1 maps the survey questionnaire to theoretical concepts. Each question block represents a concept and is mapped to the underpinning theory or concept, commencing with socioeconomic factors and access and equity to digital technologies. The first question block is linked to Devlin (2013a) discourse on sociocultural capital. Socioeconomic status was identified in the study using the student’s postcode. This SES postcode system is not a clear illustration of socioeconomic status but it was the best available to the researcher due

to the Australian higher education sector's use of the postcode system to identity SES. The questionnaire is available in Appendix 2.

3.11 Digital fluency test

The survey questionnaire allowed the collection of data on respondents' digital attitudes, mindset and self-reported knowledge and skills but further evidence was required to test actual digital skills and 21st century fluency (Crockett et al., 2012). A digital fluency test study was created on the usability testing platform TechSmith Morae,. This platform enabled the researcher to record, observe and analyse participants' interactions through a series of digital tests. The platform recorded the participants' desktop as they progressed through the tests, analysed mouse clicks, mouse movements and time taken on each task. A picture of the participant was also recorded via webcam to gauge facial expressions and speech. Time on task, mouse clicks and mouse movement were counted and contributed to the overall picture of the participants' test performance. Further discussion on usability testing measurements is included in Chapter 5.

The platform included five tests (Table 10).

Table 10 Digital Fluency Test

Study Name	**Digital Divide Study**	
Study Description	This Digital Divide Study will include multiple computer-based tasks	
Study Instructions	There are five tasks to complete that should not take more than 30 minutes. You will be guided through the study and prompted to use particular software applications to complete a goal, however, you may use any other available software applications if you need to. The tasks build upon each other so completing each to the best of your ability will be an advantage for completing subsequent tasks.	
Task 1. Excel	Using a set of variables develop a bar chart	Use these pairs of data to construct a bar graph: Year Size 2010 3020 2011 4570 2012 4812 2013 5534 2014 3872 2015 5867 2016 6441
Task 2. Word	Using Word to format your Excel output	Using Word, complete these tasks in order: 1. Insert your chart from Task 1 into a new Word file 2. Centre the chart in wrap-around text 3. Change the chart variables

		4. Move the legend to the bottom 5. Change the bar chart to a pie chart
Task 3. Blog	Create a blog	Open LearnJCU and navigate to the Organisation site *Help and Support* at: https://learn.jcu.edu.au/ultra/organization/_72928_1 1. Go to the **Digital Divide Study** link in the left menu 2. Create a blog page. 3. Transfer the pie chart from Word (Task 2) to the blog page 4. Save the blog page.
Task 4. Research	Essay Research	Hypothetically, as part of your assessment in a 2nd year business subject, you are to write an essay on leadership styles. 1. Locate three articles which you could reference in your essay.
Task 5. Media article	Research a Topic	Please read this article http://www.dailymail.co.uk/health/article-2699875/I-cured-cancer-CANNABIS-OIL.html 1. Investigate if claims that "Cannabis can cure cancer" are based on scientific evidence. True or False?
Research Question	Answer the following question (T / F)	Are the claims that "Cannabis can cure cancer" based on scientific evidence? o True o False
Study Question	Answer the following question (open answer)	Do you have any comments on the previous question? and/or final thoughts about the study?

The first two tasks used Excel and Word activities to test the participants' digital literacy. They were simple in design and required the participant to develop a bar chart in Excel and transfer it to Word along with some editing requirements. Task 3 required the participant to insert a pie chart in a blog. The blog interface did not allow the participant to copy and paste the pie chart created in word. Participants had to save the pie chart as an image then upload the image file to the blog. As the blog did not have an intuitive interface, many participants struggled to find a way to insert the pie chart. This task was chosen to: a) test the ability of participants to perform across platforms that were not intuitive; and b) test the participants; digital problem-solving skills and strategies.

The fourth task was to identify what search engines participants used to research a university essay and whether the papers chosen were current, valid, scholarly and peer reviewed. Here the researcher was seeking to identify whether participants used a university's library search system, Google Scholar or other less scholarly search engines

such as Wikipedia. The task was linked to 21st century fluencies Crockett et al. (2012), to assess whether the participant identified, interpreted and validated information for the university essay. Crockett et al. (2012) referred to this as information fluency.
The fifth task was again linked to 21st century fluencies Crockett et al. (2012) and sought to test the participants' ability to analyse, interpret and evaluate media communication. Participants had to read a media article concerning cannabis curing cancer and assess whether the article was true or false. Here the researcher was seeking to measure the participants' media fluency (Crockett et al., 2012). Both Tasks 4 and 5 sought to establish evidence of new fluencies which relate to the application of independent higher-order thinking skills (Crockett et al., 2012).

3.12 Techno-biography Grid

Difficulties in the research design arose with multiple theories being tested in an emerging and evolving field. Technical identity theory is valuable in mapping past experiences to digital fluency. The stages of digital fluency enable the measurement of digital skills, while (Salemink et al., 2017; Warschauer & Matuchniak, 2010) provide a base on which to identity a digital divide in terms of accessibility and use. However, none of the theorists encapsulated an Australian sociocultural perspective on the impact of the digital divide in higher education.
To overcome these issues a Techno-biography grid was designed to enable the researcher to illustratively measure the 15 case studies against the indicators listed in Table 8, Research Design Methodologies. The Techno-biography grid (Figure 16) provides a conceptualisation of the research methodologies. The Techno-biography grid measures indicators such as access, use, opportunities and influences prior experiences and sociocultural indicators to form a representation of digital fluency.

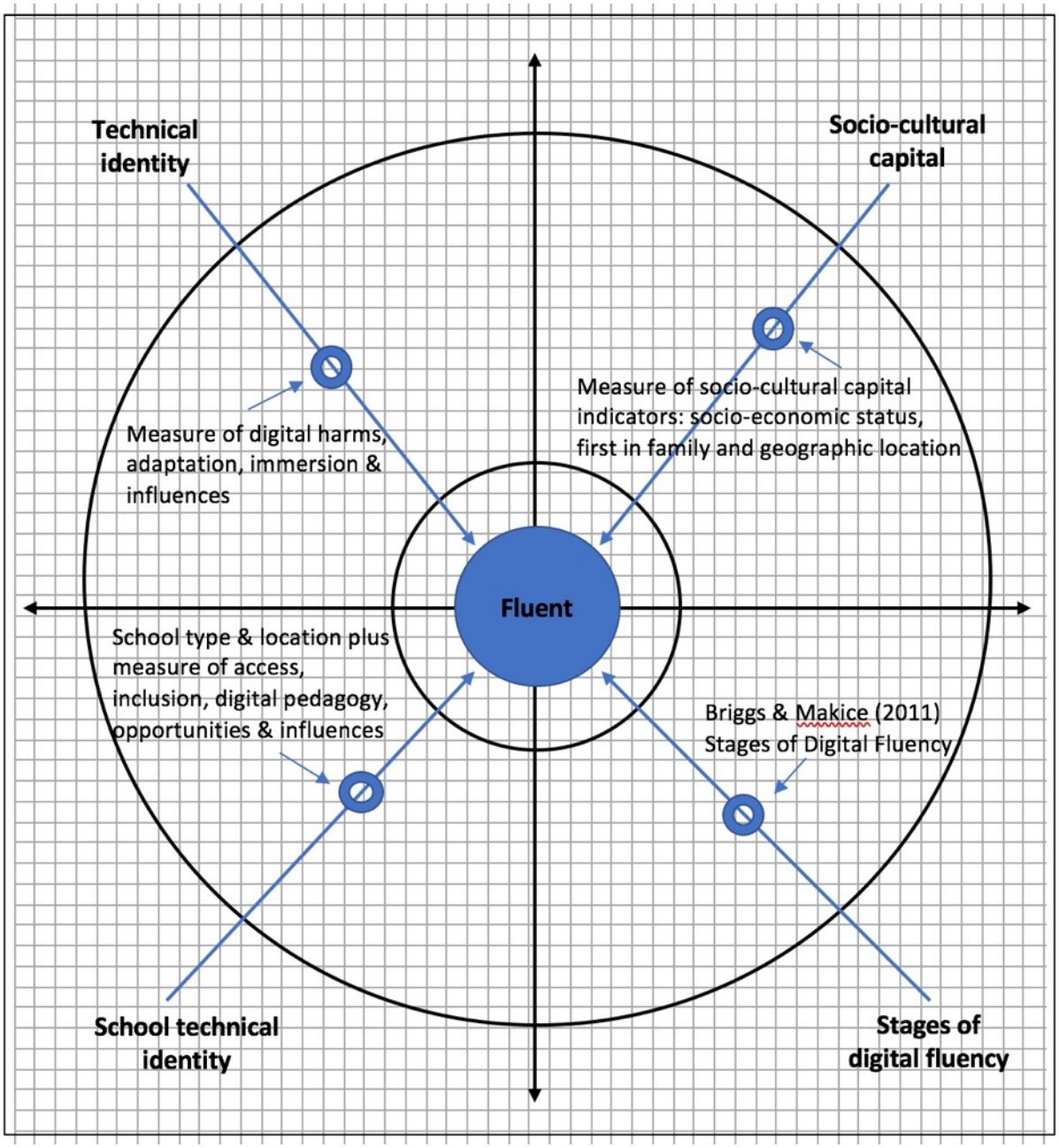


Figure 16 Techno-biography grid

3.13 Case studies: Techno-biographies

The next step in the research was to build a Techno-biography of 15 study participants and conceptualise Joanna Goode (2010) technical identity. People often describe themselves as a computer person or not a computer person. We all seem to have this perception of ourselves as either/or, however, Joanna Goode (2010) delves further into these perceptions and addresses the interplay between the use of digital technologies in our upbringing, and home and school environments which motivates us to learn and build our digital proficiency:

> Using the lens of a technology identity allows an examination of how technological proficiency is developed, how students relate to technology, and the impact of this

relationship with the social and scholarly demands which occur on a university campus (Goode, 2010, p. 588).

This Technology Identity Theory informed the development of the survey and interview instruments. It brings an innovative theoretical and methodological approach to the study of the digital divide. It was then adapted and applied to the development of the each participant's school. This allowed the Techno-biographies to incorporate a school technical identity as reported by the participant. The school technical identity is illustrated in Figure 22. Table 11 lists the interview questions in the Study 3.

Table 11 Study 3 Digital Fluency Interview Questions

Interviews questions
Digital technologies and schooling 1. How did you use digital technologies in school? 2. In what ways was your school-issued laptop incorporated into your school's curriculum? 3. What did your school do to prepare you for university? 4. What could your school have done to prepare you for university?
Sociocultural capital 5. Think back to when you enrolled. Did you have any problems enrolling? If so, what: How did you feel? 6. Have you ever contacted the Business Online Team? If so, what was the reason? Was the issue resolved? How did it make you feel? 7. What were the differences between school and university digital use or environment?
Techno-influences 8. Describe your attitude to digital technologies 9. Describe your parents'/caregivers' attitude to digital technologies 10. How did you learn to use digital technologies? Who was your biggest influence?
Digital fluency 11. How often have you changed digital platforms e.g. Phones, laptops, Word? Do you make the change easily? How does learning a new digital platform make you feel? 12. Are you able to troubleshoot problems? If so what strategies do you use?

Appendix 3 links Study 3 digital fluency interview questions with the research questions and theoretical concepts. These interview questions were designed to identity what contributed to the participants' digital skills, their beliefs about their digital skills and whether they believe the digital divide has had an impact on their success in higher education.

3.14 Techno-biography concept map

Figure 17 is a representation of the Techno-biography concept map that connects the interview questions with the Research Question 1 and aligns four propositions to accomplish the theoretical contribution outcome. These propositions break down the research question into four areas: digital inequity; digital harms; digital ease; and digital immersion. Evidence gathered from Study 2 and Study 3 then informed the development of the students' Techno-biography written into each case study.

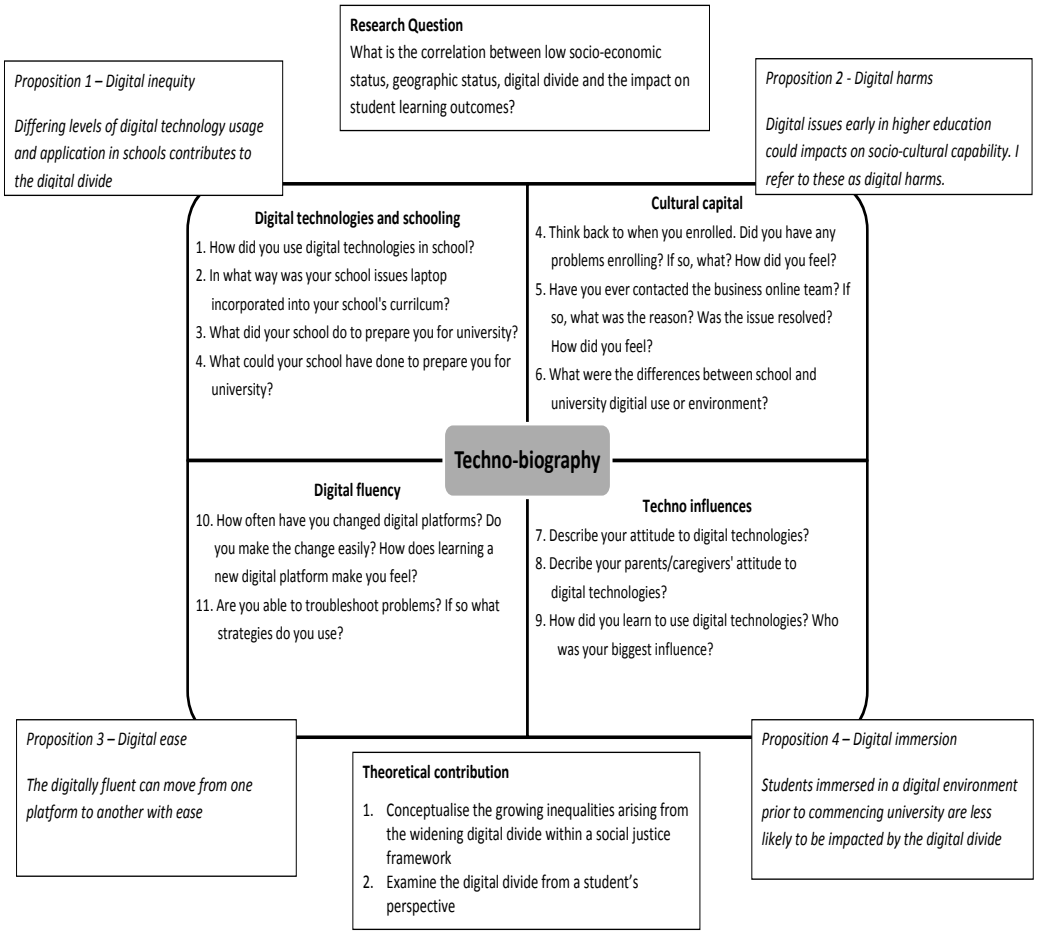


Figure 17 Technobiography concept map

The case study also includes a school technical identity to identity school influences in the development of digital fluency. The school technical identity concept map (Figure 18) is self-reported by the study participant. This concept map identifies connectivity, inclusion, pedagogical practice and influences in the use and distribution of digital resources and opportunities.

This concept maps builds a narrative of school influences on the development of the participants' digital proficiencies.

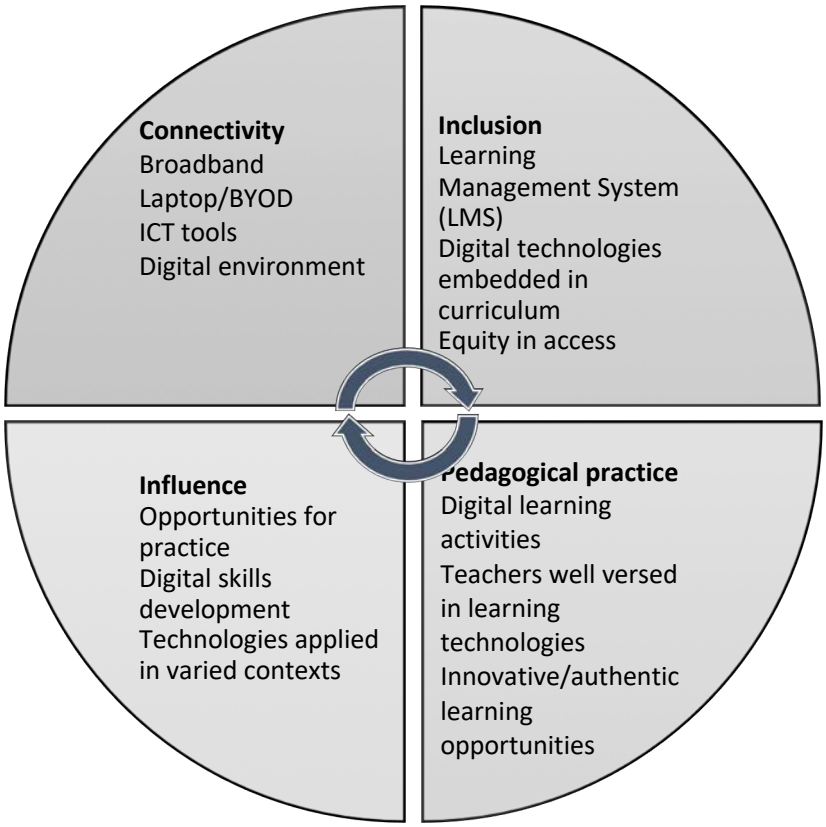


Figure 18 Student reported school technical Identity concept map

3.15 Staging and measuring Fluency

The four stages of digital fluency (Briggs & Makice, 2012) informed the survey instrument, interview questions and the digital test design. Questions relating to the knowledge, skills and mindset were included in the survey to ascertain the digital fluency stage. Interview questions relating to attitudes towards digital technologies, problem-solving technical issues and the respondents' mindset were also developed to stage the respondents' fluency. Finally Briggs and Makice (2012) stages were tested in the digital fluency test to investigate the level of actual digital skills compared with the self-reported digital skill.

21st century fluencies (Crockett et al. (2012) where also measured in the survey and digital fluency test. These 21st century fluencies include:

1. Solution fluency: problem-solving by apply and evaluating solutions
2. Information fluency: interpret and critically evaluate information to establish authenticity
3. Collaboration fluency: working collaboratively in a digital environment
4. Creative fluency: form, function and creative design

5. Media fluency: analytically interpret media messages to determine intende4d message

(Crockett et al., 2012).

These fluency measurements were incorporated into the survey instrument, interview, and the digital test by connecting questions to searching, interpreting, evaluating and validating online information.

3.16 Conclusion

Drawing on Dewey's Theory of Knowledge, Critical Theory and Ajzen's Theory of Planned Behaviour (TPB), Chapter 3 has outlined a research methodology and analytical approach situated in a social justice perspective. The research design identifies participants' sociocultural background and self-reported school digital experiences to measure digital fluency and technical identity.

The digital test summarised in Chapter 3 explains how participants were tested in a variety of digital platforms from Excel, Word, Blogs, LMS and university library and university administration programs. This digital test enabled a comparison to be drawn between self-reported and actual digital skills.

These measurements, experiences, backgrounds and digital test results helped to build a narrative which contributed to a Techno-biography. The interplay between Dewey's construction of knowledge from past experiences, TPB's distribution of resources and Critical Theory's historical realism enabled the researcher to report whether a digital divide exists in Australian higher education and if so, whether it is socio-culturally driven.

Chapter 4 The Digital Divide

4.1 Introduction

The arrival of the digital native in higher education was predicted to produce a hyperconnected digitally fluent student cohort. The digital native was expected to be able to navigate the digital learning environment with great ease and use technologies to create and reformulate knowledge. Chapter 4 presents the analysis of data from Study 1, which sought firstly to identify whether a digital divide is emerging within business students in higher education, and secondly to ascertain whether a student's digital fluency is influenced by prior digital experience, family background and/or school influences. Specifically, the study aimed to determine whether the respondents' perceived preparedness for university-level study was impacted by their level of digital fluency.

Underpinned by both the Theory of Planned Behaviour and Critical Theory, Study 1's statistical analysis was undertaken using SPSS version 25. Descriptive statistics were generated, then a series of Pearson's Chi-Square and one-way ANOVA tests was used to assess univariate relationships. Following these procedures, factor analysis with principal axis factoring and reliability tests were used to create a set of scales on the topics of fluency mindset, fluency attitude, critical literacies, creating literacies and university system literacies. These scales were then used in K-Mean Cluster analysis to develop a set of groups with similar fluency mindsets, attitudes and self-reported digital skills. These groups were compared and profiled using chi-square, one-way ANOVA and MANOVA on disadvantage indicators, for example: socioeconomic and sociocultural background, secondary school participation and geographic location. Included in the study reported here is an investigation of whether the divide is more pronounced in students from rural and remote areas and/or low socioeconomic/sociocultural backgrounds.

Two important areas conclude Study 1. These are: did respondents perceive their secondary school prepared them for university study; and how did this preparedness compare with their self-reported digital skills and digital fluency attitudes and mindsets Briggs and Makice (2012).

4.2 Statistical tests

SPSS statistical tests were performed (Figures 19 and 20). Descriptive analysis was used to examine students' demographic features, digital access and digital fluency indicators. Pearson's Chi-Square tests for association were performed and a Cramer's V test was executed to assess the strength of association. A factor analysis was then performed using principal components analysis (PCA) using Varimax rotation. The Eigenvalues, Bartlett's Test of Sphericity and overall Kaiser-Meyer-Olkin (KMO) measure were also implemented and assessed for each factor analysis to determine the appropriateness of the analyses.

Once the factors were identified, Reliability Scales with Cronbach's alpha were executed to test the dependability of scales constructed by combining items that were indicated to be related in the factor analyses. Cluster analysis was then performed to identity groups with similar fluency mindsets and attitude characteristics prior to one-way and multiple AVONAs being performed to assess whether these groups also differed in terms of their demographic characteristics and their educational background.

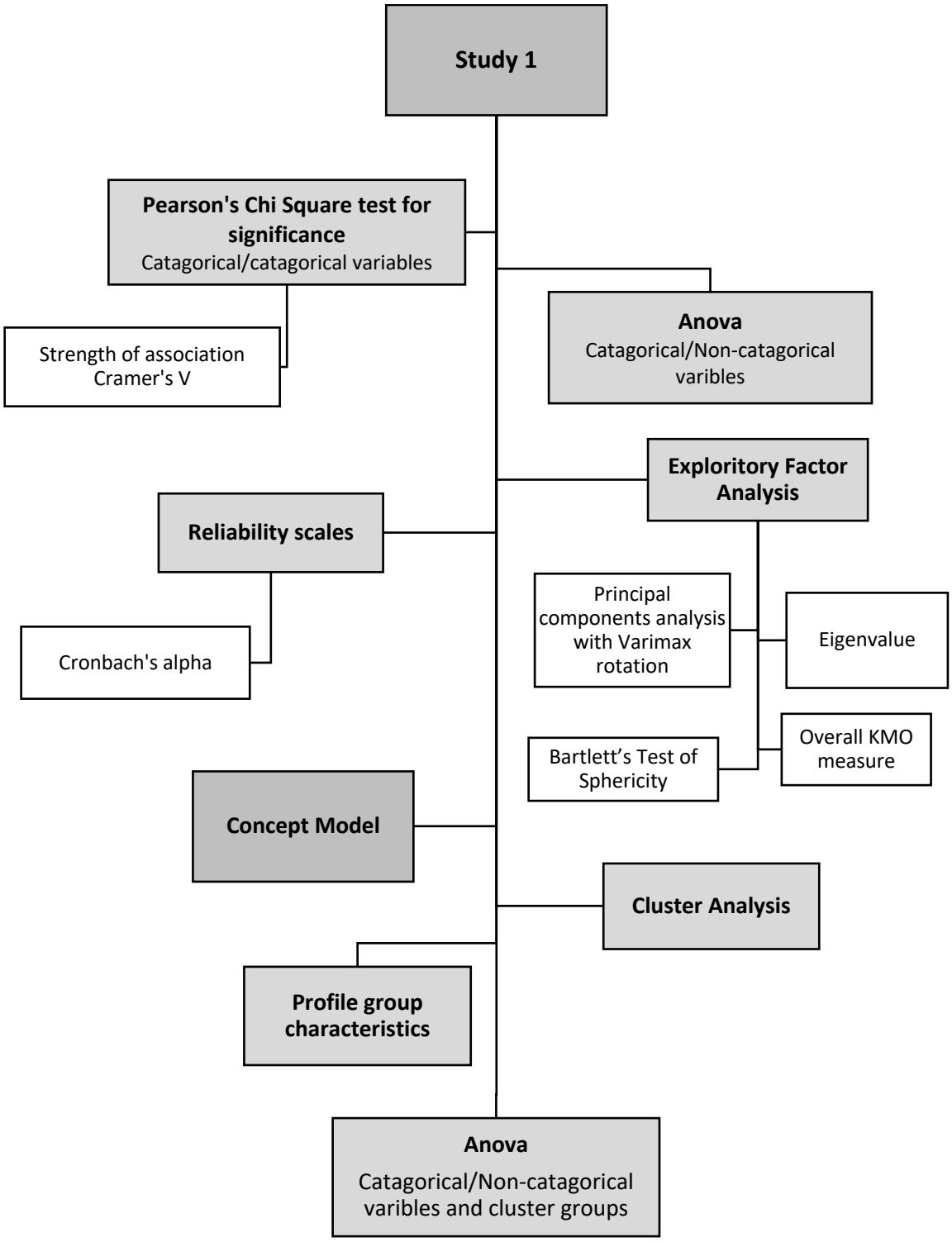


Figure 19 SPSS Statistical tests for study 1

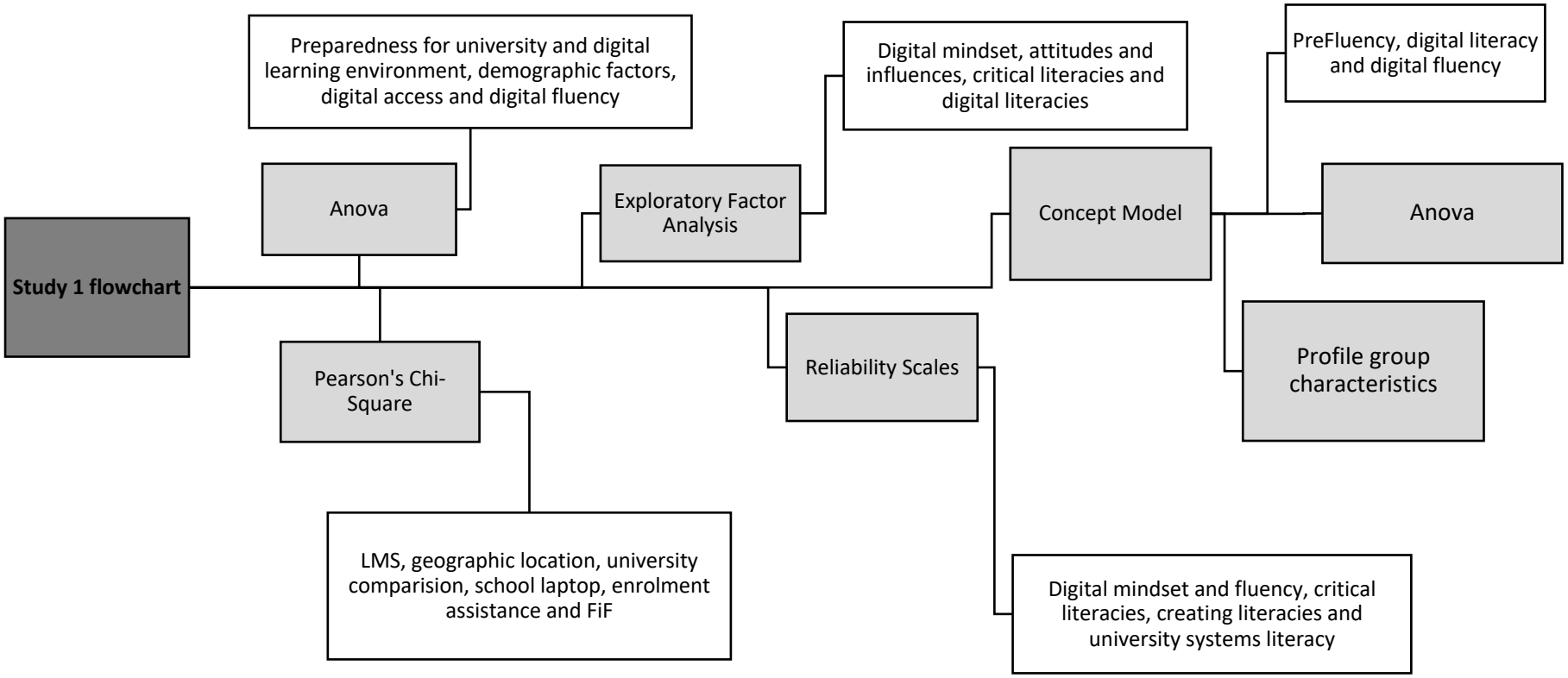


Figure 20 SPSS Statistical variable tests flowchart

4.3 The Digital Divide: Study 1 Results

To situate the study's analysis, refer to Figure 21, designed to demonstrate the number of significant relationships identified in Study 1. Figure 21 illustrates a myriad of interrelationships between dependent and independent variables. The two-way arrows illuminate the co-dependencies of the variables. For example, digital literacies, school types, fluency mindset/attitudes and access to digital technologies form a relationship with digital fluency but are also influenced by socioeconomic, demographic, sociocultural capital and geographic factors.

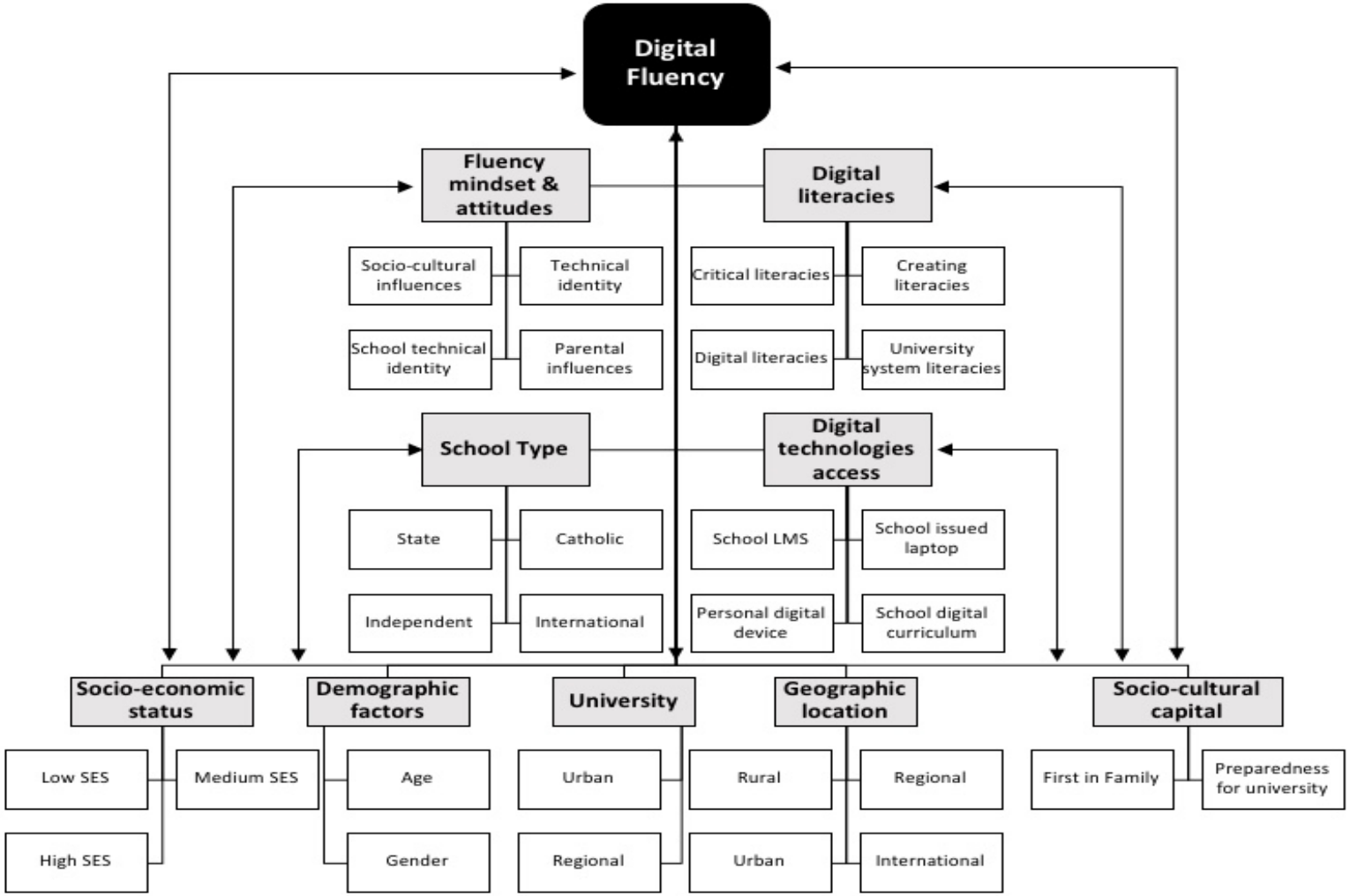


Figure 21 Interrelationship between variables

Study 1 was conducted at a regional Australian university and an urban Australian university across the 2017 and 2018 1st year business student cohort and 259 questionnaires were distributed at the regional university in marketing and management lectures with 236 returned completed: a 91% response rate. At the urban university, 179 questionnaires were handed out in marketing and management lectures with 173 questionnaires returned completed: a 96% response rate. The high response rates could be contributed to the questionnaires being handed out in paper form and collected in the lectures. Students were informed they did not have to participate in the survey and were entitled to hand back a blank questionnaire. A combined total of 409 participants were thus surveyed to determine whether disadvantage indicators impact on digital fluency and contribute to a digital divide in higher education. Table 12 below illustrates the study's demographics.

Table 12 Study 1 Demographics

Variable	Category	Distribution	
		Frequency	Percentage
University	Urban	173	42%
	Rural	236	58%
Gender	Male	151	43%
	Female	202	57%
Age group	School leaver (<20yrs)	226	65%
	Post-school leaver (20-24yrs)	114	32%
	Mature aged (>24yrs)	10	3%
Socioeconomic status	High	33	13%
	Medium	154	62%
	Low	62	25%
First in Family	First in Family	141	41%
	Not First in Family	207	59%
Geographic location	Urban	62	19%
	Regional city	145	43%
	Rural	60	18%
	International	68	20%
Secondary school type	Private independent	63	17%
	Catholic	91	24%
	State	132	35%
	International	88	24%

4.4 Demographic and digital access results

Respondents from regional, rural, and remote schools were more likely to be from first-in-family and low socioeconomic backgrounds and first in family. In regional and rural schools,

69.1% were first-in-family $\chi^2(3) = 24.743$ $p < .001$ with a moderately strong association of Cramer's V = .277 (Cohen, 2013).

Questions designed to measure access to digital devices during secondary schooling established 51% had a school-issued laptop, 73.9% had a personal computer/laptop and 92.6% responded they had used computers/digital technologies throughout secondary schooling. Furthermore, 81.1% agreed they were well prepared by school to study in a digital learning environment, which suggests – even with an overrepresentation of medium-to-low socioeconomic status – the participants were identifying as having access to technology during school. This created some difficulties in measuring relationships between socioeconomic and attitudinal variables and "preparedness" due to lack of variance in the responses to the preparedness question.

Access to a digital environment was a non-issue. Participants maintained they had used digital technologies throughout their secondary schooling and were well prepared to study in a digital learning environment. Nonetheless, 24% without access to a personal computer/laptop is of concern and could be representative of the sample's socioeconomic status.

4.5 Comparison of University Demographics

An analysis of the demographic features of Study 1 in Table 12 determined that 10% more females than males participated in the regional university and 19% more females than males in the urban university survey. These figures are in line with Larkins (2018) gender analysis of Australian universities which found 58% of Australian university students are female. At the regional university, 70.7% were school leavers and 26% post-school leavers between 20-24. The figure was lower in the urban university with 58% school leavers. There was minimal participation by mature-aged participants in the study, which was unusual. The HEIMS data indicates that on average the "non-regional" universities (those with fewer than 40% students from regional or remote areas) have an average of 33% mature-age students compared with 10% at regional universities. The non-response rate of mature-aged students in the study is of concern. A review of age profile at the regional university illustrates 8% of all enrolments are mature aged yet only 3% participated in the study. This non-response rate and differences across the demographics of the cohorts may have implications for interpretation of the responses. However, the study's focus is on students who had received school-issued laptops. A mature-aged cohort is unlikely to have had access therefore this non-response rate is not expected to impact on findings.

Of note is the 54.3% first-in-family recorded at the regional university compared with 26.6% recorded at the urban university. A chi-square test shows a statistically significant association between the regional and urban university participants of a first-in-family background of $\chi^2(1) = 27.689$ $p < .001$ with a moderately strong association, Cramer's V =

.282 (Cohen, 2013). This suggests regional university participants were more likely to be from a first-in-family background.

Among regional university participants, 99.3% were low-to-medium socioeconomic status and 88.7% were from a regional or rural location. In comparison, urban university participants recorded 61.8% low-to-medium socioeconomic status and 15.9% were from a regional or rural location. Statistical significance was again recorded by means of Pearson's Chi-Square with a recording of $\chi^2(2) = 70.819$ $p < .001$ with an exceedingly strong association, Cramer's V = .533 (Cohen, 2013).

A high proportion of international students were surveyed at the urban university, with a recorded 45% compared with 9.8% at the regional university. Significant differences were also found in the types of secondary schools attended by students. A high proportion of urban university participants attended an international school outside Australia, while regional university participants were more likely to attend a State High School (45.8%) or were educated in the Catholic secondary sector (30.2%), $\chi^2(3) = 78.097$ $p < .001$ with an exceedingly strong Cramer's V = .457 (Cohen, 2013).

These demographic features suggest a fundamental difference in the student cohort between the urban and regional universities in the study. The demographic characteristics (Table 12) provide a snapshot of a regional university cohort with numerous equity and disadvantage indicators. The high proportion of first in family to participate in higher education illustrates low cultural capital (Devlin, 2013a). The fact that only one student registered as high socioeconomic status, though illustrative of the manner in which SES is collected in Australia via a postcode system, is still indicative of relative disadvantage within the regional university cohort as measured by the Australian Bureau of Statistics (ABS) SEIFA Index of Education and Population (Education, 2019). There are no postcodes in the regional university catchment that qualify as "High" socioeconomic, those in the top 25% of the nation (HEIMS, 2019).

This disadvantage is further supported by the 89% of participants from regional and rural areas attending the regional university plus the low number of regional university participants from independent schools.

Another feature of the demographic characteristics is the low proportion of international students who participated in the study from the regional university. This result is indicative of low international student enrolments in the regional university, which sits at around 7% in the Bachelor of Business. Australian regional university campuses do not attract large international student enrolments compared with their urban university counterparts (Education, 2019).

In summary, demographic and digital access results between the two universities in the study have illustrated significant differences between the two cohorts. Discussion will now

move to the relationship between the respondents' demographics, access and exposure to digital environments and their attitudes and self-reported digital proficiency.

4.6 Participants' access to digital technologies

Figure 22 illustrates university students' access to digital technologies during their secondary schooling. Overall, 53.4% of participants had access to a school-issued laptop during secondary schooling and 80% of students with school-issued laptops said they were for home use as well.

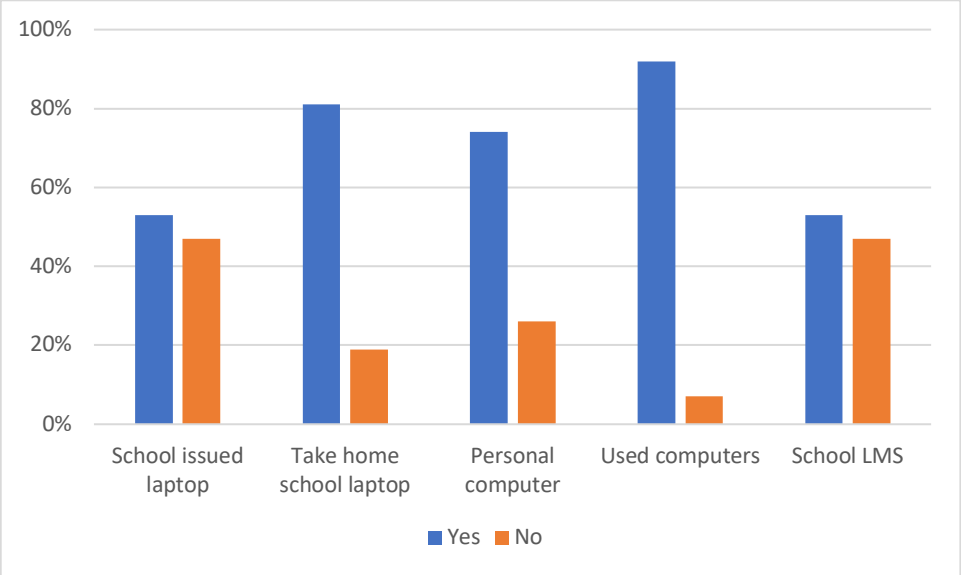


Figure 22 Access to digital devices

A Pearson's Chi-Square was performed and no statistically significant difference was established between access to personal computers and geographic location. Of the 26% without access to a personal computer or laptop during secondary schooling, 34% attended State schools and 28% attended Catholic schools. Figure 22 also demonstrates 92% of respondents used computers or digital technologies throughout secondary schooling. Questions relating to access to digital technologies sought to determine whether participants had access to a digital curriculum during their secondary schooling and 53% of respondents had access to a school LMS, which suggests a digital curriculum. The presence of an LMS at a respondent's secondary school was revealed throughout the analyses to be strongly related to the development of digital fluency, more so than a school-issued laptop, socioeconomic or sociocultural status and will be investigated further in Chapter 5.

4.7 Comparison of university online enrolment experiences

The examination of findings now moves to difficulties encountered in enrolling online, one of the measurements for digital fluency used in the study. Self-reported digital literacy skills, information fluency and the respondents' online experiences were measured to ascertain the

level of digital fluency. The measurement of the participants' online enrolment experience was to establish whether students were able to move across different digital platforms with ease and to use an unfamiliar digital environment such as a university online enrolment system. The ability to move with ease in a digital environment is deemed a fundamental 21st Century skill and a skill a digital native should be able to accomplish (Crockett et al., 2012; Dede, 2010; Silva, 2009). However, university online enrolment processes are not intuitive and can be a hindrance to students with low digital literacies or low sociocultural capital (Devlin, 2013a).

When indicators such as first in family, low socioeconomic status, school type and geographic location were combined with difficulties arising in enrolling online in university, a narrative of disadvantage developed (Figure 23) and 61% of participants from first in family experienced difficulties enrolling online ($p < .011$). From a geographic perspective, 62% of regional participants and 62% of rural participants had difficulty enrolling online compared with (a still high) 50% of urban participants. Only 42% of international participants had difficulty enrolling online ($p < .024$). State and Catholic ($p < .025$) school students were statistically more likely to have enrolment difficulties. Participants who had difficulty enrolling also rated themselves as not proficient in graphics packages ($p < .024$) and in Excel ($p < .042$). These platforms require higher-order digital literacy and the findings may indicate a lower level of digital fluency at the time of the survey (Briggs & Makice, 2012).

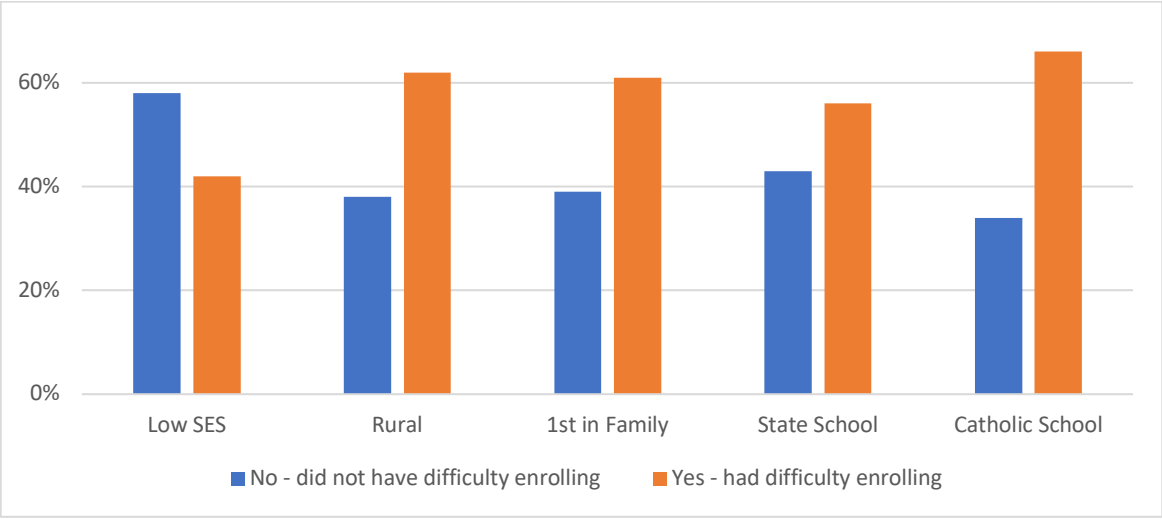


Figure 23 Study 1 University online enrolment experience with disadvantage indicators

Online enrolment experiences could be impacted by multiple issues including more complicated online enrolment processes and different enrolment websites. While the researcher does not want to place too much emphasis on online enrolment issues, disparities did arise when disadvantage indicators were applied to requiring assistance with

online enrolment. Further, the enrolment difficulties experienced by respondents from disadvantaged backgrounds could also be linked to lack of sociocultural capital to partake in university digital systems (Devlin, 2013a).

These results imply a relationship between disadvantage and digital fluency, as in the ability to move with ease across digital platforms. As indicated by the questionnaire responses and later interviews on their experience, the online enrolment experience appears to have been difficult and fraught with issues for many respondents.

4.8 Summary of univariate tests of relationships between demographic, geographic and school variables

Overall seven categorical variables displayed 98 statistically significant interactions and associations. The seven variables include access to an LMS at secondary school, geographic location during secondary school, university comparison, school-issued laptop, enrolment assistance, first in family to participate in university, and preparedness for university.

Access to an LMS in secondary school recorded the highest variance in the study against all disadvantage indicators and perceived digital ability. Appendix 4 displays Pearson's Chi-Square for significance in access to an LMS during secondary schooling and showed signficiance across 24 categorical and non-categorical variables. The decision tree (Figure 24) illustrates the differences in LMS access across geographic and school categorical variables. Of note is that urban schools were much more likely to have an LMS than regional, rural or international schools. Furthermore the decision tree illustrates that private schools were more likely to have an LMS than State and international schools, particularly those in rural areas. Within regional areas, State schools were more likely to have an LMS, and regional city schools more likely to have an LMS than international or rural schools.

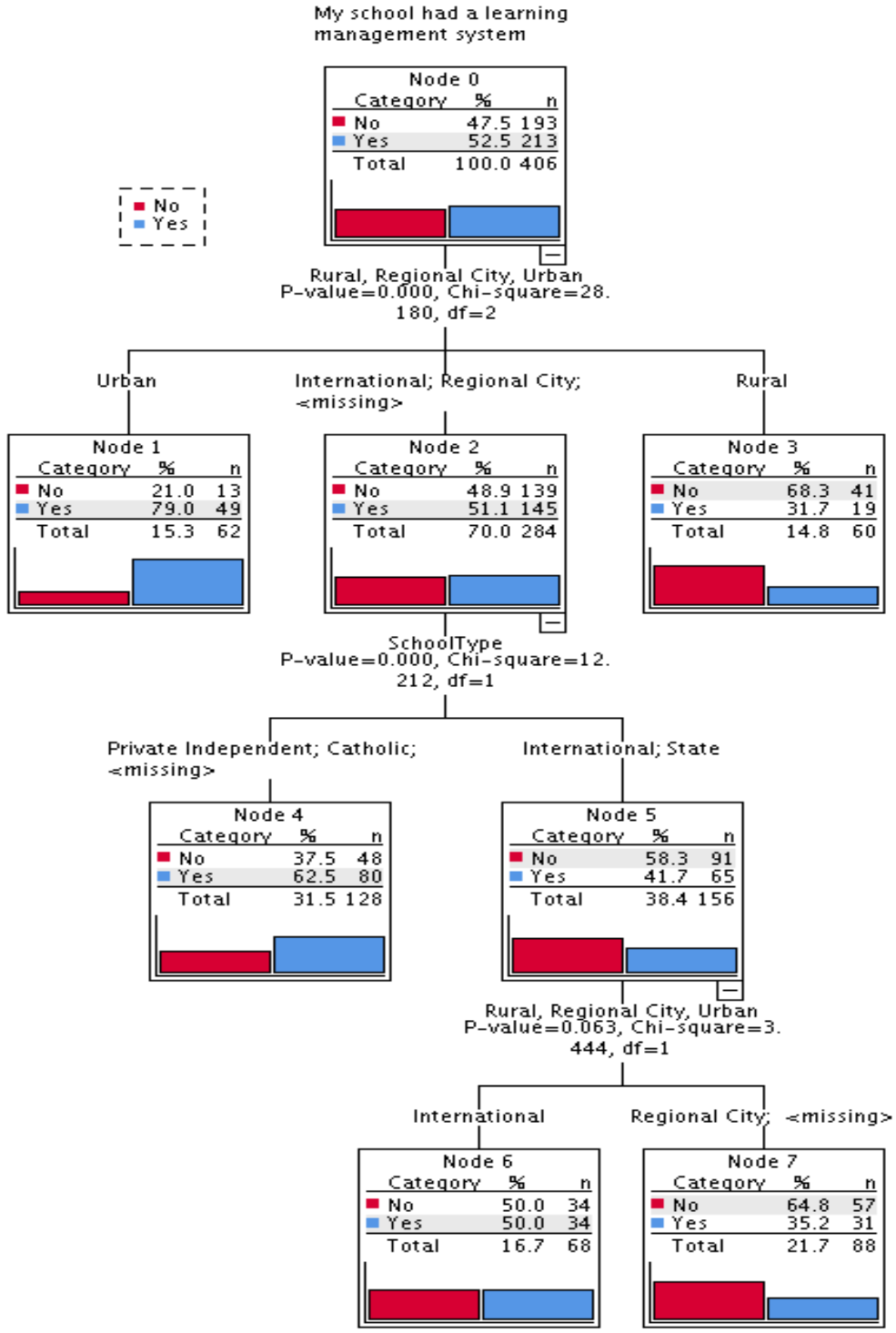


Figure 24 Access to LMS and disadvantage indicators tree

Analysis of socioeconomic status and access to an LMS during secondary schooling (Figure 25) illustrates 33% of participants from a low SES background had access to an LMS, compared with 91% of high SES background particpants with access to an LMS in

secondary school ($p < .001$). These results were reiterated in first in family and access to an LMS, with 59% of first in family not having access to an LMS ($p < .001$) compared with 37% in not first in family. This narrative continued across all disadvantage indicators including geographic location, with 68% of rural participants not having access to an LMS at secondary school, compared with 21% of their urban counterparts ($p < .001$). A further 60% of State school participants did not have access to an LMS compared with 25% of private independent school participants ($p < .001$).

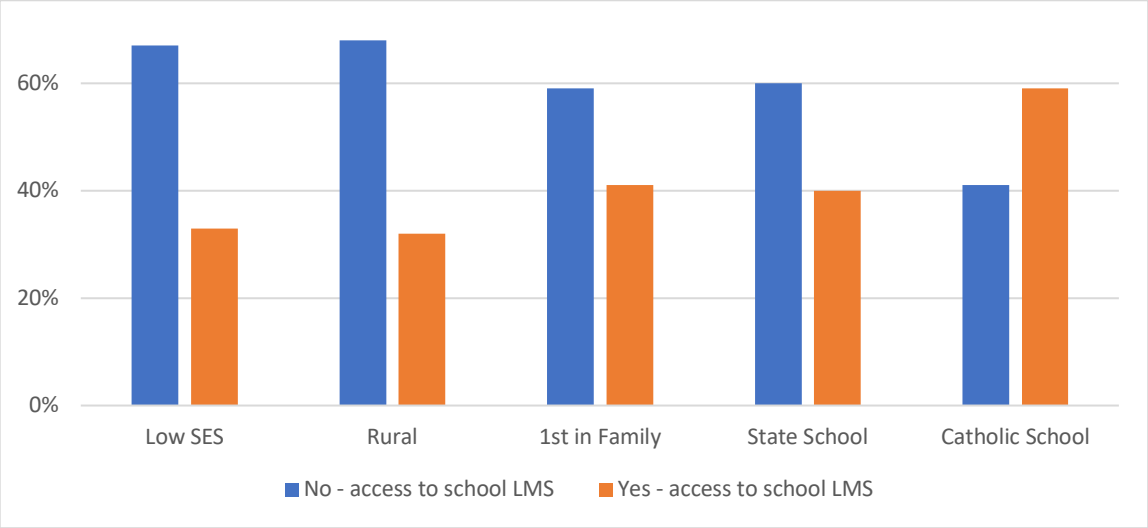


Figure 25 Access to a School LMS with disadvantaged indicators

Among participants without access to a school LMS, 79% disagreed that they had been well prepared by their school to study in a digital learning environment compared with 21% with a school LMS ($p < .001$). The issue of preparedness for university study by their secondary school also illustrated statistical significance between participants with and without access to a school LMS, with 60% of participants without access to an LMS disagreeing with being well prepared by their school for university study ($p < .010$).

No access to a school LMS had a significant impact on digital skills. Proficiency levels were consistency rated lower by participants without access to a school LMS in Outlook Calendar or equivalent, online tests and quizzes, editing video and sound recordings, postings to blogs, forums and wikis, posting to social networking sites and uploading videos to social networking sites (Appendix 4 shows chi-square test outcomes). These participants were also less likely to critically evaluate information for fairness, validity and currency.

Table 13 provides a summary of the statistical significance for digital attitude, mindset and perceived digital skills against the categorical variables of access to an LMS, geographic location, access to a school-issued laptop, enrolment assistance and first in family. This result was based on an ANOVA F Test and Pearson Chi-Square test for significance.

Table 13 Summary table of statistical significance for digital attitude, mindset and perceived digital skills non-categorical variables

Access to a school learning management system	**Results**	**Measure**
1. I would rate myself as having excellent digital technology skills	$p < .021$	LMS > no LMS
2. I believe there is only one right way to use digital technologies	$p < .053$	No LMS > LMS
3. I am able to jump from one kind of digital technology to another to achieve my goals	$p < .042$	LMS > no LMS
4. I have a large number of followers on social media	$p < .007$	No LMS > LMS
5. Proficiency in Outlook Calendar or equivalent	$p < .009$	LMS > no LMS
6. Proficiency in online tests and quizzes	$p < .015$	LMS > no LMS
7. Proficiency in editing video and sound recordings	$p < .026$	LMS > no LMS
8. Proficiency in posting to blogs, forums & wikis	$p < .051$	LMS > no LMS
9. Proficiency in posting to social networking sites	$p < .043$	No LMS > LMS
10. Proficiency in uploading videos to social networking sites	$p < .038$	No LMS > LMS
11. Proficiency in posting to social networking sites	$p < .043$	No LMS > LMS
12. Critically evaluate information is fair, valid and current	$p < .005$	LMS > no LMS
Geographic location		
1. Proficiency in posting to blogs, forums and wikis	$p <.030$	Urban > Rural
2. Proficiency in uploading videos to social media	$p <.035$	Urban > Rural
3. Uses university online search to research assignments	$p <.000$	Urban > Rural
4. Uses Wikipedia to research assignments	$p <.000$	Urban > Rural
5. Uses peer reviewed or academic articles in assignments	$p <.001$	Urban > Rural
6. Uses online referencing tools	$p <.044$	Urban > Rural
School-issued laptop		
1. I would rate myself as having excellent digital technology skills	$p <.036$	Laptop > no Laptop
2. I believe there is only one right way to use digital technologies	$p <.029$	Laptop > no Laptop

3. I think technologies, not people, always cause success or failure	p <.006	Laptop > no Laptop
4. I think high social media use always causes a decrease in face-to-face communication	p <.039	Laptop > no Laptop
5. I often oversimplify or underestimate the role of a new technology	p <.027	Laptop > no Laptop
6. I understand the types of potential value in using social media	p <.030	Laptop > no Laptop
7. Proficiency in Power Point	p <.004	Laptop > no Laptop
8. Proficiency in Outlook Calendar or equivalent	p <.001	Laptop > no Laptop
9. Proficiency in uploading videos to social media	p <.041	Laptop > no Laptop
Required help to enrol online		
1. I use Wikipedia to research my assignments	p <.016	Help > no Help
2. I use Google Scholar to research my assignments	p <.018	Help > no Help
3. Proficiency in graphics packages e.g. Adobe Photoshop etc.	p <.024	Help > no Help
4. Proficiency in Excel	p <.042	Help > no Help
First in Family		
1. It was difficult to set up my class registration	p <.009	FiF > Not FiF
2. Only one right way to use digital technologies	p <.024	FiF > Not FiF
3. I use Wikipedia to research my assignments	p <.011	Not FiF > FiF

Similar differences arose in chi-square testing for significance based on geographic location (Appendix 4), where 68.1% of regional and rural participants required assistance to enrol online compared with 50% of urban participants (p < .024). A further 75.8% of regional and rural participants had difficulty setting up their class registration compared with 17% of urban participants (p < .005). These participants were also more likely to be from medium-low socioeconomic backgrounds, first in family and have attended a State or Catholic school in comparison to their urban counterparts.

Furthermore, participants from regional and rural schools consistently rated themselves lower on a scale of 1-5 of digital literacy proficiency than urban school participants. Proficiency in posting to blogs, forums and wikis, uploading videos to social media and online tests and quizzes was again recorded lower by regional and rural school participants. Critical literacy skills in the use of university online library systems, peer reviewed or academic article in assignment and online referencing tools were less likely to be used by regional and rural participants (Appendix 4).

Overall, regional university participants rated themselves lower in critical literacy proficiencies for questions relating to the use of peer reviewed or academic articles ($p < .001$) and using the university online library ($p < .001$), while urban university participants rated highly in questions relating to using Wikipedia to research their assignments ($p < .001$). Further analysis illustrated the international student cohort at the urban university was more likely to research using Wikipedia, with 54% of international participants agreeing that they use Wikipedia to research their assignments ($p < .001$).

Appendix 4 illustrates Pearson's Chi-Square for significance with the school-issued laptop variable. Participants from a low SES background were more likely to have a school-issued laptop ($p < .050$). This result is in line with the national rollout of laptops to schools which targeted low SES schools: 77.8% of Catholic and 52.3% of State schools had school-issued laptops compared with 41.9% of private independent schools ($\chi^2(3) = 28.016$ $p < .001$). Notably, 43.4% international students had access to school-issued laptops during secondary schooling. Furthermore 63% of students who did not have access to a personal computer or laptop during their secondary schooling had a school-issued laptop which supports the importance of the school-issued laptop program ($p < .049$).

Variables relating to digital fluency mindsets and attitudes suggested 64.7% of students with a school-issued laptop agreed with the statement that there is only one right way to use digital technologies ($p < .029$). These participants were also more likely to oversimplify technology ($p < .027$) or believe technology, not people, caused success or failure ($p < .006$). Briggs and Makice (2012) links the simplification of, and belief in, only one way to use digital technologies as an indication of a pre-fluency mindset.

Participants with school-issued laptops consistently rated themselves higher in digital literacy than those without. Comparison of self-reported proficiencies in PowerPoint ($p < .004$); Outlook Calendar or equivalent ($p < .001$) and uploading videos to social networking sites ($p < .041$) achieved statistical significance from those participants without school-issued laptops: 62% of students from schools with an LMS also had school-issued laptops ($p < .001$). These results may suggest that school-issued laptops alone are not sufficient unless matched with a school LMS or digital curriculum. Respondents with access to a school LMS indicate across multiple measures they had higher levels of digital literacy proficiency.

Table 14 provides a summary of the statistical significance of the variable "perceived preparedness by secondary school for university study". Respondents who disagreed with the preparedness variable were more likely to be female, from a regional or rural location, have attended a State or Catholic school, be first in family, not have access to a school LMS, required help to enrol online and contacted the student centre for enrolment assistance. This result was based on an ANOVA F Test.

Table 14 Summary table of statistical significance for perceived preparedness by school for university study categorical variables

Perceived preparedness by school for university study	**Result**	**Measure**
1. I needed help to enrol online	$p < .003$	No Help > Help
2. I needed to contact the student centre for help to enrol	$p < .015$	No Help > Help
3. It was difficult to set up my class registration	$p < .001$	Not Difficult > Difficult
4. Gender	$p < .002$	Female > Male
5. Geographic location	$p < .006$	Urban > rural/ Regional
6. School Type	$p < .002$	Independent > State/Catholic
7. First in Family	$p < .044$	Not FiF > FiF
8. Access to a school LMS	$p < .010$	LMS > No LMS
9. University	$p < .009$	No Help > Help

Pearson's Chi-Square analysis demonstrates participants with disadvantage indicators consistently disagreed with the statement they were well prepared by their school for university study. This preparedness for university study also showed statistical significance with school type (Figure 26). Participants from State and Catholic schools were less likely to agree that they were well prepared by their schools, with 33% State and 30% Catholic school respondents disagreeing or not sure. In comparison, 16% private independent and 10% international schools disagreed or were not sure with the statement ($p < .002$). Further disparities arose with 39% of rural respondents disagreeing or not sure that they were well prepared by their school for university study.

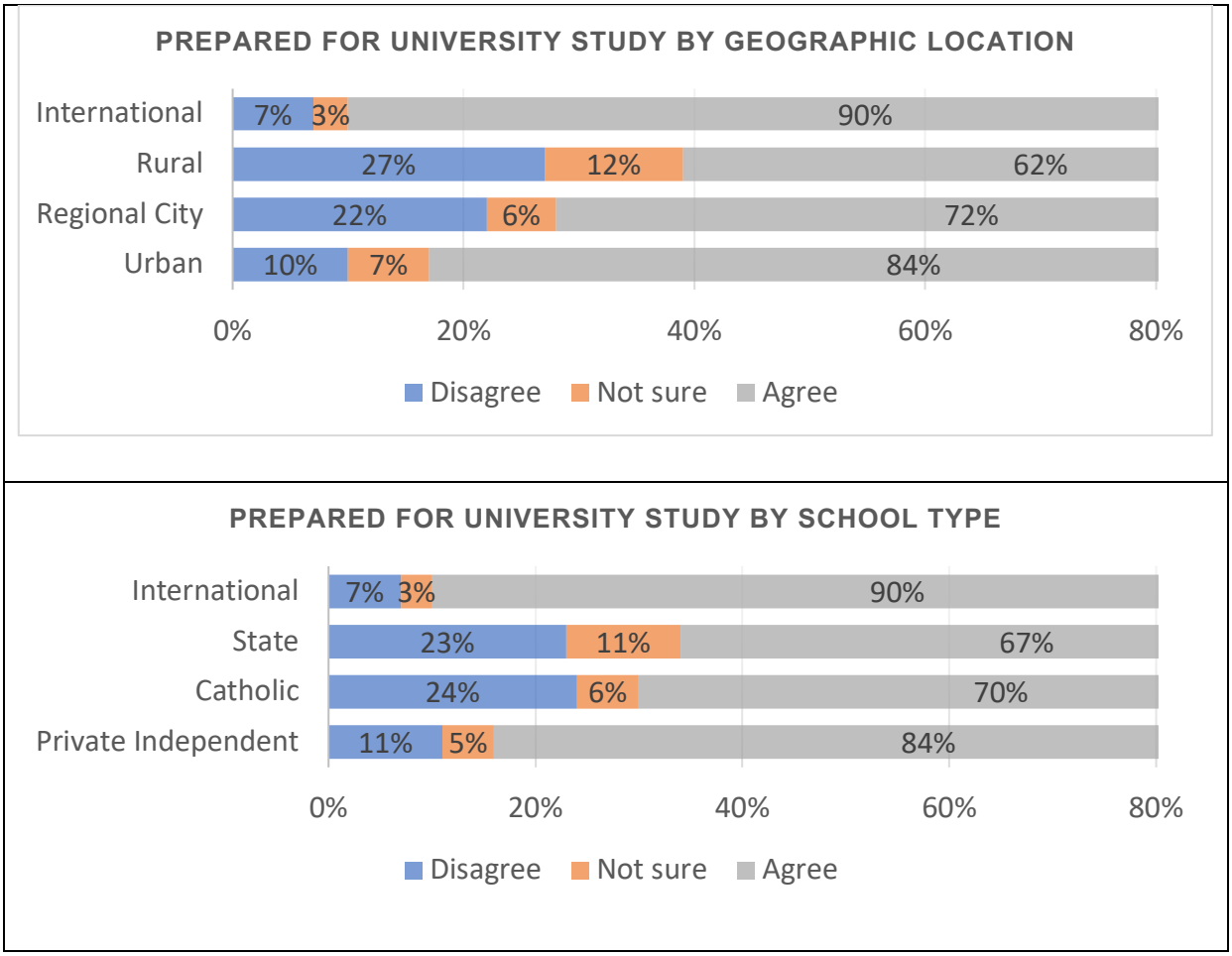


Figure 26 Preparedness by school type and geographic location

School LMSs contributed to students' perception of preparedness for university study (Figure 27): 82% of respondents with a school LMS also agreeed to being well prepared for university-level study while 30% without a school LMS disagreed or were unsure they were well prepared. Again, participants who required assistance to enrol online ($p < .003$) or contacted the university for enrolment assistance ($p < .015$) or had difficulty setting up their class registration ($p < .001$) were more likely to disagree with preparedness for university.

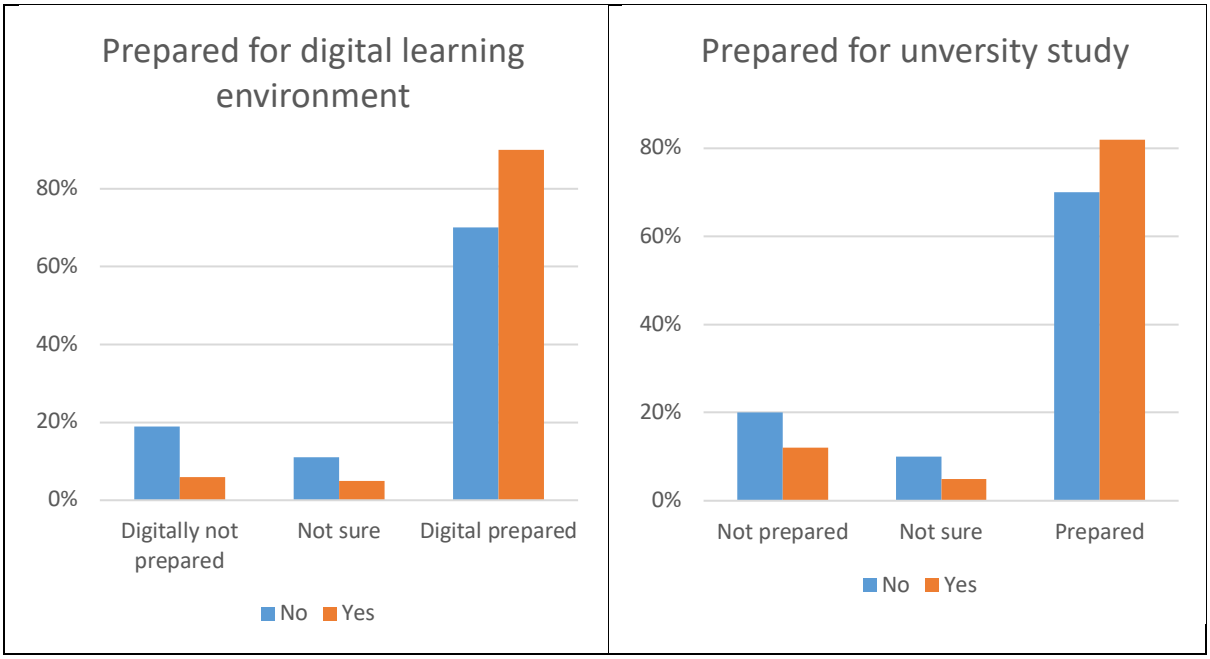


Figure 27 Preparedness and access to a school LMS

Gender played a role as well, with 81.6% of females and 68.7% of males agreeing they were well prepared ($p < .002$). Furthermore, participants who scored low in digital fluency indicators such as online enrolment issues also disagreed that they were well prepared ($p < .003$). Lower proficiency levels in Adobe also equated to being less likely to be well prepared ($p < .037$).

Moreover, participants who rated themselves as underprepared, consistently rated themselves lower in proficiency in all the digital literacy platforms e.g. Excel, Outlook Calendar, but results were not statistically significant. This was again evident in questions relating to parental digital skills and self-rating of digital technology skills. Participants who disagreed with these statements were also more likely to disagree that their school prepared them well for university-level study.

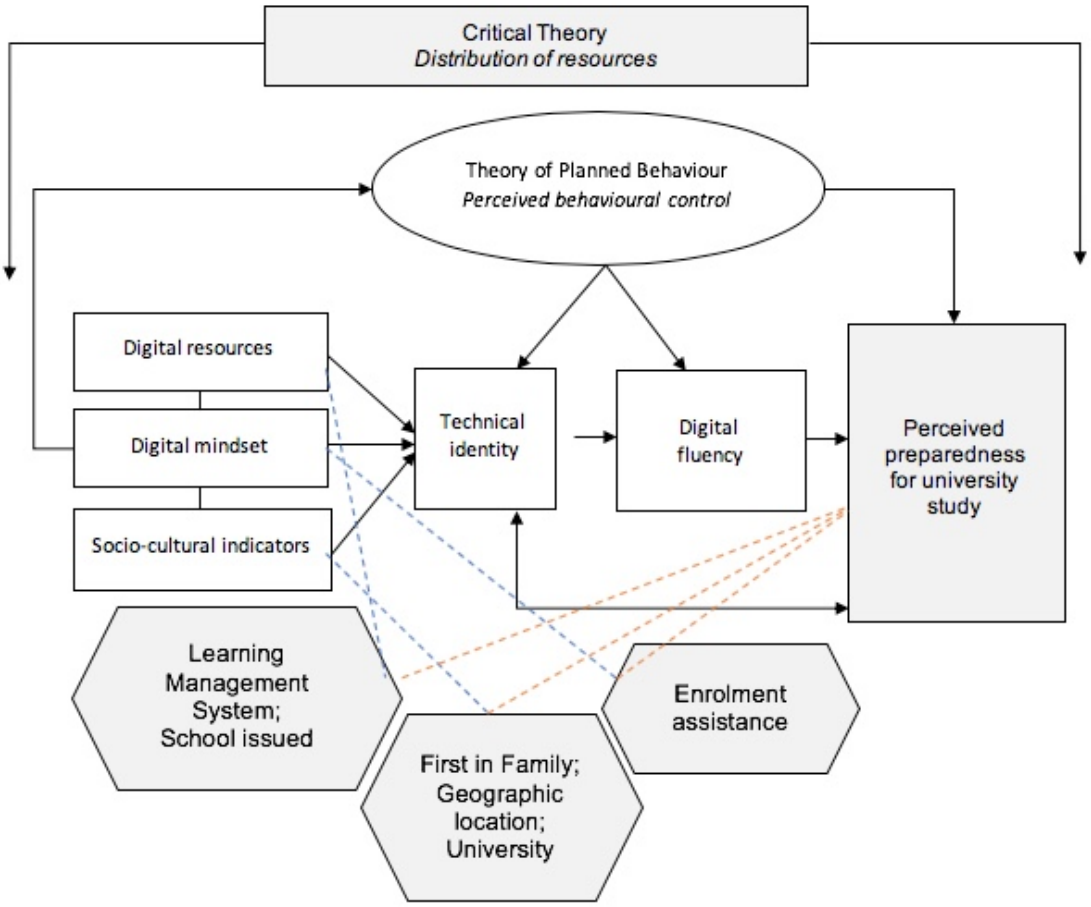


Figure 28 Preparedness for university concept model within a digital fluency context

Figure 28 proposes that the distribution of digital resources, in particular access to a school LMS, could influence the individual's preparedness for university study. The presence of an LMS was a critical factor but the impact on their sense of preparedness was mediated by other factors. The results indicate discrepancies in how participants perceived their preparedness for university study and could be indicative of systemic problems with the Australian education system.

However, multiple disadvantage indicators were related to preparedness e.g. geographic area, school type, SES, and sociocultural factors, as well as the presence of an LMS. An LMS is more likely to be present in an urban private school which in turn is more likely to be populated by non-first in family and higher socioeconomic students. Consequently, while the results indicate access to an LMS in secondary school enhanced students' sense of preparedness for university study, the results do not definitively support an LMS as the mitigating factor in isolation of the disadvantage indicators. This sense of preparedness was a perplexing variable with multiple associations. The researcher needed to delve deeper into the indicators of digital fluency and their influence on preparedness.

4.9Factor analysis overview

To examine the underlying concepts of the elements affecting digital fluency observed in the study, a factor analysis employing Principal Component Analysis was performed on 56 questions in Study 1's questionnaire to assess the underlying concepts impacting on digital fluency captured in the analysis. This helped to clarify the key concepts or components at play and reduced the number of variables used in subsequent statistical tests (Statistics, 2015b).

The extraction method was Principal Component Analysis (PCA) with a Varimax with Kaiser Normalization rotation method. Varimax rotation enabled the data to be displayed in a component matrix and assisted in identifying the linear relationship between factors. Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were also performed. The KMO sampling adequacy range above .7 was thought to be deemed acceptable together with Bartlett's test of sphericity to identity statistical significance (Kaiser, 1974; Statistics, 2015b). All cases below .460 were excluded from the analysis to focus on the variables within the KMO sampling adequacy range (Statistics, 2015b).

Prior to the Principal Component Analysis, the questionnaire was separated into three question blocks in Table 15.

Table 15 Principal Component Analysis of the question blocks

1. Digital mindset, attitude and influences (Appendix 5)	• Correlation co-efficiency was greater than .460 • KMO and Bartlett's test measured .779 overall which is in the high middling range of Kaiser-Meyer-Olkin (Kaiser, 1974) • Bartlett's test for sphericity was statistically significant (*p* <.000) • Six components with an Eigenvalue greater than 1 • Component 1 explained 4.808/21 x 100 = 22.8% of variance. The total variance of six factors equated to 12.806/21 x 100 = 61%. • The scree plot indicates an inflection point at 4 and again at 6 • Six components were retained as a measure of digital fluency indicators (Cattell, 1966)
2. 21st Century/Critical Literacies (Appendix 6)	• Correlation co-efficiency was greater than .460 • KMO and Bartlett's test measured .615 overall which is in the mediocre range of Kaiser-Meyer-Olkin (Kaiser, 1974) • Bartlett's test for sphericity was statistically significant (*p* <.000) • three components with an Eigenvalue greater than 1

	• Component 1 explained 2.204/8 x 100 = 27.5% of variance. The total variance of three factors equated to 4.616/8 x 100 = 57.7%. • The scree plot indicates an inflection point at 3. • Three components were retained as a measure of 21st Century/Critical literacies (Cattell, 1966)
3. Digital Literacies (Appendix 7)	• Correlation co-efficiency greater than .460 • KMO and Bartlett's test measured .790 overall which is almost in the meritorious range of Kaiser-Meyer-Olkin (Kaiser, 1974) • Bartlett's test for sphericity was statistically significant (p <.000) • Four components with an Eigenvalue greater than 1 • Component 1 explained 4.790/15 x 100 = 31.9% of variance. The total variance of four factors as displayed in Appendix 7 equated to 9.665/15 x 100 = 64.4%. • The scree plot indicates an inflection point at 4 • Four components were retained as a measure of 21st Century literacies (Cattell, 1966)

The final factor analysis of the combined question blocks is illustrated in Appendix 8. Based on the literature and the findings thus far, the researcher removed underperforming components. Components < 0.6 were removed and the final factors (Table 16) remained.

Table 16 Final Factor Analysis

FAC1	Fluency Mindset
FAC2	Parental Influences
FAC3	Fluency Attitude
FAC4	School Influences
FAC5	Critical Literacies
FAC6	Creating Literacies
FAC7	Digital Literacies
FAC8	Consuming Literacies
FAC9	University systems Literacies

4.10 Reliability Scales

Cronbach's alpha tests were then conducted to measure the internal consistency of the principle component analysis clustering of questions from the survey questionnaire (Table 17). The Cronbach's alpha is a coefficient of reliability and was used to measure the consistency of the scales then tested to assess whether the scales were testing the same

underlying assumption (To, 2019). The use of Cronbach's alpha in combination with principle component analysis also allowed the reduction of data.
Statistics (2015a) states a Cronbach's alpha score <.5 is unacceptable, with >.8 consider good.

Table 17 Cronbach's Alpha, Source (To, 2019)

Cronbach's alpha	**Internal consistency**
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Thirteen scales were deemed reliable (Table 18). Further detailed scales are illustrated in Appendix 5.

Table 18 Reliability Scales

Scale	***n***	**Cronbach's alpha score**
1: Fluency mindset	*n401*	FAC1 α = .81
2: Parental Influences	*n404*	FAC2 α = .84
3: Pre-Fluency Mindset	*n400*	FAC3 α = .60
4: Fluency Attitude	*n407*	FAC4 α = .73
5: School Influences	*n406*	FAC5 α = .70
6: Literacy Mindset	*n407*	FAC6 α = .58
7: Critical Literacies	*n385*	FAC7 α = .79
8: Research Literacies	*n405*	FAC8 α = .40
9: Academic Research Literacies	*n396*	FAC9 α = .50
10: Creating Literacies	*n341*	FAC10 α = .82
11: Digital Literacies (revised to exclude Q Excel)	*n393*	FAC12 α = .81
12: Consuming Literacies	*n387*	FAC13 α = .84
13: University Systems Literacies	*n393*	FAC14 α = .66

4.11 Final Factor Analysis after reliability testing

On completion of the reliability testing, a revised factor analysis was compiled (Table 19). All factors with an alpha score < 7 were removed. As illustrated in Table 17, a Cronbach alpha score < .7 is considered questionable (To, 2019). Factor 2, Parental Influences, and Factor 4, School Influences, were removed as the researcher deemed these factors to be influences or effects not indicators of digital fluency, even though each score was in the acceptable range of .8 and .7 respectively. The justification for the removal influences was that the focus remain on digital fluency indicators to establish the impact on self-reported digial skills. Digital influences were then compared with the self-reported digital skills to ascertain impact. Digital influences are further examined in Study 3.
Digital influences are further examined in Study 3.

Table 19 Final Factor Analysis after reliability testing

Factor Analysis Retained	**Question**
FAC1 Fluency Mindset	I can quickly learn how to use new technology
	I am able to jump from one kind of digital technology to another to achieve my goals
	I recognise the potential transformative uses for new digital technologies
	I take comfort with the fact that there is more than one way to use a technology
	I would rate myself as having excellent digital technology skills
FAC4 Fluency Attitude	I believe change is necessary
	I embrace change as opportunity
FAC7 Critical Literacies	I critically evaluate information by checking that the content is fair, valid and current
	I evaluate and interpret online sources by checking for bias
FAC10 Creating Literacies	Posting to blogs, forums and wikis
	Creating blogs, forums or wikis
	Adobe Acrobat Professional
	Graphics packages e.g. Adobe Photoshop etc.
FAC13 University systems Literacies	LearnJCU
	Online Tests e.g. LearnJCU quizzes, Aplia, Wiley

Figure 30 presents the five digital fluency indicators that were subsequently tested in a multi-variant analysis. These are fluency mindset, fluency attitude, critical literacies, creating literacies and university systems literacies. These scales were used as the basis for cluster analyses to assess whether meaningful sub-groups could be identified in the sample with different levels of digital fluency and different socioeconomic and demographic characteristics.

4.12 Digital Fluency Scales Profiles

In this section, digital fluency indicator scales (Figure 29) are analysed to identity factors or combinations of factors that influence the development of digital fluency.

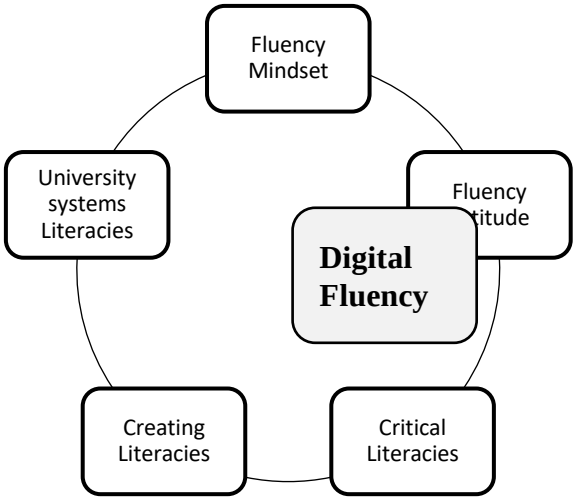


Figure 29 Digital Fluency Indicator Scales

The concept is to classify respondents into similar groups based on indicators of different levels of digital fluency. Survey respondents were separated into five groups that were defined using cluster analysis on the scales (Table 19). Figure 30 illustrates the digital fluency indicator scales plus the parental and school influences. Group 4 rated the highest in all digital fluency indicators, followed by Group 5, Group 3, Group 1. Group 2 recorded the lowest on the digital fluency indicator scales.

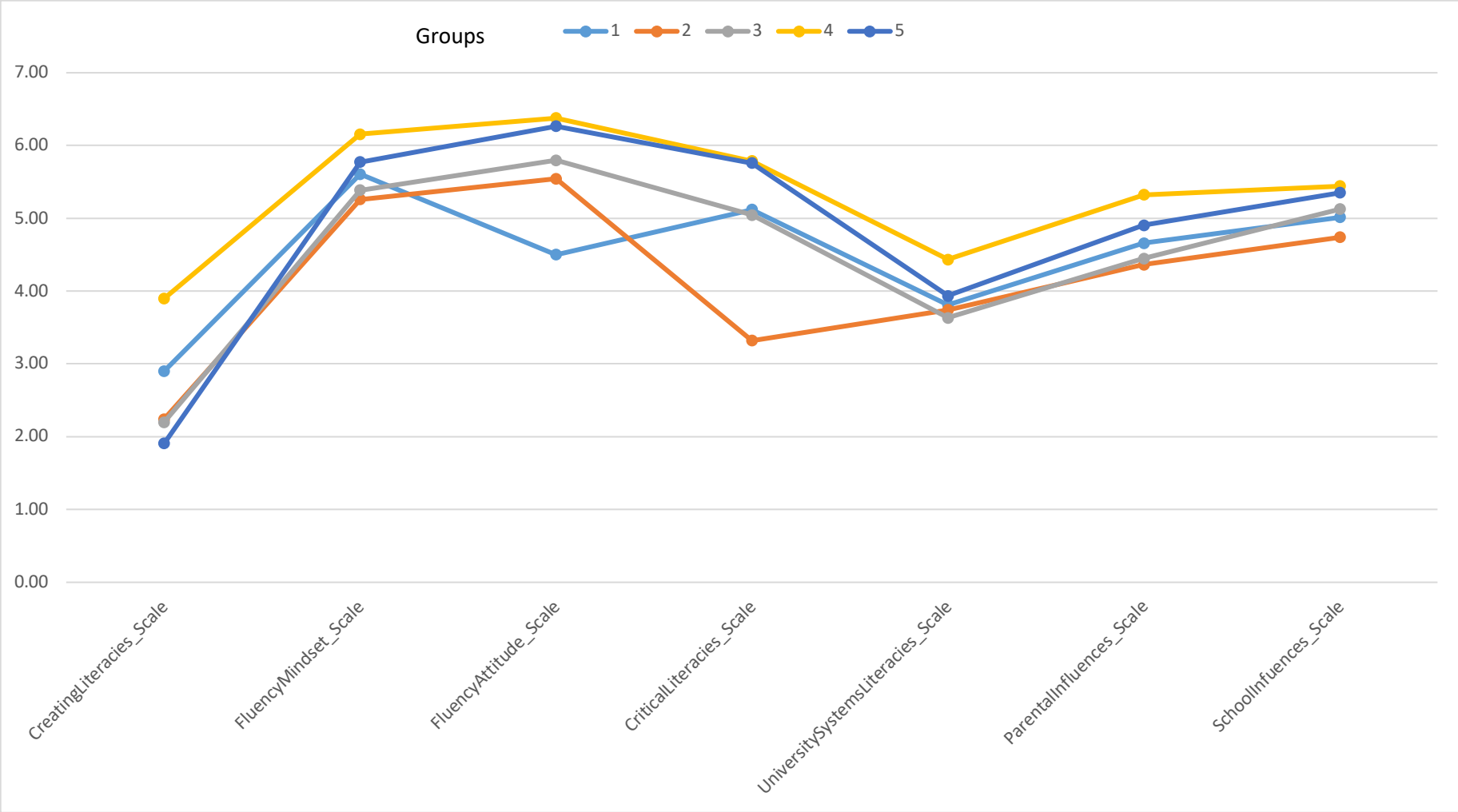


Figure 30 Digital fluency indicators scales with parental and school influences

Profiles for each group were then compiled based on demographic variables, digital access and prior digital experience.

Table 20 Group Characteristics Test Profiles

Legend	1 (lowest)	2	3	4	5 (highest)

Variable	Group 1	Group 2	Group 3	Group 4	Group 5	All	Measure
University	32%	36%	57%	52%	38%	43%	% Urban
Gender	51%	50%	51%	65%	63%	57%	% Female
First in Family	42%	40%	38%	36%	44%	40%	% FiF
Socioeconomic Status	30%	26%	30%	20%	20%	24%	% Low
Age Group	62%	77%	48%	55%	76%	64%	% school leaver
	2%	5%	7%	1%	2%	3%	% mature age
Rural, Regional City, Urban	19%	23%	14%	17%	19%	18%	% rural
	71%	66%	50%	49%	67%	61%	% rural & regional
School Type	15%	**24%**	9%	19%	14%	16%	% Private
	18%	**33%**	22%	19%	30%	24%	% Catholic
	48%	30%	26%	32%	38%	35%	% State
	19%	13%	**43%**	31%	18%	24%	% International
I had a school issues laptop during my secondary schooling	44%	58%	45%	63%	53%	53%	% yes
Take home	80%	85%	72%	74%	87%	80%	% yes
I had a personal computer or laptop during my secondary schooling	77%	73%	66%	77%	76%	74%	% yes
My school had a learning management system	44%	63%	42%	60%	52%	52%	% yes
I needed help to enrol online	47%	61%	42%	42%	67%	52%	% yes
I needed to contact the student centre for help to enrol	35%	42%	28%	38%	41%	37%	% yes

Group 1 Rural and low SES background, State-school educated

This group were primarily enrolled in the regional university and more likely to be from a first-in-family, low socioeconomic and rural/regional background and have attended a State secondary school (Table 21). They rated the highest with access to a school-issued laptop but were less likely to have had access to an LMS during secondary schooling. Group 1 self-reported second highest in creating literacies but were lowest in fluency attitudes. The group also rated low in school digital influences.

Table 21 Group 1 Rural and Low SES

Variable	Group 1	All	Measure
University	32%	43%	% UQ
Gender	51%	57%	% Female
First in Family	42%	40%	% FiF
Socioeconomic Status	30%	24%	% Low
Age Group	62%	64%	% school leaver
	2%	3%	% mature age
Rural, Regional City, Urban	19%	18%	% rural
	71%	61%	% rural & regional
School Type	15%	16%	Private
	18%	24%	Catholic
	48%	35%	State
	19%	24%	International
I had a school-issued laptop during my secondary schooling	44%	53%	% yes
Take home	80%	80%	
I had a personal computer or laptop during my secondary schooling	77%	74%	% yes
My school had a learning management system	44%	52%	% yes
I needed help to enrol online	47%	52%	% yes
I needed to contact the student centre for help to enrol	35%	37%	% yes
Legend	**1 (lowest)**	**5 (highest)**	

Group 2 Rural and non-state school educated school leavers

Group 2 were more likely to be males from a rural background, educated at Private or Catholic schools (Table 22). This group had a high proportion of access to an LMS during secondary schooling and were more likely to be enrolled in a regional university. They were also more likely to require help to enrol and most likely contacted the student centre for assistance. Group 2 also had significant numbers from low SES backgrounds and the lowest

scores on all scales except fluency attitudes. This group self-reported low proficiency in creating literacies.

Table 22 Group 2 Rural and non-state school educated school leavers

Variable	Group 2	All	Measure
University	36%	43%	% UQ
Gender	50%	57%	% Female
First in Family	40%	40%	% FiF
Socioeconomic Status	26%	24%	% Low
Age Group	77%	64%	% school leaver
	5%	3%	% mature age
Rural, Regional City, Urban	23%	18%	% rural
	66%	61%	% rural & regional
School Type	24%	16%	Private
	33%	24%	Catholic
	30%	35%	State
	13%	24%	International
I had a school issued laptop during my secondary schooling	58%	53%	% yes
Take home	85%	80%	
I had a personal computer or laptop during my secondary schooling	73%	74%	% yes
My school had a learning management system	63%	52%	% yes
I needed help to enrol online	61%	52%	% yes
I needed to contact the student centre for help to enrol	42%	37%	% yes
Legend	**1 (lowest)**	**5 (highest)**	

Group 3 International non-school leavers with poor access to digital technologies

Group 3 were more likely to be international post-school leavers enrolled at the urban university who did not have access to an LMS or school-issued laptop during secondary school (Table 23). This group scored mid-range in low SES backgrounds but were less likely to require help to enrol online. Overall, Group 3 appears to have had poor access to digital technologies throughout their secondary schooling. This group rated themselves low in creating literacies, consuming literacies and university system literacies.

Table 23 Group 3 International non-school leavers without access to LMS

Variable	Group 3	All	Measure
University	57%	43%	% UQ
Gender	51%	57%	% Female
First in Family	38%	40%	% FiF
Socioeconomic Status	30%	24%	% Low
Age Group	48%	64%	% school leaver
	7%	3%	% mature age
Rural, Regional City, Urban	14%	18%	% rural
	50%	61%	% rural & regional
School Type	9%	16%	Private

		22%	24%	Catholic
		26%	35%	State
		43%	24%	International
I had a school-issued laptop during my secondary schooling		45%	53%	% yes
Take home		72%	80%	% yes
I had a personal computer or laptop during my secondary schooling		66%	74%	% yes
My school had a learning management system		42%	52%	% yes
I needed help to enrol online		42%	52%	% yes
I needed to contact the student centre for help to enrol		28%	37%	% yes
Legend	**1 (lowest)**	**5 (highest)**		

Group 4 Highest recorded access to digital technologies

This group were more likely to be female school leavers from higher SES and not from first-in-family backgrounds (Table 24). The group had digital technologies throughout secondary schooling including an LMS and school-issued laptops with the highest recorded access in the study. This group were also more likely to be enrolled at the urban university and were a mix of international and urban students. This group were the least likely to require assistance to enrol online. Group 4 rated highest on all digital fluency indicators, parental and school influences. The group had the highest digital literacies test scores.

Table 24 Group 4 Highest recorded access to digital technologies

Variable		4	All	Measure
University		52%	43%	% UQ
Gender		65%	57%	% Female
First in Family		36%	40%	% FiF
Socioeconomic Status		20%	24%	% Low
Age Group		55%	64%	% school leaver
		1%	3%	% mature age
Rural, Regional City, Urban		17%	18%	% rural
		49%	61%	% rural & regional
School Type		19%	16%	Private
		19%	24%	Catholic
		32%	35%	State
		31%	24%	International
I had a school-issued laptop during my secondary schooling		63%	53%	% yes
Take home		74%	80%	
I had a personal computer or laptop during my secondary schooling		77%	74%	% yes
My school had a learning management system		60%	52%	% yes
I needed help to enrol online		42%	52%	% yes
I needed to contact the student centre for help to enrol		38%	37%	% yes
Legend	**1 (lowest)**	**5 (highest)**		

Group 5 Female and first-in-family school leavers

Group 5 were more likely to be female school leavers from a first-in-family background (Table 25). This group were mainly from rural and regional communities and were enrolled in the regional university. They were also less likely to have had access to an LMS during secondary schooling but did have access to a take-home school-issued laptop. Of note was the high score in requiring help to enrol online and contacting the student centre for assistance. Group 5 had the lowest digital literacies test profile in creating literacies and had the lowest fluency attitude score.

Table 25 Group 5 First-in-family female school leavers

Variable	Group 5	All	Measure
University	38%	43%	% UQ
Gender	63%	57%	% Female
First in Family	44%	40%	% FiF
Socioeconomic Status	20%	24%	% Low
Age Group	76%	64%	% school leaver
	2%	3%	% mature age
Rural, Regional City, Urban	19%	18%	% rural
	67%	61%	% rural & regional
School Type	14%	16%	Private
	30%	24%	Catholic
	38%	35%	State
	18%	24%	International
I had a school-issued laptop during my secondary schooling	53%	53%	% yes
Take home	87%	80%	% yes
I had a personal computer or laptop during my secondary schooling	76%	74%	% yes
My school had a learning management system	52%	52%	% yes
I needed help to enrol online	67%	52%	% yes
I needed to contact the student centre for help to enrol	41%	37%	% yes
Legend	**1 (lowest)**	**5 (highest)**	

4.12 Group Profiles

To interpret how the sociocultural, digital resources and digital mindset factors interrelate to impact on digital fluency, the researcher examined the results from the following:

a) Figure 30 Digital fluency indicators scale in groups
b) Figure 31 Secondary schooling
c) Figure 32 Demographics and sociocultural capital
d) Figure 33: Access to digital resources and prior digital experiences
e) Figure 34: Self reported digital literacy capabilities by group, and
f) Figure 35 Perceived preparedness for university study.

In particular the researcher was seeking to identity possible predictors e.g. access to an LMS in secondary schooling, experiences, influences, background etc. that may influence a 1st year business students' digital fluency.

Group 5 rated the highest in disadvantage indicators and lowest in digital access. On the other hand, Group 4 recorded the lowest disadvantage indicators and highest in digital access. Group 1 had the highest State school respondents. Group 2 had the highest Catholic school respondents, while Group 3 had the highest proportion of international respondents.

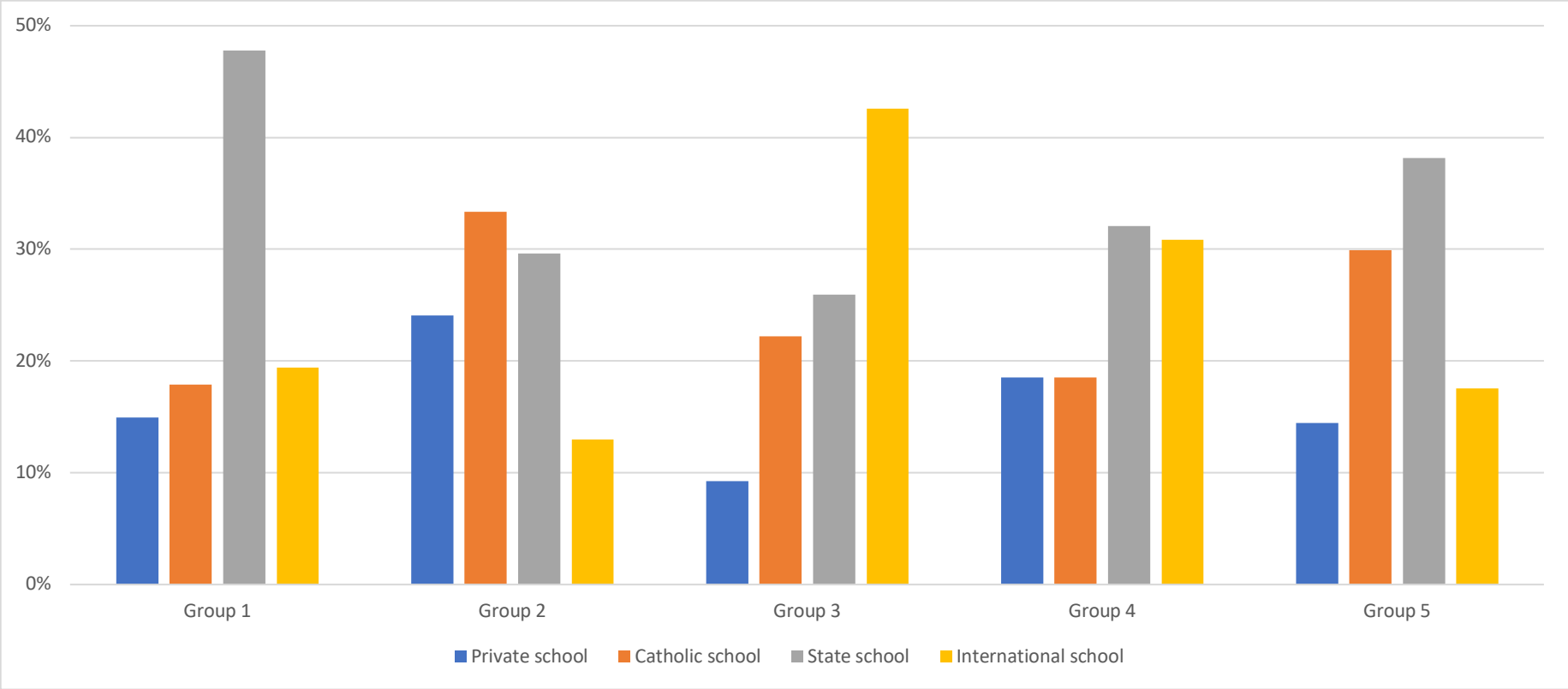


Figure 31 Group secondary schooling

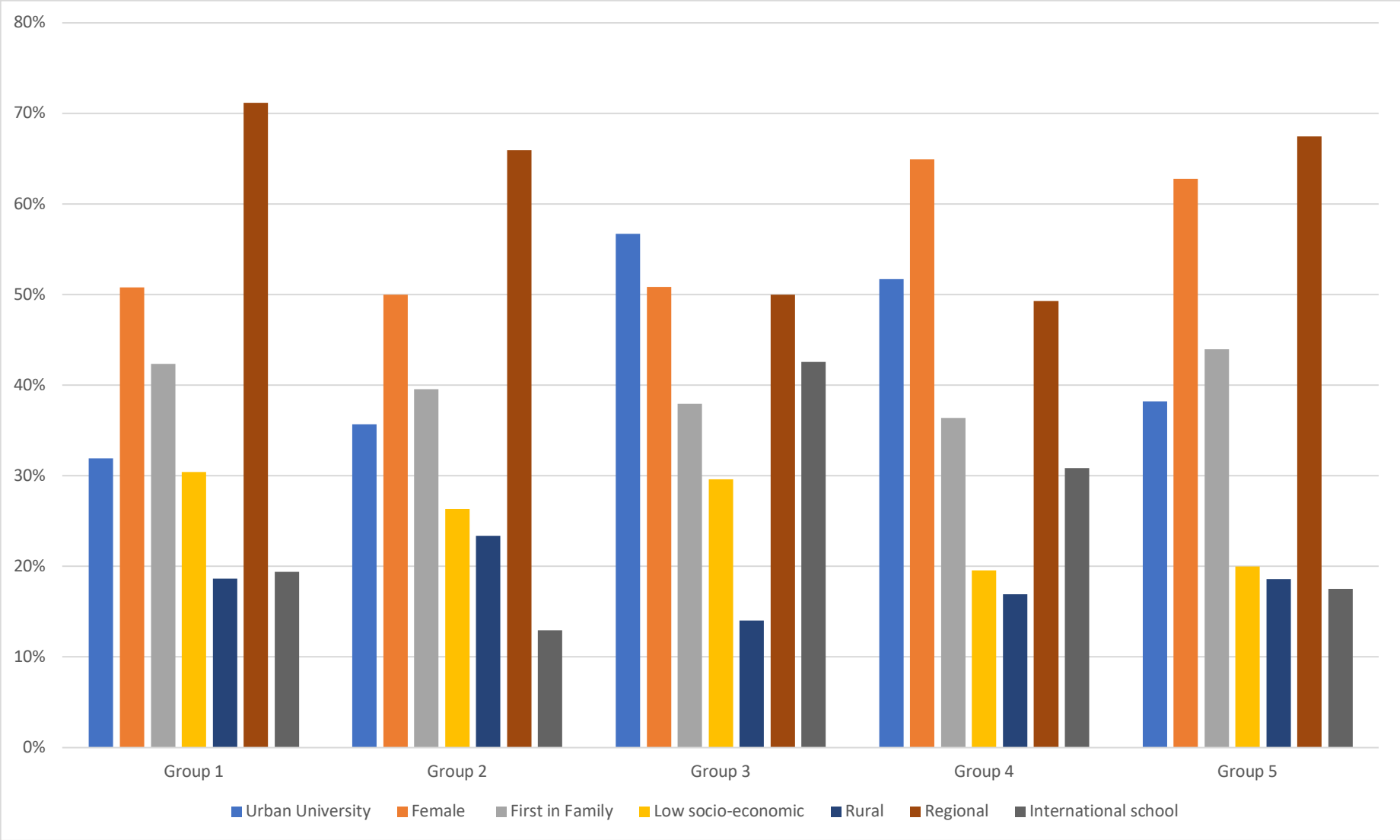


Figure 32 Group demographics

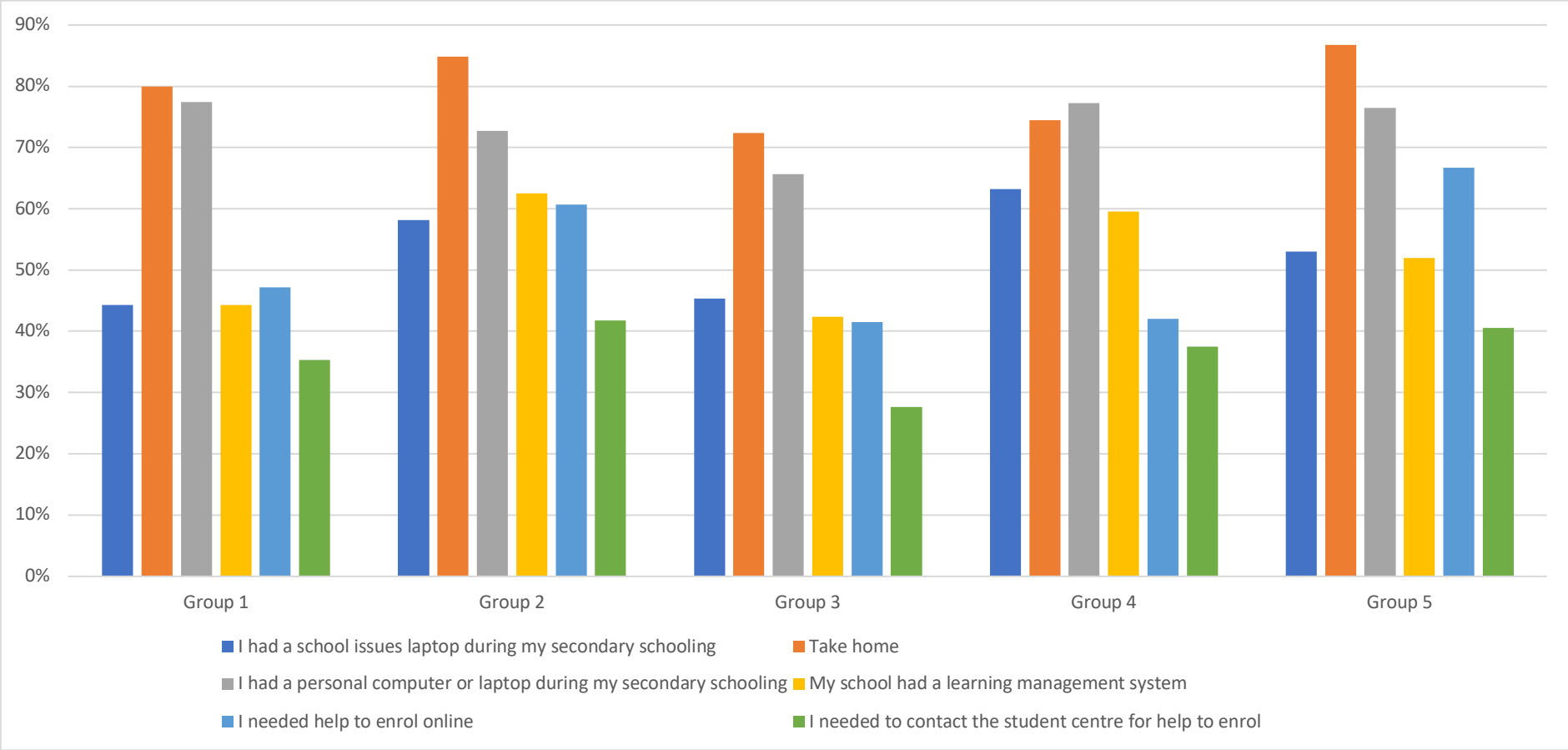


Figure 33 Group digital access and experiences

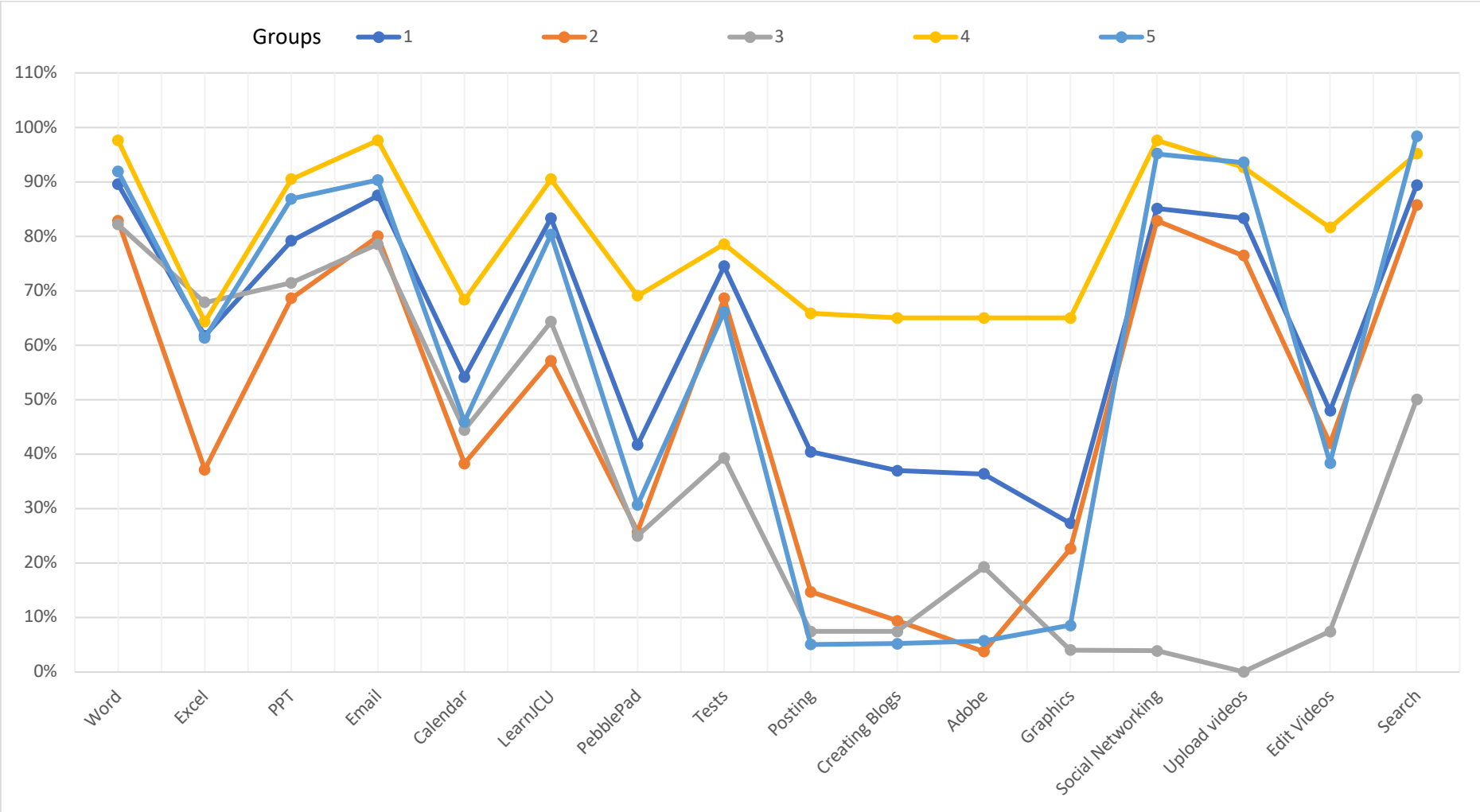


Figure 34 Self Reported Digital Literacy Capabilities Scores by Group

Group 4, who had the highest access to digital technologies during secondary schooling, outperformed all respondents in the self reported digital literacy capabilities and had the highest digital fluency indicator score. Of particular note is that although Group 2 and Group 4 both had access to an LMS, Group 2 reported the lowest score in critical literacies. Group 2 also rated themselves lower in creating literacies, fluency mindset/attitude and university systems than Groups 1, 4 and 5. This is a surprising finding. Similar to Group 4, Group 2 were well resourced in digital technologies and were more likely to have attended Private schools yet rated lowest on the digital fluency indicator scale. The differences that separate the two groups are sociocultural and disadvantage indicators, with Group 2 primarily from low socioeconomic backgrounds and attended rural and regional schools.

A review of the self reported digital literacy capabilities scores of the five groups in Figure 34 has Group 4 scoring the highest across many of the digital tools. In particular the higher-level digital literacies proficiencies required for an ePortfolio such as PebblePad, creating blogs, Adobe and graphics packages were rated significantly higher by Group 4. Group 5 scored lowest in these higher-level digital literacies. The other group scores were comparable and generally within a 95% confidence margin. Group 3's low rating in social networking, uploading and editing videos could be due to international students, particularly students from China, being less likely to use Facebook.

Of note is Group 2 scoring the lowest in Excel and university LMS proficiency which again is a surprising result given that this group had access to a school LMS. The researcher expected Group 2 to be proficient in the use of an LMS. Group 2 also rated higher in requiring help to enrol and needing to contact the student centre for assistance. These ratings may indicate the implementation of an LMS at schools with higher disadvantage indicators such as SES and geographic.

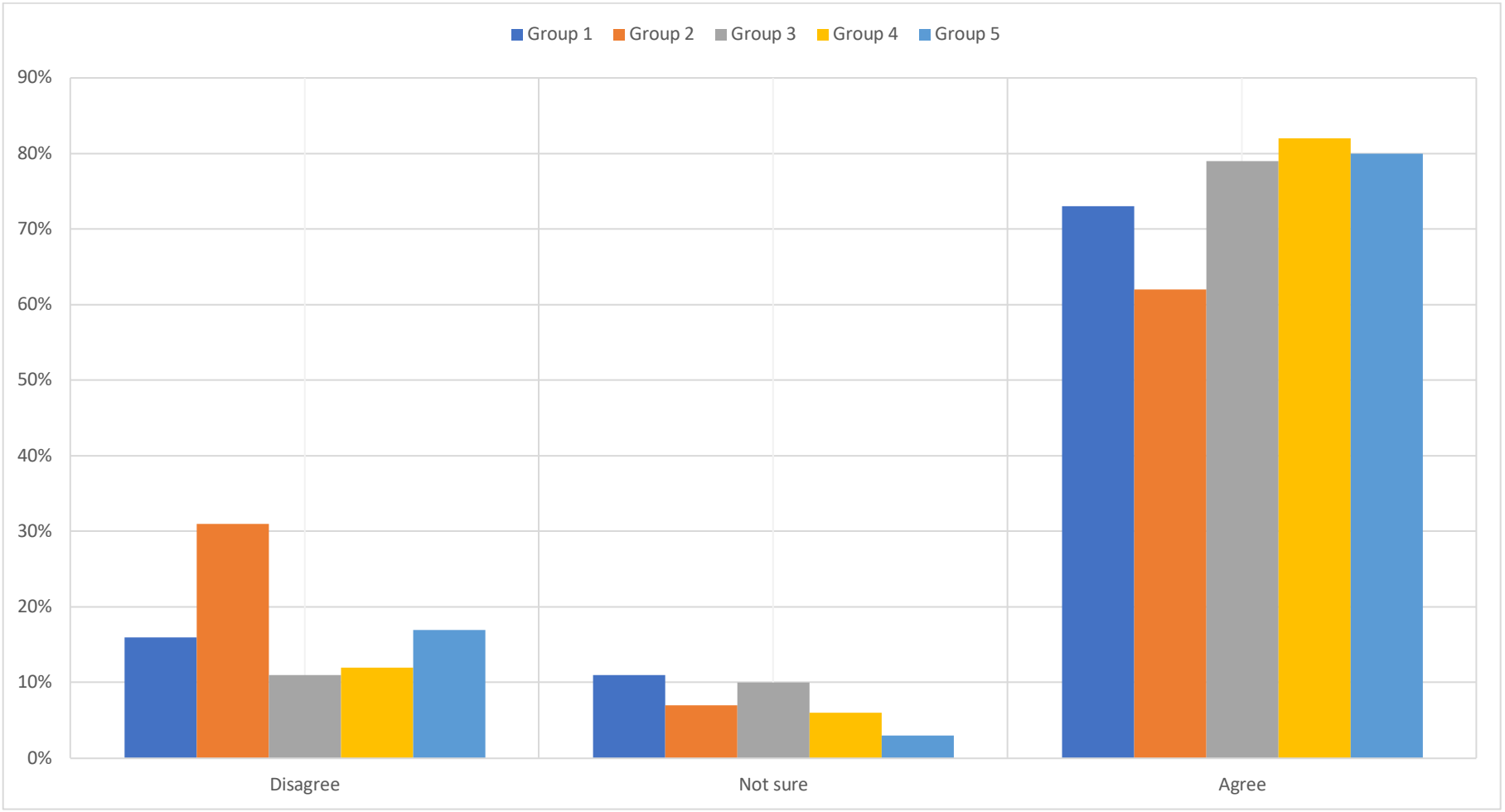


Figure 35 Perceived prepared by secondary school for university-level study

Figure 35 highlights significant differences between agreement levels of the groups' perceived preparedness at secondary school for university-level study. Here the focus is on Group 2 which scored the highest disagreement in the preparedness variable. Group 4 scored the lowest disagreement and a high of 82%, agreeing they were well prepared for university study, 20% above Group 2. In Group 2, 38% disagreed or were unsure of their preparedness. Also, of note is Group 5 which recorded 80% agreement and 17% disagreement, compared with Group 1 with 27% in disagreement or not sure. This issue of preparedness is then reflected in how the groups are profiled in digital fluency scales indicators (Figure 30) and digital literacy skills (Figure 34). Group 2 scores the lowest in Figures 30 and 34 yet attended schools that were well resourced. Again, the differences come back to disadvantage indicators.

These differences can be further explained in examining the parental and school influences (Figure 30). Group 4 scored the highest in both parental and school influences while Group 2 recorded lowest scores. The higher the level of disadvantage indicators, the lower the self-reported digital fluency and digital influences

Figure 36 illustrates the Preparedness for University Study Concept Model with the inclusion of the digital fluency indicators.

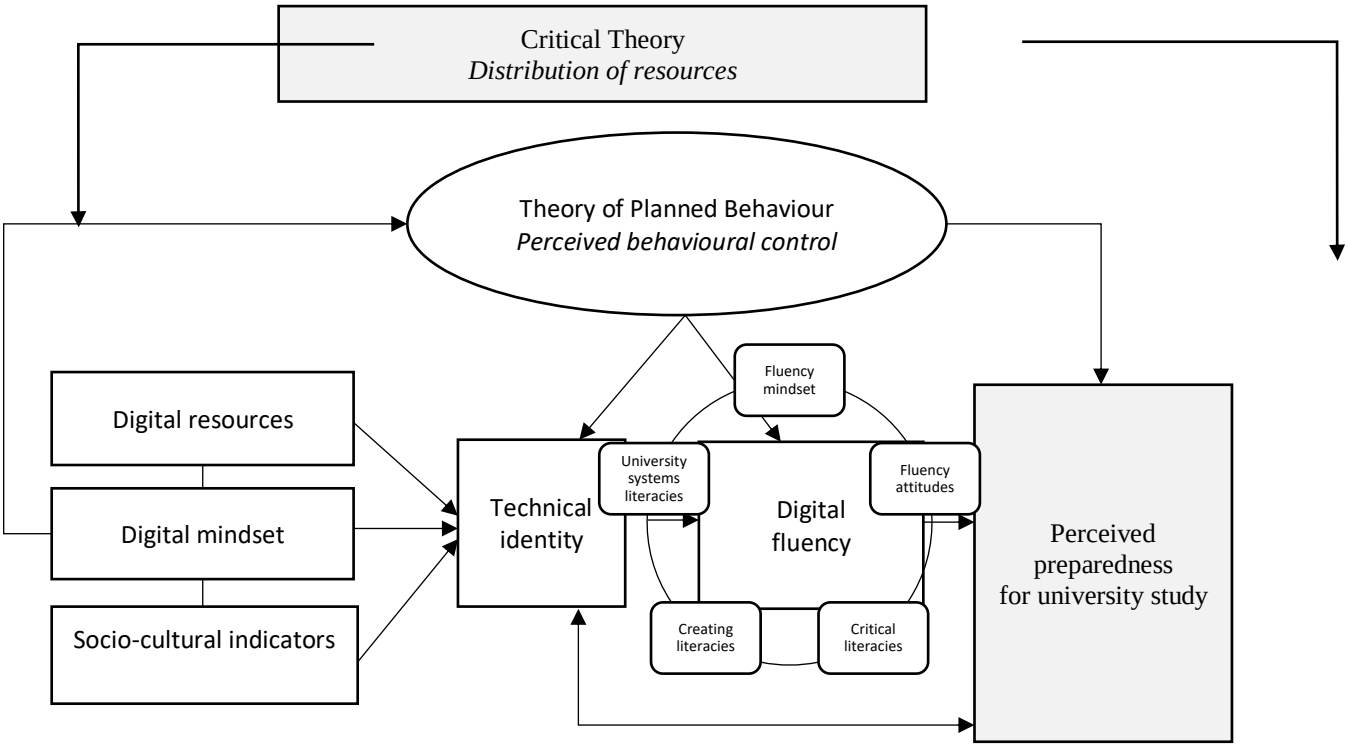


Figure 36 Preparedness for university model with digital fluency indicators

The three components of digitally fluency are characterised in Figure 36. These are firstly, digital competency and self-efficacy, secondly the ability to create/reformulate knowledge, problem solve and collaborate in a digital environment, and thirdly the ability to research,

analyse, interpret and evaluate. Figure 37 illustrates the cycle of maintaining digital fluency. As stated in Chapter 2, similar to language acquisition, digital fluency requires immersion in a digital environment and practice of the skills. Therefore, the digitally fluent can move up and down the scale accordingly to their immersion, opportunity to practice and experience.

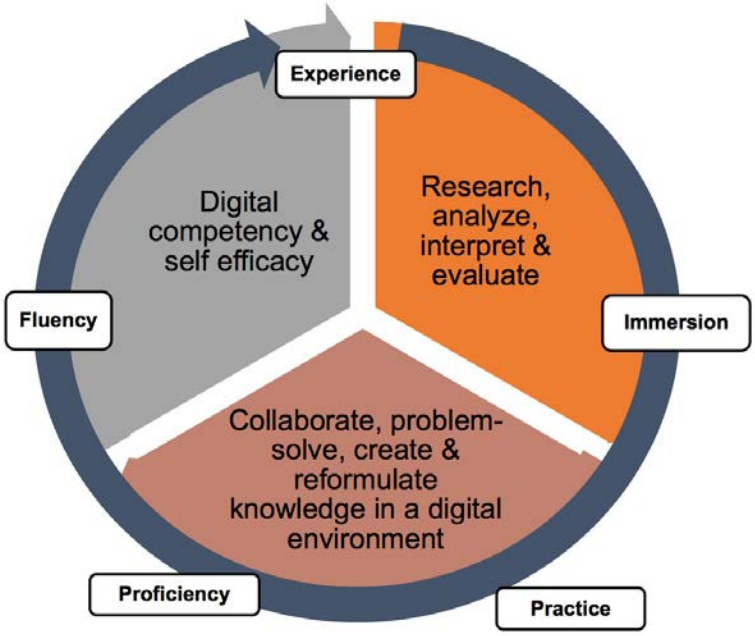


Figure 37 The cycle of digital fluency

Source: Author originated

4.13 Conclusion

What does this mean? The narrative that has unfolded in Chapter 4 has illustrated key differences in how school influences, digital experiences and access to digital technologies have influenced study participants' perception of their digital fluency and perceived preparedness for university studies. These digital influences and experiences, when linked to disadvantage indicators such as socioeconomic/sociocultural capital, geographic location and school type, indicate a relationship between access and application of digital resources and the development of digital fluency.

The Study 1 reported on RQ1. What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide? The findings illustrate that digital fluency is pronounced in individuals from higher socioeconomic status and sociocultural capital, who attended schools with an LMS and who had greater access to family or friends who could assist in digital issues. These findings on support building digital fluency and reinforce the work of (Caluya et al., 2018; Devlin and O'Shea., 2012; Warschauer et al., 2010). The need for higher education to create inclusive and supported digital learning environments is clear from the Study 1 results.

The overall results of Study 1 indicate a digital divide which reflects wider society has emerged in higher education. The design of university digital learning environments assumes students are digitally fluent, especially school leavers who had access to school-issued laptops. Study 1 has shown the digital native has not arrived. In particular the study revealed the proficiency of students with access to school LMSs, higher socioeconomic status, urban geographic locations and strong sociocultural capital were more likely to be digitally fluent and report being well prepared for university-level study. The fact that Group 2 had a high proportion of members who had access to an LMS in school but low digital fluency suggests that the way LMSs are implemented/used in schools is also important, together perhaps with whether the students' parents reinforced digital fluency development. This chapter has presented a series of statistical tests and provided an analysis that could contribute to the development of a conceptual model. The proposed Preparedness For University concept model with digital fluency indicators (Figure 36) suggests support for the conceptual model. A large-scale study would be necessary to generate a sample of sufficient size to test the relationships between factors in the model more comprehensively.

However, the concept model links digital resources, mindset and sociocultural indicators to the development of a technical identity. In turn, technical identity contributes to the digital fluency stages (Briggs & Makice, 2012). Therefore, the distribution of resources and opportunity could impede or advance the development of digital fluency.

Digital proficiency and the distribution and application of digital resources appears to be the major contributing factor to the developing digital divide. Research into the link between SES factors, school digital resources and the digital divide and its impact on Australian higher education is minimal but digitally underprepared students participating in higher education could be further disadvantaged if unsupported in a digital learning environment.

Chapter 5 Digital Fluency: Study 2

5.1 Introduction

This chapter presents an analysis of Study 2 digital tests on 15 participants from Study 1. The anomalies linking the development of digital fluency with the distribution and application of digital resources in schools identified in the previous chapter are further investigated here. The digital test format and design is then examined before comparing test outcomes. Comparisons are drawn between participants' test results, self-reported digital skills and prior access and experience in digital environments before concluding. These comparisons are importance to the study as self-reported digital skills are often an over-estimate actual digital skills (ECDL, 2018).

5.2 Digital test format and design

Usability testing software was employed to conduct the digital fluency test. Digital fluency, as defined in Chapter 1, is the ability to move with ease and proficiency from one digital platform, device or software to another. Measuring time on task and mouse clicks and movement are common methods used by web designers to test the usability of digital software or websites (Kortum & Acemyan, 2016). These competencies are often tested in traditional usability testing data to track progress through a series of online tasks. Time on task demonstrates efficiency and measures how quickly a task can be completed, while mouse metrics such as clicks and movements can demonstrate the likelihood of success on a task. The more clicks and/or mouse movements, the less probability of successfully completing the task (Kortum & Acemyan, 2016). The usability testing software enabled video and audio capture but did not use eye movement analysis as would normally be used when testing the usability of software of website design (J. Wang et al., 2019).

The digital fluency test was to assess the level of competency demonstrated by the participant. As discussed in Chapter 3, usability testing software enabled the researcher to capture and record participants' progress through a series of five tasks. Time on task, mouse clicks and mouse movement were counted and contributed to the overall picture of the participants' test performance. The design of the digital test was to build on each of the first three tasks before moving to assess critical literacies and media literacies.

5.3 The study 2 sample group

Of the 209 respondents, 15 individuals agreed to continue their participation in the study by undertaking the digital test and interview. No students from the urban university were invited to participate in Study 2 due to the location of the digital testing lab at the regional university. The researcher had planned for urban participants to undertake the digital test online.

However, there were limitations with the software. To download the software essential for the digital test, students required a particular operating system and had to be digitally fluent. Therefore, the decision was made to focus on the regional university student experience. This has skewed the results with no participants from a high socioeconomic status or urban secondary schooling background participating in Study 2. However, a sharper focus has been achieved on the regional and rural student experience in navigating a digital learning environment at regional universities.

5.4 Study 2 – digital test

The 15 participants from Study 1 undertook the digital test individually in the digital testing lab. The participants were informed that the digital test would be completed on a laptop and would take approximately 20-30 minutes. Participants were not told what tasks they would undertake in the test, just that a pop-up window would prompt them with the tasks (Figure 24). Participants had to complete the first task before moving on to the second and progressing through all five tasks. The platform included five tests (Table 24).

Table 24 Digital Fluency Test

Study Name	**Digital Divide Study**	
Study Description	This Digital Divide Study will include multiple computer-based tasks	
Study Instructions	There are five tasks to complete that should not take more than 30 minutes. You will be guided through the study and prompted to use particular software applications to complete a goal, however, you may use any other available software applications if you need to. The tasks build upon each other so completing each to the best of your ability will be an advantage for completing subsequent tasks.	
Task 1. Excel	Using a set of variables develop a bar chart	Use these pairs of data to construct a bar graph: Year Size 2010 3020 2011 4570 2012 4812 2013 5534 2014 3872 2015 5867 2016 6441
Task 2. Word	Using word to format your Excel output	Using Word, complete these tasks in order: 1. Insert your chart from Task 1 into a new word file 2. Centre the chart in wrap-around text 3. Change the chart variables 4. Move the legend to the bottom

		5. Change the bar chart to a pie chart
Task 3. Blog	Create a blog	Open LearnJCU and navigate to the Organisation site *Help and Support* at: https://learn.jcu.edu.au/ultra/organization/_72928_1 1. Go to the **Digital Divide Study** link in the left menu 2. Create a blog page. 3. Transfer the pie chart from Word (Task 2) to the blog page 4. Save the blog page.
Task 4. Research	Essay Research	Hypothetically, as part of your assessment in a 2nd year business subject you are to write an essay on leadership styles. 1. Locate three articles which you could reference in your essay.
Task 5. Media article	Research a Topic	Please read this article http://www.dailymail.co.uk/health/article-2699875/I-cured-cancer-CANNABIS-OIL.html 1. Investigate whether claims that "Cannabis can cure cancer" are based on scientific evidence. True or False?
Research Question	Answer the following question (T / F)	Are the claims that "Cannabis can cure cancer" based on scientific evidence? o True o False
Study Question	Answer the following question (open answer)	Do you have any comments on the previous question? and/or final thoughts about the study?

The first two tasks used Excel and Word activities to test the participants' digital literacy. They were simple in design and required the participant to develop a bar chart in Excel and transfer it to Word along with some editing requirements. Task 3 required the participant to insert a pie chart in a blog. The blog interface did not allow the participant to copy and paste the pie chart created in Word. Participants had to save the pie chart as an image then upload the image file to the blog. As the blog did not have an intuitive interface, many participants struggled to find a way to insert the pie chart. This task was chosen to: a) test the ability of participants to perform across platforms that were not intuitive; and b) test the participants' digital problem-solving skills and strategies.

The fourth task was to identify what search engines participants used to research a university essay and whether the papers chosen were current, valid, from scholarly publications and peer reviewed. Here the researcher was seeking to identify whether participants used a university's library search system, Google Scholar or other less scholarly search engines e.g. Wikipedia. The task was linked to 21st century fluencies (Crockett et al.,

2012), in particular whether the participant identified, interpreted and validated information for the university essay: information fluency (Crockett et al., 2012).

The fifth task sought to test the participants' ability to analyse, interpret and evaluate media communication. Participants had to read a media article about whether cannabis cures cancer and assess whether the claims were true or false. Here the researcher was seeking to measure the participants' media fluency (Crockett et al., 2012). Both Tasks 4 and 5 sought to establish evidence of new fluencies which relate to the application of independent higher-order thinking skills (Crockett et al., 2012).

Participants' screens were recorded as they progressed through the test and a camera and headset recorded their face and audio (Figure 38). The usability software recorded participants' time on task, mouse clicks and mouse movements. On completion of the test, participants were debriefed by the researcher before commencing the interview.

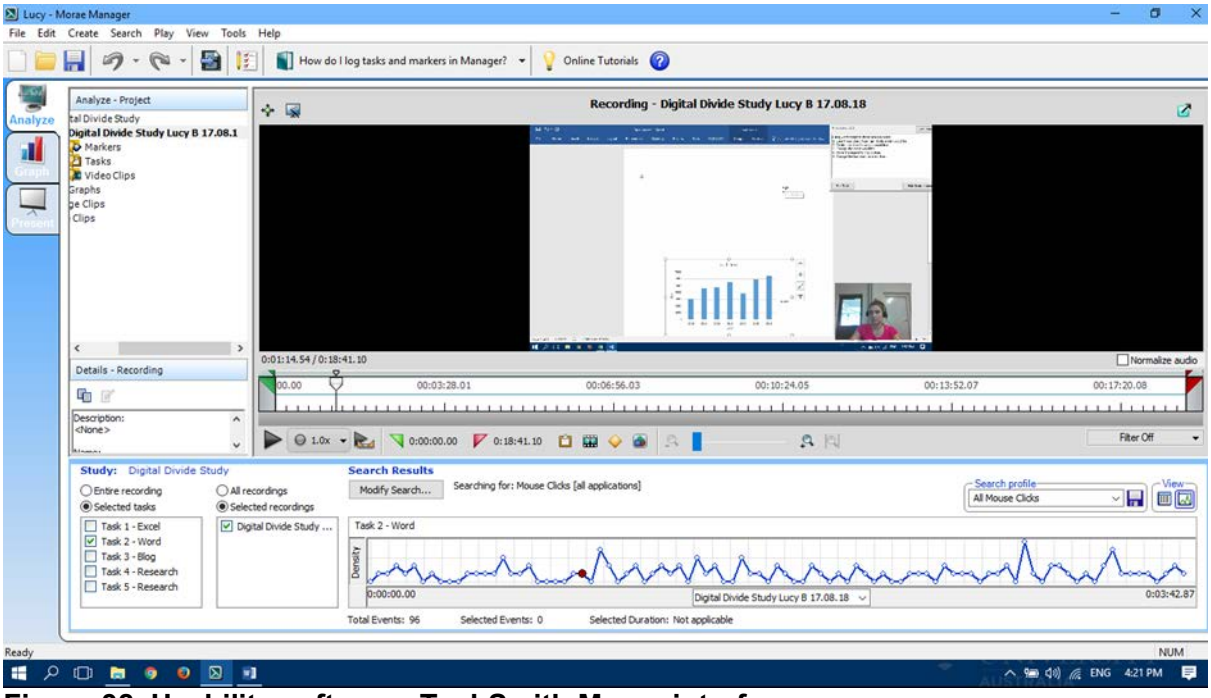


Figure 38 Usability software: TechSmith Morae interface

5.5 Comparison of digital test participants

A comparison of the participants' time on tasks, mouse clicks and mouse movements (Figures 39, 40 and 41) illustrates considerable differences in the participants' tests. Lily, Emily and Michelle completed the digital test in fewer than 15 minutes: 13.43 minutes, 13.64 minutes, and 14.17 minutes respectively (Figure 42). However, Michelle did not complete Task 3, the blog. Suzy recorded 51.7 minutes and was unable to complete the Tasks 3, 4 and 5 before the test timed out. These inconsistencies continued through all three data collection points. The shorter the time on task, the fewer mouse clicks and movements (Figures 42, 43 and 44).

The minimum time spent on the Excel task in Task 1 was Lily's 12 seconds compared with Michael's 10.62 minutes, the maximum.

Task 3, posting an image to a blog, created the most difficulties for participants with times ranging from 2.75 minutes for Michelle to 23.06 minutes for Suzy. Emily and Carla had technical issues accessing the blog, therefore have been excluded from Task 3.

Figures 39, 40 and 41 illustrate that the higher the level of task complexity, the greater was the time on task and the higher was the count of mouse clicks and mouse movements recorded. Task 1, create an Excel document, had a mean completion time of 4.49 minutes and 75 mouse clicks to complete. This task was completed by all participants. Lily completed Task 1 in 12 seconds with two mouse clicks, an exceptional score that was not achieved by any other participant. The closest times were Carla and Michelle with 2.1 minutes and 2.2 minutes respectively. Michael took 10.62 mins to complete Task 1 closely followed by Suzy on 10.56.

In Task 2, the level of complexity was increased with participants asked to create a bar chart then insert that into a Word document. The mean completion time was 5.66 minutes with a mean of 162 mouse clicks. Ben recorded the longest time of 12.71 minutes and mouse clicks of 243 to complete. Carla recorded the most mouse clicks with a score of 638 however, Carla could not access the blog and this contributed to her high mouse clicks.

Task 3, change bar chart to a pie chart and insert into a blog, was a complex task that required a level of digital fluency to achieve. Four participants took longer than 10 minutes to complete Task 3. The mean completion time for Task 3 was 7.96 minutes with a mean of 287 mouse clicks. Suzy could not complete Task 3 and recorded 23 minutes with 685 mouse clicks. Ben also did not complete Task 3 and recorded 12 minutes with 724 mouse clicks.

Task 4 required participants to research three articles for a university essay. All participants located academic articles. Gina took 8 minutes and recorded the highest mouse movements. This was due to a change in the university website and students had to scroll for the library link. The majority of students researched through Google Scholar or the university library.

Task 5, the media article, drew a range of different perspectives. The article referred to cannabis as an agent to cure cancer. The article mentioned a university but did not reference research or scientific inquiry. The majority of participants dismissed the article as making false claims.

Appendixes 23-36 illustrate the participants' progression through the test and individual test scores.

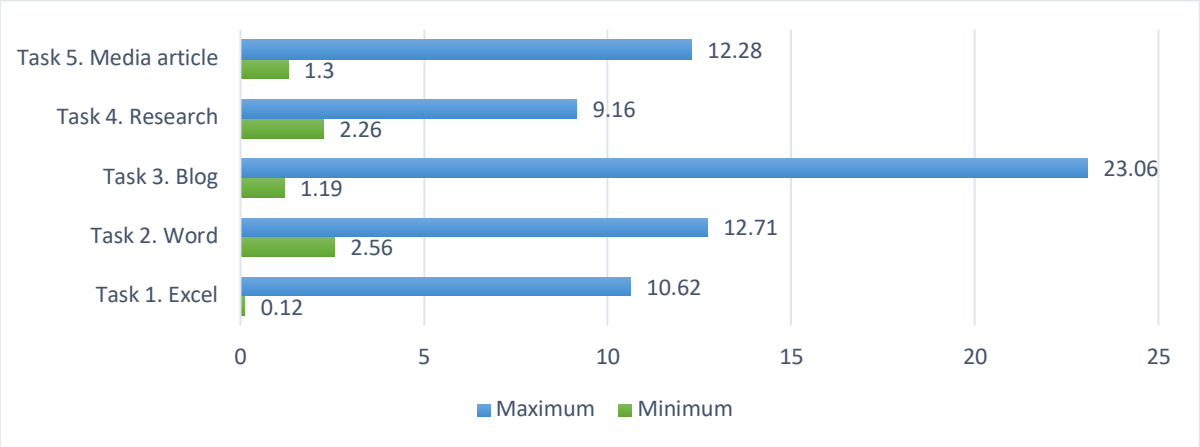


Figure 39 Minimum and maximum time on tasks

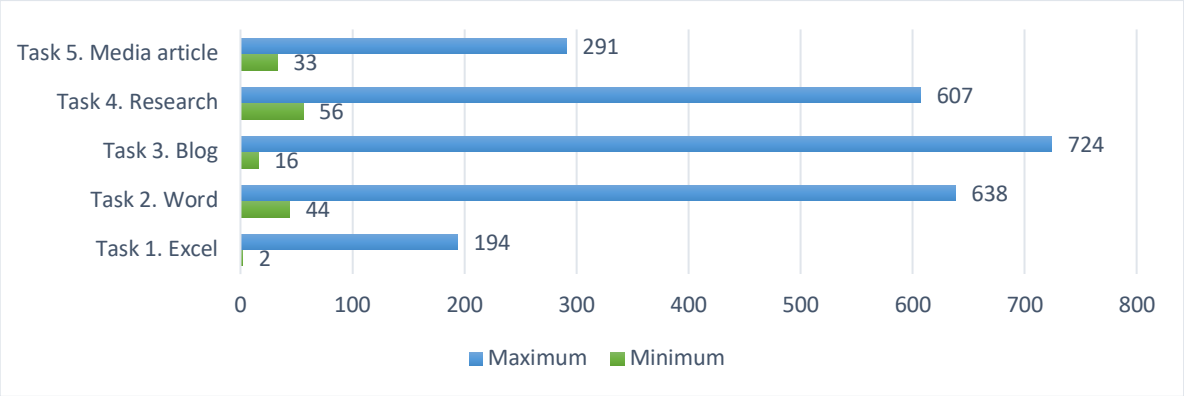


Figure 40 Minimum and maximum mouse clicks per task

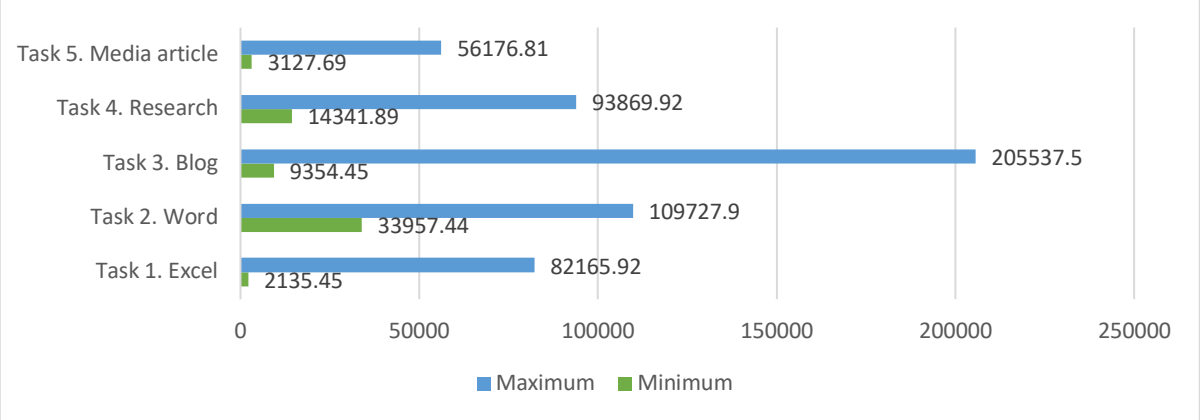


Figure 41 Minimum and maximum mouse movements per task

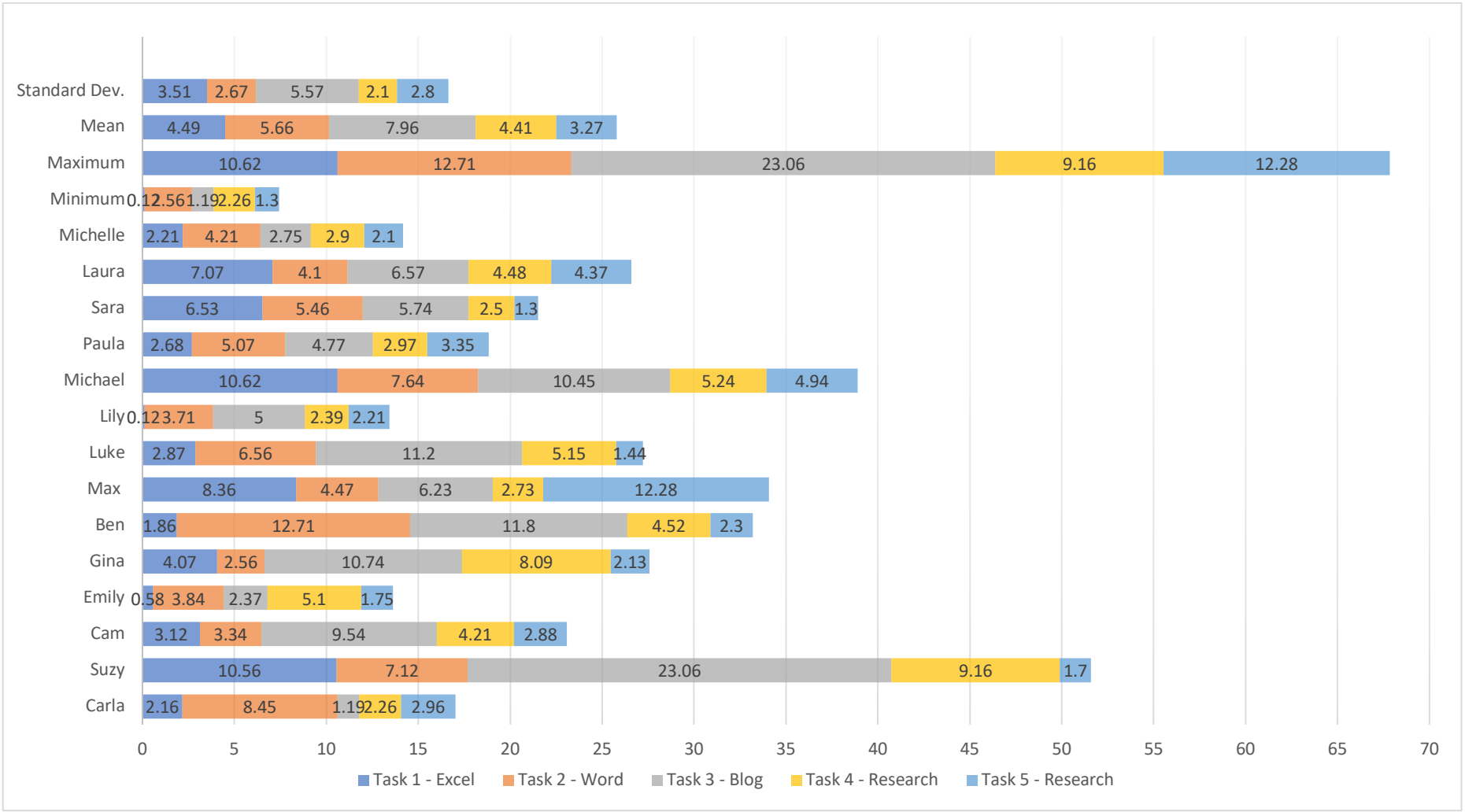


Figure 42. Time spend on tasks by participants

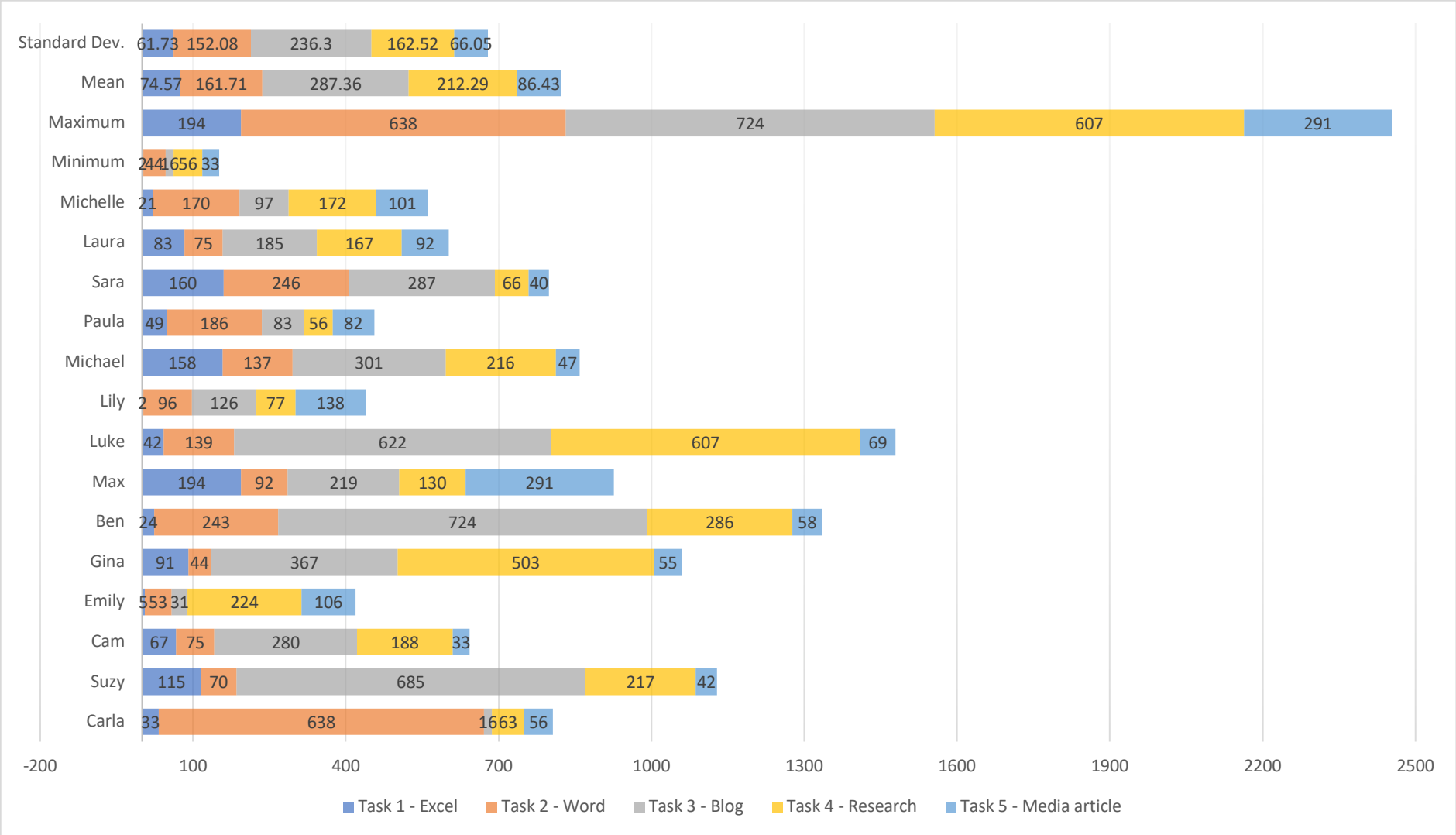


Figure 43. Mouse clicks on tasks by participants

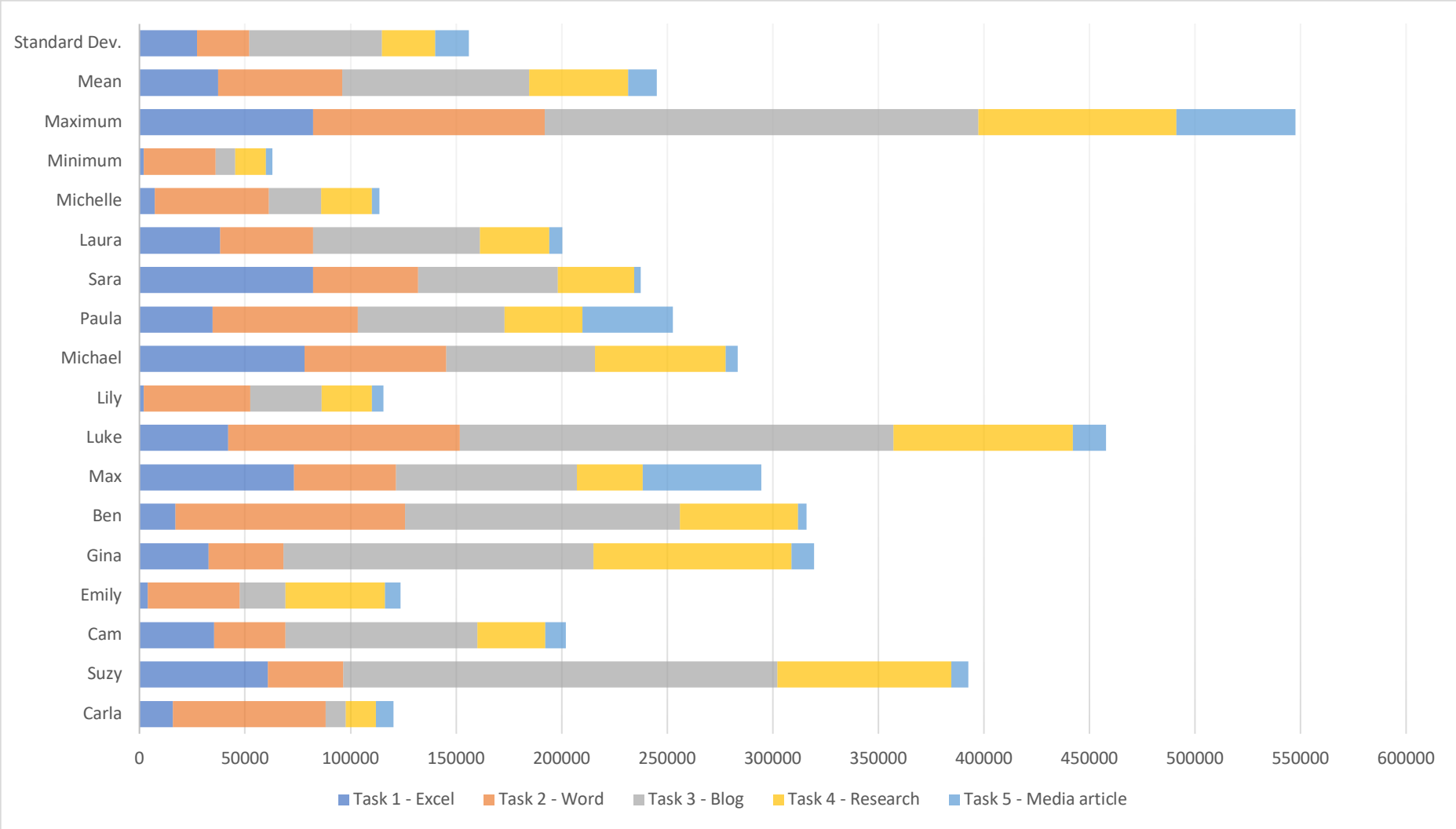


Figure 44. Mouse movement by participants

5.6 Study 2 – digital test results

Table 28 tallies the metrics of time on task, mouse clicks and mouse movements of each task for each participant. The total metric is then allocated a score. The less time on task, the fewer mouse clicks and movements produced by the participant. Suzy's test results are of interest in that she continued to work through the tasks and spent 23 minutes on Task 3, the blog. The researcher requested Suzy move on from Task 3 and complete the test. Suzy then completed Tasks 4 and 5 without any difficulties.

Jake did not complete the digital test and deleted his test from the laptop and the computer program. He became angry with the researcher and the test as he did not believe he was given enough information to complete the tasks. The researcher debriefed Jake, who revealed he found the test frustrating and was given to angry outbursts. Further information is provided in his case study in Chapter 6.

The participants' digital test results are illustrated in Table 28. Lily was the top scorer, followed by Michelle, Carla, Paula, Sara and Cam.

Table 26 Participants' digital test results

Name	Task	Time	Mouse clicks	Mouse movements	Total	Task complete	Score
Lily	1	0.12	2	2135	2137.12	Yes	1
	2	3.7	96	50468	50567.7	Yes	
	3	5	126	33823	33954	Yes	
	4	2.3	77	23605	23684.3	Yes	
	5	2.2	138	5465	5605.2	Yes	
Michelle	1	2.2	21	7237	7260.2	Yes	2
	2	4.2	170	54038	54212.2	Yes	
	3	2.7	97	24716	24815.7	No	
	4	2.9	172	24185	24359.9	Yes	
	5	2.1	101	3415	3518.1	Yes	
Carla	1	2.1	33	15753	15788.1	Yes	3
	2	8.4	638	72515	73161.4	Yes	
	3	1.1	16	9354	9371.1	No	
	4	2.2	63	14341	14406.2	Yes	
	5	2.9	56	8320	8378.9	Yes	
Paula	1	2.6	49	34565	34616.6	Yes	4
	2	5	186	68834	69025	Yes	
	3	4.7	83	69607	69694.7	Yes	
	4	2.9	56	36838	36896.9	Yes	
	5	3.3	82	42823	42908.3	Yes	
Sara	1	6.5	160	82165	82332	Yes	5
	2	5.4	246	49811	50062	Yes	
	3	5.7	287	66260	66553	Yes	
	4	2.5	66	36044	36113	Yes	
	5	1.3	40	3127	3168	Yes	
Cam	1	3.1	67	35299	35369.1	Yes	6

	2	3.3	75	33957	34035.3	Yes	
	3	9.5	280	90781	91070.5	Yes	
	4	4.2	188	32219	32411.2	Yes	
	5	2.8	33	9668	9703.8	Yes	
Laura	1	7	83	38195	38285	Yes	7
	2	4.1	75	44130	44209.1	Yes	
	3	6.5	185	79015	79206.5	Yes	
	4	4.4	167	32675	32846.4	Yes	
	5	4.3	92	6272	6368.3	Yes	
Luke	1	2.8	42	42068	42112.8	Yes	8
	2	6.5	139	109727	109872.5	Yes	
	3	11.2	622	205478	206111.2	Yes	
	4	5.1	607	84833	85445.1	Yes	
	5	1.4	69	15834	15904.4	Yes	
Gina	1	4	91	32674	32769	Yes	9
	2	2.5	44	35518	35564.5	Yes	
	3	10.7	367	146783	147160.7	Yes	
	4	8	503	93869	94380	Yes	
	5	2.1	55	10647	10704.1	Yes	
Ben	1	1.8	24	17090	17115.8	Yes	10
	2	12.7	243	108710	108965.7	Yes	
	3	11.8	724	130264	130999.8	No	
	4	4.5	286	55989	56279.5	Yes	
	5	2.3	58	3946	4006.3	Yes	
Max	1	8.3	194	73160	73362.3	Yes	11
	2	4.4	92	48488	48584.4	Yes	
	3	6.2	219	85528	85753.2	Yes	
	4	2.7	130	31224	31356.7	Yes	
	5	12.2	291	56176	56479.2	Yes	
Emily	1	0.5	5	7439	7444.5	No	12
	2	3.8	53	43699	43755.8	Yes	
	3	2.3	31	21621	21654.3	No	
	4	5.1	224	47091	47320.1	Yes	
	5	1.7	106	7383	7490.7	Yes	
Michael	1	10.6	158	78328	78496.6	Yes	13
	2	7.6	137	67041	67185.6	Yes	
	3	10.4	301	70404	70715.4	No	
	4	5.2	216	61988	62209.2	Yes	
	5	4.9	47	5692	5743.9	Yes	
Suzy	1	10.5	115	60884	61009.5	Yes	14
	2	7.1	70	35704	35781.1	Yes	
	3	23	685	205537	206245	No	
	4	9.1	217	82359	82585.1	No	
	5	1.7	42	8038	8081.7	No	
Jake	1	0	0	0	0	no	15
	2	0	0	0	0	no	
	3	0	0	0	0	no	
	4	0	0	0	0	no	
	5	0	0	0	0	no	

5.7 Study 2 – participants' digital access

Top scorers in five out of the six digital tests had access to an LMS at secondary school. Paula was the outlier who was not immersed in a digital environment at school. Paula's digital experience is further examined in her case study in Chapter 6. Paula competed an ICT subject and learned coding at school. This prior experience could have exposed Paula to digital settings that contributed to her familiarity in navigating a digital environment. Table 29 compares preparedness and access to digital resources with task completion. The results illustrate that the higher the level of task complexity, the greater the risk of task non-completion. Participants who stated a lack of preparedness for university and who did not have access to digital resources were not able to complete the tasks. These participants were also more likely to take the longest time to complete the test and record the highest mouse clicks and mouse movement. Michael's issue with dyslexia possibility impacted on the completion of Task 3 and is noted in Chapter 6.

Table 27 Student comparison of preparedness and resources to digital test task completion

Student	Prepared-ness	Digital curriculum	School issued laptop	Task 1	Task 2	Task 3	Task 4	Task 5
Sara	yes	yes	yes	completed	completed	completed	completed	completed
Carla	yes	yes	no	completed	completed	not completed *	completed	completed
Max	yes	no	yes	completed	completed	completed	completed	completed
Michelle	no	yes	no	completed	completed	not completed	completed	completed
Ben	no	no	no	completed	completed	not completed	completed	completed
Laura	yes	no	no	completed	completed	completed	completed	completed
Emily	no	no	yes	completed *	completed	not completed *	completed	completed
Lily	not sure	yes	yes	completed	completed	completed	completed	completed
Cam	yes	yes	no	completed	completed	completed	completed	completed
Paula	yes	no	yes	completed	completed	completed	completed	completed
Michael	yes	yes	yes	completed	completed	not completed	completed	completed
Luke	yes	no	no	completed	completed	completed	completed	completed
Jake	no	no	no	not completed	not completed	not completed	not completed	not completed
Gina	yes	no	yes	completed	completed	completed	completed	completed
Suzy	no	no	no	completed	completed	not completed	not completed	not completed

**Technical difficulties*

5.8 Conclusion

Study 2 reports on the results of the digital test. Fifteen of the surveyed respondents completed a digital test with usability testing software prior to an in-depth interview. Reporting on RQ_1 – "What is the correlation between socioeconomic, sociocultural/ geographic indicators and the digital divide?" and; RQ_2 – "Is digital fluency a precursor to preparedness for university study?", the study provides a link between access and application of digital environments in schooling and the development of digital fluency. This study presents data showing disadvantage indicators can overcome the digital divide if respondents have appropriate access to digital learning environments during secondary schooling. Respondents with access to a school LMS were more likely to be prepared for a digital learning environment and four of the six participants reported being prepared by their school for university study. While this is a small-scale study with only 15 respondents, the top scorers had many disadvantage indicators such as rural and regional location, low SES and first in family, yet were able to achieve digital fluency. The commonality of all six top scorers was prior digital exposure, digital usage patterns and immersion in a digital learning environment prior to enrolling at university.

Chapter 6 Digital Influences: Study 3

6.1 Introduction

This chapter begins with an exploration of technical identity before moving to the four propositions underpinning the development of individual Techno-biographies. These Techno-biographies are based on the Technical Identity Conceptual Framework J. Goode (2010) discussed in Chapter 3. This researcher defines a Techno-biography as an amalgamation of technical identity through experiences, digital usage patterns, sociocultural influences and access to resources. A school Techno-biography concept map is also presented to assess the connectivity, inclusion, influence and pedagogical practice of each participant's secondary-school experience. The individual and school Techno-biographies contribute to the formation of the technical identity.

The 15 case studies are introduced, followed by a review of the group's demographic features. Each case study presents a Techno-biography that maps the participant's digital fluency. The use of Technical Identity Conceptual Framework enabled the study of the digital divide to explore how individual experiences influence the development of identity and impacts on future endeavours (J. Goode, 2010).

Study of the digital divide is an emerging field and the concept of identity is used in Study 3 to form a framework in the study of digital usage patterns, experiences, sociocultural positions and influences. The concept of identity is seen "as the missing link between learning and its sociocultural context (Holland, 1998; Sfard and Prusak, 2005; Wenger, 1998 cited inJ. Goode, 2010, p. 502). Chapter 6 concludes with an examination of the use of Techno-biographies to study the digital divide and links the case studies to the "Preparedness for University Proposed Concept Model" in Chapter 3.

6.2 Study 3 – The Interview

The in-depth interview questions (Appendix 2) link Study 3's theoretical and practical contributions to theoretical concepts and readings. The four areas of influence used in the Techno-biography concept map are again evident in the interview question structure. These are digital technologies and schooling, cultural capital, techno-influences and digital fluency. Drawing on work by Devlin (2013) in cultural capital, questions were structured around the participants' universities, secondary schools and family influences and experiences. Cultural capital is defined by Aschaffenburg and Mass (1997), as "proficiency in and familiarity with dominant cultural codes and practices" (Cited in Devlin 2013 p.940). This cultural capital also refers to the value placed on knowledge, skills and qualifications (Luzeckyj, King, et al., 2011). Cultural capital or lack thereof was particularly relevant to Study 3's cohort who were primarily first in family. The interview sought to understand the relationship between

navigating university online systems and the lived experience of the participants' cultural capital and school experiences. School experiences are communities of practice which form part of our identity construct. J. Goode (2010) states: "Viewing identity as a product of participation in communities can strengthen our investigation of how past computing experiences influence individuals' relationships with technology" (p. 502). Technology identity is formed through experiences and influences from school, family and friends. These experiences influence an individual's relationship with technology. Goode (2010) continues: "In each of these environments, learning more about technology, with the guidance of more knowledgeable users, is important for building a technology identity" (p. 502).
The primary aim of the case studies is to characterise the participants' technology identities and build Techno-biographies based on their responses to the survey, interview and digital fluency test. Underpinning the Techno-biographies are four propositions that influenced the interview questions and digital fluency test (Table 30).

Table 28 Study 3. Propositions

RQ_1. What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide? RQ_2. Is digital fluency a precursor to preparedness for university study? RQ_3. What enhances and develops digital fluencies?	**Proposition 1: Digital inequity**	Differing levels of digital technology usage and application in schools contributes to the digital divide.
	Proposition 2: Digital harms	Digital issues early in higher education could impact on sociocultural capability referred to as digital harms.
	Proposition 3: Digital Ease	The digitally fluent can move from one platform to another with ease.
	Proposition 4: Digital Immersion	Students immersed in a digital environment prior to commencing university are less likely to be impacted by the digital divide.

Aligned with the Technology Identity Theoretical Framework (J. Goode, 2010), the interview questions sought to examine the participants' beliefs about technology, opportunities, constrains and motivations. Goode, (2010) referred to these belief patterns as the "conceptual backbone of a technology identity" (p. 502). Goode (2010) states,

> Incorporating technology identity as a theoretical lens provides an ideal perspective on the digital divide for several reasons. First, it places the unit of analysis on the

> individual since belief systems about one's relationship with technology can only be captured at the individual level of analysis. Second, this theoretical perspective foregrounds the social and cultural context of the digital divide by situating lived experiences in a landscape of culturally situated learning practices. Third, framing the digital divide around a technology identity leads to new methodological tools that capture a nuanced understanding of the digital divide (p. 503).

The Techno-Biography Concept Map and School Technical Identity Concept Map are illustrated in Figures 22 and 23 and were outlined in Chapter 3. These concept maps align the interview questions with the research questions, the theoretical and practical contributions of the thesis and Study 3 propositions outlined in Table 30. The four areas of influence represented in the techno-biographies are cultural capital, techno-influences, digital fluency and digital technologies and schooling.

6.3 Study 3 – Case studies

This section portrays the 15 participants' lived experiences in the four areas of influence of cultural capital, techno-influences, digital fluency and digital technologies and schooling.

6.3.1 Lily – Case study 1

(Appendix 7 – digital test results)

Lily is a school leaver who attended a rural state school. During Grades 8 and 9, Lily's school provided a laptop for her "take-home" and "in-class" use. In Grade 10, the school moved to a "Bring your Own Device" (BYOD) system and subsequently Lily's parents bought her a laptop which she still uses today. When asked whether, after the BYOD system was introduced, the school continued to provide laptops Lily said:

> They did provide school-issued ones that you could hire but they weren't very good quality at all, so I bought my own. A great portion of our grade did (purchased their own laptop) then the school banned that halfway through and then (sic) everyone contested it because the school laptops were so poor quality."

Lily said she used her laptop for everything at school. The school appears to have been well resourced with various digital technologies including Smart Boards. Teachers uploaded the day's notes, learning activities and assessments to the school's curriculum drive (shared-drive facility). Students were then expected to log on and download their material prior to class. If material was not available on the curriculum drive, learning activities were downloaded on to a USB drive and distributed. Lily said: "I had my laptop every single day. I rarely used a book. Like it was my laptop for everything."

Lily stated it depended on the teacher as to how technology was integrated into class. Some teachers handed out notes but the expectation was that digital technologies were embedded throughout the curriculum. When asked to identify the differences between school and university digital use or environments, Lily stated there was no real difference except the university's LMS was much easier to use than the school's curriculum drive.
When asked how she learned to use digital technologies and who her biggest influence was, Lily stated digital technologies were the norm and have always been about. Lily said primary school probably taught her to use technologies but she believes she is self-taught and her friends were the biggest influence

6.3.2 Max – Case study 2

(Appendix 8 – digital test results)
In secondary school Max had a take-home school-issued laptop from Grades 8 to 11. Max said: "I had to fight to keep the laptop in Year 11, and then they completely scrapped it (the laptop program) in Year 12."
In Grade 12 the laptop program was stopped and his school moved to a BYOD system with a laptop trolley for students who could not afford a laptop. Subsequently Max used his mother's laptop at home and occasionally at school but primarily used a laptop from the school laptop trolley.
Max's school had a curriculum shared drive where some learning activities were uploaded for him to access his learning activities and assignments. However, not all teachers used the curriculum drive. Max said his secondary school wasn't as well equipped as his primary school had been. The primary school had Smart Boards and a variety of digital technologies. He said laptops at secondary school were mainly used to type assignments or do web searches. The school did not appear to have fully embedded digital technologies.
Max noted the difference between school and university was that at university, study materials were more organised because of Blackboard and other online systems.
When asked if he had problems enrolling, Max stated:

> It's a bit of a nightmare, I'm not going to lie. I just sort of plodded my way through it with my old girl (mother) … we couldn't really find any instructions. I found that after I'd done my application and all that, they put a set of instructions up on YouTube about it … but for someone that's coming with a family that's never been to uni before and haven't done anything like that, trying to set that up and knowing what button to press, especially with setting up the HECS, was very hard.

At the time, Max worried about his enrolment problems. He was concerned he might miss out or miss a deadline. In the end he didn't need to contact the student enrolment centre as he eventually worked it out for himself.

When asked how he learned to use digital technologies, Max stated it was mainly through trial and error and that his biggest influence in learning was his primary school teachers. Max said technology was used a lot in primary and was always there. Max said: "I was sort of forced to use it and then just picked it up."

6.3.3 Laura – Case study 3

(Appendix 9 – digital test results)

Laura is a school leaver who attended a private school in Victoria. Laura had a school-issued laptop from Grades 7-9. Her school then moved to a BYOD system and Laura's parents purchased her an Apple MacBook Air to use. Laura's school had an LMS and teachers uploaded learning materials for students. When asked how digital technologies were used at school, Laura said:

> Basically, just used the basics, like Word and PowerPoint every day, just in class. The teacher would put up documents for us to read and then … we downloaded homework, assignments …"

Laura said all homework questions were uploaded on the school LMS and technology was used every day. It appears the school had integrated technology throughout the curriculum and resources such as LMS supported digital pedagogies.

When asked if she was able to enrol easily online, Laura responded that there was an issue and she had to call enrolments twice for help. Laura said enrolment staff walked her through the process and were very helpful. Laura also had a friend who assisted her to enrol. When asked how she felt about needing assistance Laura replied: "I didn't really mind. It wasn't like a big thing so I wasn't really surprised that I needed help."

Laura talked about the difference between school and university. Technology, she said, was embedded in everything at university and quite different from school: "At university it's a lot more technology. Like although I used it every day at school, I'd be lost here without my laptop, because all the lecture slides, everything else."

However, because of her school digital experience, Laura said she didn't need to learn extra digital skills to use university systems. Laura described herself as knowing the basics of technology and having a good attitude towards digital technologies. She liked to keep up-to-date with technology as she didn't want to fall behind. Her parents also tried to stay up-to-date with digital technologies and were comfortable using technologies. Laura said primary

school was her biggest influence in using technologies but that her parents also taught her how to use her MacBook and helped her to learn technologies.

6.3.4 Paula – Case study 4

(Appendix 10 – digital test results)

Paula is a school leaver who attended a Catholic secondary school in a regional city and had a school-issued laptop. Her school primarily used the laptop for learning activities such as an interactive white board and Kahoot games. Paula said the laptops were not generally used in class and if they were to use the laptop it was to do Google searches. Assignments were handwritten:

> Yeah, it was all handwritten. We weren't really allowed to use the laptops, because a lot of girls would get distracted. So, it (the laptop) was a privilege. I would just carry it around. See, a lot of girls went shopping so whenever you're on a laptop you're always suspected of being shopping. So, we were told to handwrite as opposed to using the computer because it was better for us.

Paula would have liked the school to place more emphasis on technology and said her school experience still influenced her attitude and use of technology. Paula said she had some competence but would like to know more. She generally uses her laptop as a word processor:

> I do prefer to handwrite things. But I feel like I know something – I have some competence in it but I could have better knowledge. I mainly use my laptop, or any technology, just for printing purposes.

Paula also had problems enrolling online at university:

> I had to do it about eight times and watch videos, because I got lost. It was very confusing. But I managed in the end.

Paula's mother only uses technology for Facebook and Solitare. When asked about her main influences in technology Paula said:

> I wouldn't say I had an influence. I just thought if I knew what I was doing it could be helpful in the future. I don't think there was any one thing that really influenced.

However, primary school did teach her Word and PowerPoint. In Grades 11 and 12 Paula did ICT and learned coding. The laptop wasn't used for ICT, just a school desktop. Paula learned how to code a game and play it. Below is an excerpt from the interview.

Interviewer:	Okay. So, you did do a fair bit of technology then before you came to university?
Paula:	A little bit but not as much as you would expect from a technology subject.
Interviewer:	Okay.
Paula:	Yes. So, it was mainly typing notes and once a semester doing coding.
Interviewer:	Once a semester you did coding?
Paula:	Yeah, so it wasn't a frequent event.

When asked how learning a new digital technology make her feel Paula said:

> If it's easy to understand, I feel amazing, confident, I can do it, whatever. But then if it's difficult and I have struggles with it, I do get stressed and anxious until I understand it.

However, overall Paula is able to troubleshoot technology problems by using Google.

6.3.5 Ben – Case study 5

(Appendix 11 – digital test results)

Ben is a mature-aged international student from a South Pacific Island. Ben's school did not have school-issued laptops but computers were available for students to use in the school library. Ben's school did not use digital technologies in their lessons as most students did not have access to computers or internet at home. The school computers were used as a tool of learning how computers worked.

Even so, at secondary school Ben undertook a few levels of programming and automation. Ben became interested in technology and together with his friends built his own computer while at school. Prior to this, Ben used his mother's computer. Ben's mother had a government job and as such was able to access the internet at home.

> I was the first one in my neighbourhood, actually, to get the internet because my mum worked at a post office. They were the only internet provider at the time. So, it was very revolutionary, I can say, having the internet at home.

When asked about his online enrolment experience Ben said:

> It was a little bit hard to get into the way of how JCU works, like their systems and their procedures, which for an outsider is quite like different. You have to do everything on a computer without coming in and no one really knows – because you talk to someone online, then you come to JCU … it depends on who you talk to. So, it was bit hard that way, although my online experience was good, because I registered, they told me I got in. But when I came in, I didn't know what to – you know, how to register my classes or how to do this.

When asked how he felt when he was experiencing problems enrolling, Ben stated he was not anxious and that it was just a hurdle he had to pass to get into university.
In explaining the differences between school and university, Ben said he did not have any major issues with the university digital environment.

> It's probably like because I'm – a bit tech savvy, so it wasn't so much of a difficulty. I think it was much more of a help for me to actually have everything online and just go on the tablet or on the phone, go onto my Blackboard on my phone or my Blackboard on my tablet, or my computer at home. Everything is online and if you do want to have a question, you send an email. So, everything's quite compact, which I appreciate.

Ben felt the university digital environment suited him because of his interest in technologies, particularly as he has lived both in a non-digital world growing up without internet to here and now where he is immersed in a digital environment.
When asked about his biggest influence in digital technologies, Ben said it was his high-school friends who worked together with him to build machines: "The Pacific island was far away and remote from everything and technology opened it up to the world."

6.3.6 Luke – Case study 6

(Appendix 12 – digital test results)
Luke is a post-school leaver student who has previously studied at a different university and is a writer for a series on YouTube. Throughout his secondary schooling, Luke attended an International School in China. He had a personal laptop at school but did not recall teachers using technology in classes other than ICT subjects. Luke did some coding in his computer science subject and mainly used his laptop for assignments.
When asked whether he was well prepared by his school for university study, Luke said school should be teaching self-learning:

> In high school you're walked through everything. Whereas at uni, you have to be able to be self-motivated. But how do you get high-school students motivated to be able to learn on their own?

Luke said it was a "shock to the system" when he started university because at school he could submit multiple drafts of assignments.
Luke began his studies at a New South Wales university and had difficulties enrolling online but did not have a problem enrolling at the regional university. He said the main difference between school and this university was the digital environment. Even when he first enrolled in a university there were still paper copies of readings but at this university, everything was online and digital. Luke primarily used his phone to access items on campus or watch lectures.
Luke described his attitude to technology as mixed:

> I still like bringing my book and like writing through the lectures and things like that. I think when you go digital, people can lean on it too much and get an overload of information, more so than when it's physical … it's daunting.

Luke said his father was his biggest influence in technology and he learned how to use computers through him.

> He was like the Apple technician at BHP in Whyalla. So, we had an early entrance to computers and he knew a lot about them. But I do remember them coming in, you know, coming into the home. But yeah, I remember playing – like I used to like playing games on them as a little kid, and then doing some other things. Like he would network them in the house so you could type on one and then get the message on the other one, and that was exciting.

Luke had significant experience growing up with computers through his father's influence. Luke stated he could set up his own computer, install programs and back up data. However, Luke continued to stress throughout the interview that he preferred to read a book in print than on a computer.

6.3.7 Cam – Case study 7

(Appendix 13 – digital test results)
Cam is a school leaver who attended a Private independent school in a regional city. Cam's school was well resourced with a LMS, Smart Boards, shared drives and a BYOD policy introduced in Grade 11:

> Every classroom had either a Smart Board or a Smart TV, so everything was – the lessons were all run through those.

Cam used a personal laptop throughout secondary school which was used in classes:

> There was the online LMS, which everything is run through, but then there was also shared drives that we could all access. The school's online forum was called eCat and we would log onto that. All the classwork was shared through that, effectively and then assessment submissions would run back through that, same sort of set-up as (this university's LMS)".

Cam's school had made a significant investment in digital technologies and had a digital curriculum:

> For example, in a math's class, teachers would use the Smart Board to write on rather than the whiteboard, because then they would save that and upload it to eCat.

Not all students had a personal laptop but a class set of laptops was available to ensure all students had access to a laptop. Cam said the class set laptops were not great as they had not been updated but most people had their own laptop.

Cam said he was well prepared by his school for university study. Cam's school focused on self-directed learning, academic writing and referencing to prepare for university. However, Cam stated his school should have been less helpful by requiring fewer drafts.

Cam did not have any problems enrolling online at university. When asked about the differences in digital environments between school and university, Cam said at school his teachers were very good at teaching with technology and using the LMS.

> … at school, a lot more teachers were probably a lot more across all aspects of it, in using the online LMS itself … There was a very big focus from the school on everyone using it, and using it in the same way, in the right way.

Cam said at university not all lecturers were using the LMS in the same way. He said there was no consistency across subjects at university.

Cam described himself as an early adopter of technology and could not remember a time without technology. His parents were also very comfortable with using technologies. Cam said his biggest influences in learning digital technologies were his friends. Cam said he could troubleshoot computer problems and keep up-to-date with new technologies.

6.3.8 Emily – Case study 8

(Appendix 14 – digital test results)

Emily is a school leaver originally from the Philippines and came to Australia as a young child. She attended a Catholic secondary school in a regional city and had a school-issued laptop. Her school was very strict about the use of the laptop and would only allow its use in class at certain times. The laptops were primarily used for homework and assignments. Emily's school had a website for uploading assignments and some teachers uploaded activities to the site to use in class. The school also used iPods for recordings.

When asked how her school prepared her for university study, Emily said they did assignments to university standards and practiced academic writing. Emily spoke about the school being very helpful with assistance provided for assignments and multiple drafts. However, Emily said university was:

> different to what we were taught … Nothing was the same. When I got here, it was all different. I wasn't expecting it.

Emily said there was a big change between school and university, particularly with the university digital environment and LMS.

> Yeah. The university had more resources than the schools, and we were really limited. They (the school) were really strict on what we used.

When asked about her online enrolment experience, Emily said a friend helped her to enrol and there were no problems. Emily said she was comfortable with technology and that teachers were her biggest influence in learning how to use technologies. Emily tries to keep up with the latest technology and though she sometimes gets frustrated with learning a new digital platform overall, she is comfortable around technology.

6.3.9 Gina – Case study 9

(Appendix 15 – digital test results)

Gina is a school leaver who attended a rural State school which had a school-issued laptop and BYOD scheme from Grade 9. Gina had her own laptop which she connected to the school Wi-Fi. When asked how her school used technologies Gina said:

> For the majority of subjects, it would just be for assignments, so using Word to type it all up and possibly Excel for graphs. Otherwise, for graphics, we had the programs on there so you could design products.

Primarily the school used print-based learning materials and laptops were used for assignments. Gina said her school prepared her for university.

> They showed us how to reference so they showed us how to use some websites as well as Microsoft Word referencing. They'd go through what a good article or reference website would look like, and taught us how to tell if the information's good or not.

When asked what else her school could have done to prepare her for university, Gina said,

> Maybe give us more textbook readings, because I know we didn't do that very often at all. We just used them mainly for questions but if we had to, say, for homework and go and read so many pages, then we'd go and do that but that didn't happen very often at all.

Gina said there was a big gap between school and university in the use of digital environments:

> It was a bit because here (university) we actually go into websites, find out all our information, whereas (at school) you'd just be handed out a paper form. At my school they didn't use much technology at all, so even just using interactive websites or anything, we just never really did that.

Gina spoke further about the differences between school and university:

> I use my laptop every day here, whereas at school I'd use it may be around exam or assignment time, just for research for assignments. But here I use it every day. I put my notes on there. I do all my research and log in and check my emails and use LearnJCU every day.

Gina did have some issues with her online enrolment but sorted it out by contacting the university for assistance. Gina said enrolling was frustrating and stressful.
Gina's attitude to digital technologies is good. She likes to use the latest versions of software and says: "I can log on to something and quickly learn how it works or where to find things." Gina was introduced to computers in Grade 2 and in Grade 3 had an IT subject in a computer lab. Her biggest influence in using technology was her primary school teachers: "Mum did help from time to time but we mainly learned everything from the teachers".

Gina does not update software often and is happy to continue with dated software. If she has any issues with technology her brother helps out or she sends it to an IT business for support. However, Gina troubleshoots any technology issues by searching for a solution using Google.

6.3.10 Jake – Case study 10

(No digital test results)

Jake is a mature-aged student educated in South Africa at a Catholic school. Jake did not grow up with technology and was a young adult when he first started using computers. Jake learned to use computers while he was imprisoned. Jake said that in prison he completed multiple vocational programs including a Certificate I and II in Information Technology and a Certificate IV in AutoCAD.

Jake said the Australian Army was his biggest influence in digital technologies having adopted technologies from 1993. Jake spoke about how he had a head start with computers as he had to learn Excel and spreadsheet as part of his job in the Army:

> Yeah, I had to learn so they put us all (through training) where you start learning how. I had to learn how to use computers and Excel spreadsheets and stuff. This is how you use it, this is the way you do it. The military way of teaching is totally different to civilian life, totally different.

Jake said he was a bit old-fashioned when it came to technology. He preferred paper to electronic copies and said: “it can be useful and it can be a trap.”

Jake does not keep up with the latest technologies and does not like to change phones. If he does need a new phone he said:

> Sometimes, yeah, but I always – get the ones where I can have a MicroSD card because I can just transfer stuff and it just updates and gets faster.

Jake finds technology frustrating:

> Sometimes frustrated because it’s not explained very well. With some, it’s fine. It depends on the brand too. I find Acers are a lot easier than other laptops. Forget HP, I find it stupid; and Apple, well, I’ve thrown it through the window and used it as a fishing boat weight.

When asked if he can troubleshoot technology problems, he said he can fix Wi-Fi connections but for anything else he contacts IT services.

Jake did not complete the digital test as he became frustrated with the lack of instructions. He was angry and upset with the researcher for not providing “proper” instructions on what he had to do in the test. Jake then deleted his test from the computer and the researcher was unable to retrieve any data relating to his test. Jake did agree to be interviewed afterwards and was debriefed by the researcher.

6.3.11 Michelle – Case study 11

(Appendix 16 – digital test results)

Michelle is a school leaver who attended a rural State secondary school. In 2014 when Michelle was in Grade 9 her school implemented a BYOD scheme. It wasn’t until she was in Grade 11 that Michelle was able to afford a laptop:

> As I sort of came from a low financial family, we – didn't have access to it (laptop). It was only once I started working that I was able to buy my own device to use at the school.

The school had a set of laptops available on a trolley for students to use if they did not have their own device. Between Grades 9 and 11 Michelle used these laptops to participate in class activities:

> I – used the school-issued laptop and then (when the school) brought in the bring your own device we sort of lost funding for the laptops. So, the kids in the under grades would pull off the keys, or they would abuse the computers. They were like falling apart and weren’t running Windows properly.

The school had an LMS and Smart Boards which were used in class time, although Michelle said not all teachers used the LMS. Those who did uploaded worksheets etc. to the LMS for students to download and complete. Michelle spoke about feeling disadvantaged because her family could not afford to purchase a laptop:

> I had to use a school laptop. I felt like I was at a disadvantage because if the laptops in the classroom weren’t working then I missed out on participating in the learning activities online.

When asked what her school did to prepare her for university, Michelle said she had never planned to go university straight after school and wanted to drop out of the OP system (Queensland university entrance exam) but her school was very negative about her dropping

out so she stayed. However, Michelle said her school did not really prepare her for university:

> I'm the first one in my family to go to university, and it was sort of very nerve wracking, and I thought if I had a bit more support then it wouldn't have been so scary.

Michelle said she would have liked the opportunity to talk with university professors, lecturers or current students to see how they found university study but was never given that opportunity. Michelle had issues understanding how to enrol and received support from the university enrolment team. When asked how she felt about her enrolment experience Michelle said:

> Oh, it kind of made me feel a little bit incompetent because it was like I've sort of done something similar before so how hard can it be; and because I was new it was really nerve wracking, really stressful and it's like, oh no.

Michelle was then asked to describe the difference between school and university's use of technology:

> Well, I feel like here at university, we're sort of more involved with the technologies. Like everything's put online and you have access to it all the time, which is a good thing because I like to study late at night, so I know I've got all the resources there if I need them. If I do need them, there are lots of computer labs here as well. I feel like it's been a lot more supportive in the technology.

Michelle's parents introduced her to technology but her biggest influences in using technologies were her primary school teachers. Michelle does not feel the need to keep up-to-date with technology and only updates her phone as required. Michelle is sometimes overwhelmed when changing or setting up new technology and researches how it works and how to use it. Michelle can troubleshoot small technology problems and outsources anything major.

6.3.12 Michael – Case study 12

(Appendix 17 – digital test results)

Michael is a school leaver who attended a rural State school in Victoria. Michael used a laptop at school from Grade 4 to assist him overcome his dyslexia. He used computers throughout his schooling:

> I used them for everything – I was diagnosed with dyslexia, and the computer helped me with my work. I didn't have a book for the whole of Year 12, and I did all my exams on a computer.

His secondary school has a BYOD scheme from Grade 7 and his schooling was digitally based. Michael said he can't read print: "I get three lines and every word goes blurry". However, using a laptop he triple spaces everything on a screen and is able to read. Michael's teachers were very accommodating and he proceeded well through school. Michael's school had a digital curriculum with classes and activities uploaded to an LMS:

> Our digital diary was automatically updated by our teachers. We could log in every morning and see what we had to do that week. There was literally no physical input from us, so any due dates or extra curriculars, it was always automatically uploaded on the system.

The school prepared him for university studies by introducing him to the university community:

> We'd get lecturers in, current students and they talked to us about everything. Everything from where to live on college to what subjects to pick and how to drop out of classes and stuff.

However, Michael would have liked his school to have introduced him to APA referencing and place more emphasis on attending lectures, time management, and self-motivation. He said he really struggled in the first semester getting into the mindset of attending lectures because he thought he could always watch the lecture online but he never did.
Michael felt there was no discernible difference between his school and university's use of technologies. He was very comfortable and placed great emphasis on using digital technologies. Michael says he feels uncomfortable when he doesn't have technology:

> It's how I've learned – it's a strategy that I've used to be able to succeed at what I want to do, more so than anything.

Michael's biggest influence in technology was his Grade 3 teacher who worked out his writing problem and came up with using the computer. Michael updates his technology, particularly his phone. He has no issues with changing devices and states he can troubleshoot technology problems 99% of the time.

6.3.13 Suzy – Case study 13

(Appendix 18 – digital test results)

Suzy is a mature-aged student who went to school prior to the introduction of digital technologies. At 25 she returned to high school to complete Grade 12. Suzy had previously studied a year in the Bachelor of Education program and does not recall having any problems enrolling in university. Suzy did have difficulties using technology at university:

> When I first started, yes, because I would actually take notes, or when I was writing assignments I would actually write them out in longhand, then type them up (on a computer).

Suzy found a first-year computer subject in her first degree enabled her to build her technology skills. She learned how to use Word, Excel and PowerPoint but up until her third year in her undergraduate degree she still wrote in longhand: “Up until third year I still wrote my notes down longhand and then typed them up”.

Suzy describes herself now as being *au fait* (comfortable) with technologies.

> I’ve got a smartwatch. I’m right in there. I’ve got ear buds; a smartwatch and I’ve got an iPhone and a smartphone.

Suzy has had many jobs prior to studying at university. She was an aviation technician in the Air Force for six years. Suzy said her main role was in keeping track of maintenance schedules online. Her father is an electrical engineer with qualifications in computers and her mother uses technology e.g. smartphone and smart watch at 81 years old.

Suzy said her biggest influence in learning technologies was her first-year lecturer in the education degree. The university learning advisers also helped her learn how to use different programs. Suzy said she makes the changes to new technologies fairly easily though she would not know how to use an Apple laptop. But she can update her phone and transfer contacts etc.

Suzy troubleshoots problems by reading the instructions or doing Google searches.

> Sometimes they have videos and you can just go follow it like a recipe, you know. But apart from that, I just follow the instructions.

Suzy spoke about how different everything was at university compared with her school education. However, by seeking help wherever it was offered, she has built her digital technology capacity.

6.3.14 Sara – Case study 14

(Appendix 19 - digital test results)

Sara is a school leaver who attended a rural State secondary school. Her school had a school-issued laptop scheme from Grade 10 and 11 however, in Grade 12 the laptop was taken away due to funding issues at the school. The school did not allow BYOD so students had to access a computer lab to use technologies. Sara had access to a personal computer at home:

> We had computer labs, which were totally booked but I think we used them twice … You had to book them (the computer lab) quite far in advance so then when we needed them, they were never available.

The school's digital technology was projectors which were not interactive. No Smart Boards were available. When Sara had the school-issued laptop it was used extensively in class:

> I could take mine home, use it in all of my classes, write all of my notes. I didn't have to take a workbook if I didn't want to. I could just use the laptop solely. School to me was very similar to the lectures here. We were given the content and then we wrote down notes on that. Then we did our activities afterwards, which we all did on the computers, so that involved searching and typing, creating graphs, finding pictures, all that sort of thing.

Sara said after the school removed their laptops in Grade 12, everything changed:

> It was a big change. We had to go back to our textbooks, back to our workbooks, handwrite everything, so the class was a lot slower. A lot of the time we didn't get our work finished, especially in the first term, because we just, like, just changed, so we didn't get a lot of our work done, all that sort of thing. Then it also made it a lot more difficult because then I'd have to go home and type whatever I had done so that I could use it for my assignment.

The school did have a shared drive or LMS for students to access their work and/or upload assignments. However, the shared drive was not used during Sara's final year at school for learning activities; just uploading assignments:

> We had a program that the teachers used to put everything up on, so it was very helpful in accounting and all that sort of thing, so we could use our Excel spreadsheet in class.

When asked how her school prepared her for university, Sara said in Grade 12 the school started teaching like a university system:

> Towards the end in Year 12, we really started to get into the first half of the class being our lecture and the second half being a tutorial. We went through in that stage and other things, like we were allowed multiple drafts in some subjects and then in Year 12 we were only allowed one. Then in the second half of Year 12, we weren't allowed any drafts. Yeah, so it was very much like uni. Obviously, we had to submit everything hard copy, and our online system, so the university LMS is just fantastic. It's so different to the one we used at school (which) was a lot more difficult to use.

In response to what the school could have done to prepare her for university. Sara said more flexibility, and allowing different learning strategies to accommodate everyone. Sara also said a better online program would have helped. The university LMS made everything easier. If Sara misses a lecture it's available online so she never misses out. Sara missed a lot of schooling because she was away with sporting commitments.
When asked about her online enrolment experience, Sara said she had a lot of difficulty enrolling online and had to contact the university three times for help. But since starting university, Sara has found the digital technology very useful and not difficult to use. Also having an older brother at university helped her settle in. Sara said her brother was her biggest influence in using technology.
Sara does not like updating to new technology. In fact, a new phone bought six months ago is still in her cupboard:

> I just find it a bit inconvenient. If I'm happy with how something's working, I'll just usually continue to use it, even if, you know – obviously the object is better and better but I just tend to use what I've got. Then when someone forces me to change over, I do.

Sara troubleshoots problems by asking people for help. Sara is well networked and has no problem calling on people at the help centre to assist to work out technology.

6.3.15 Carla – Case study 15

(Appendix 20 – digital test results)

Carla is a school leaver who attended a Private school in a regional city. Carla was enrolled in a double degree in Law and Business but dropped out of university between Study periods 1 and 2. Carla wanted to continue participation in the study. Carla's secondary school was well resourced with Smart Boards, an LMS and a class set of laptops that was well maintained:

> Some kids used to pull keys off the laptop keyboard but the school fixed them quickly.

The school's LMS was primarily used for assignment uploads. The school also enabled students to use laptops with a lockdown browser for exams. Sara said an Information Technology Systems subject she did in Grade 8 was very helpful for learning Excel, Word etc.

When asked what her school did to prepare her for university study, Carla said they were taught research skills and academic writing. Carla was able to submit multiple assignment drafts for assignments until Grade 12 when they were only allowed one draft. Carla said she would have liked the school to teach her referencing skills.

Carla described her online enrolment experience as confusing:

> I had no idea where to go on the enrolment site or what to do. I found it very frustrating because I didn't know if I had enrolled in a subject or not. So, I had to get Mum to help because she had enrolled at the university before.

Carla did not find a huge difference between the university and school's digital environment, except there were no barriers or firewalls to deal with at university:

> It wasn't super different. University's LMS is easy to use and upload things. At school you couldn't access a lot of sites because it was locked down. But here you can access everything so it's much easier to do things.

Carla has a good attitude to technology. Her parents are very good at technology and technology was used a lot in her household. School taught Carla how to use technology particularly from Grade 3 onwards, as Carla's schools had Smart Boards and she remembers that as a good way to learn about digital technologies.

Carla likes to figure things out herself and find out how things work. She found her Information Technology Systems subject in Grade 8 most useful in learning how to use different software. Strategies Carla uses to troubleshoot problems include activating the

computer “task manager” program and closing everything down. Carla searches for solutions on Google or asks for help when required.

6.4 School digital experiences

The statements below, extracted from the case studies, illustrate the lived experiences of respondents. There are clear lines of differences in the digital environments based on school types.

State school experience

> They did provide school-issued ones that you could hire but they weren’t very good quality at all, so I bought my own – then the school banned that halfway through and then (sic) everyone contested it because the school laptops were so poor quality. (Lily)

> I had to fight to keep the laptop in Year 11, and then they completely scrapped it (the laptop program) in Year 12. (Max)

> I used the school-issued laptop and then (when the school) brought in the BYOD we sort of lost funding for the laptops. So, the kids in the under grades would pull off the keys (and) abuse the computers. They were like falling apart and weren’t running Windows properly. (Michelle)
> We had computer labs, which were totally booked but I think we used them twice … You had to book them (the computer lab) quite far in advance so then when we needed them, they were never available. (Sara)

When her rural State school introduced the BYOD scheme, Michelle had to use a laptop from the class set.

> As I sort of came from a low financial family, we didn’t have access to it (laptop).
> I had to use a school laptop. I felt like I was at a disadvantage because if the laptops in the classroom weren’t working then I missed out on participating in the learning activities online. (Michelle)

Catholic school experience

> Yeah, it was all handwritten. We weren’t really allowed to use the laptops, because a lot of girls would get distracted. So, it (the laptop) was a privilege. I would just carry it around. See, a lot of girls went shopping so whenever you’re on a laptop you’re

always suspected of being shopping. So, we were told to handwrite as opposed to using the computer because it was better for us. (Paula)

Yeah. The university had more resources than the schools, and we were really limited. They (the school) were really strict on what we used. (Emily)

At my school they didn't use much technology at all, so even just using interactive websites or anything, we just never really did that. (Gina)

Private school experience

Every classroom had either a Smart Board or a Smart TV, so the lessons were all run through those. (Cam)

Some kids used to pull keys off the laptop keyboard but the school fixed them quickly. (Carla)

There was an (LMS), which everything is run through but then there was also shared drives that we could all access … The school's online forum was called eCat and we would log on to that. All the classwork was shared through that, effectively and then assessment submissions would run back through that, same sort of set-up as LearnJCU. (Cam)

Teachers would use the Smart Board to write on rather than the whiteboard, because then they would save that and upload it to eCat. (Cam)

The teacher would put up documents for us to read and then … we downloaded homework, assignments …" (Laura)

Our digital diary was automatically updated by our teachers. We could log in every morning and see what we had to do that week. There was literally no physical input from us, so any due dates or extra curriculars. (Michael)

These statements illustrate a digital divide in the Australian school systems. This divide emerges on socioeconomic, sociocultural and geographic lines.

6.5 Study 3 participants' access to digital technologies

The case studies illustrate the significant differences between participants' schooling experience, access to resources and school digital technologies usage patterns. Lily, Laura, Michael, Cam and Carla's schools had embedded digital technologies in their curriculum (Table 31). These students had access to an LMS or an established shared-drive system and teachers who used the technology. These students were also more likely to say that their school prepared them for university study.

Table 29 Digital experience & preparedness

Student	Preparedness	*Digital curriculum	School issued laptop	Bring your own device (BYOD)	Enrolment issues
Sara	Yes	yes	yes	no	yes
Carla	Yes	yes	no	yes	yes
Max	Yes	no	yes	yes	yes
Michelle	No	yes	no	yes	yes
Ben	No	no	no	no	no
Laura	Yes	yes	no	yes	yes
Emily	No	no	yes	no	yes
Lily	Not sure	yes	yes	yes	no
Cam	Yes	yes	no	yes	no
Paula	Yes	no	yes	no	no
Michael	Yes	yes	yes	yes	no
Luke	Yes	no	no	no	no
Jake	No	no	no	no	yes
Gina	Yes	no	yes	yes	yes
Suzy	No	no	no	no	no

*Digital curriculum denotes a digital pedagogy with an LMS or established shared drive

Figure 45 suggests only half the students had access to a school-issued laptop but the majority of participants had access to a personal computer during their secondary schooling.

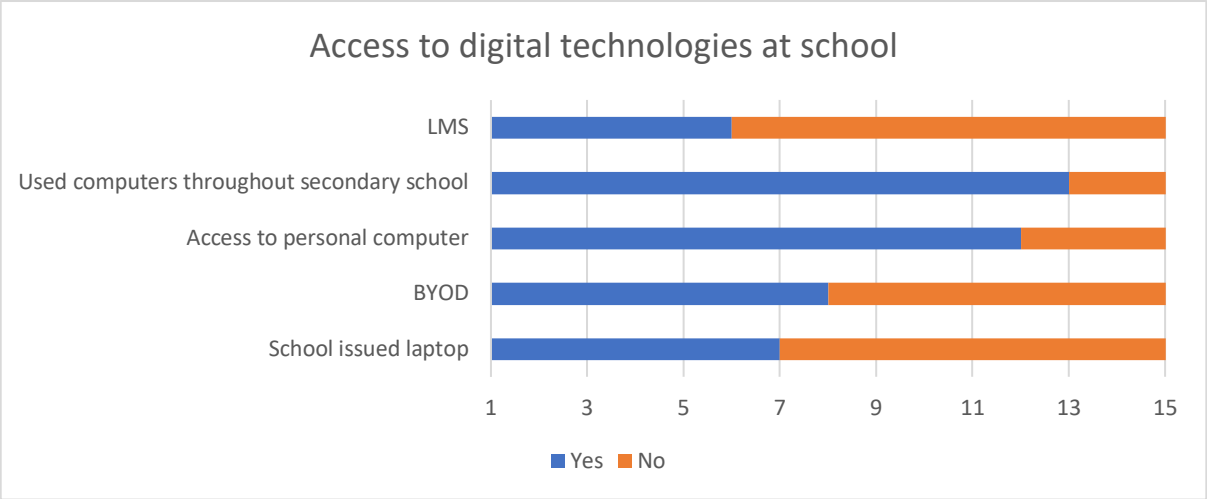


Figure 45 Access to digital technologies at school

Figure 46 represents the school technical identity concept map as described by the respondents.

1. Group 1: Sara, Carla, Lily, Cam, Michelle, Michael and Laura

   This group attended secondary schools with strong technical identities including access to an LMS. The group experienced connectivity, inclusion, pedagogical practice and influence in the development of student's technical identity. This group also performed well in the digital test except for Michael who had a learning difficulty which may have impacted on his test performance. Schools in Group 1 had embedded digital curriculum and pedagogical practices which engaged students in a digital environment. It was difficult to place Michelle due to her school rating high in school technical identity but the BYOD scheme placed her at a disadvantage.

2. Group 2: Max, Emily, Luke, Gina and Paula

   This group had access to school-issued laptops but attended schools without an LMS. This group had some teachers who engaged with digital pedagogies but as a whole did not use their laptops or personal devices for learning activities. Therefore, although these schools were networked and provided laptops or BYOD, their use of technology was primarily for students to type assignments.

3. Group 3: Jake, Sara and Ben

   Group 3 was made up of mature-aged respondents. Two partiipants came of age outside the digital transformation. The other participant was an international student who attended school in a developing country. These schools did not engage with learning technologies.

Figure 46 illustrates where respondents classified their secondary school technical identity.

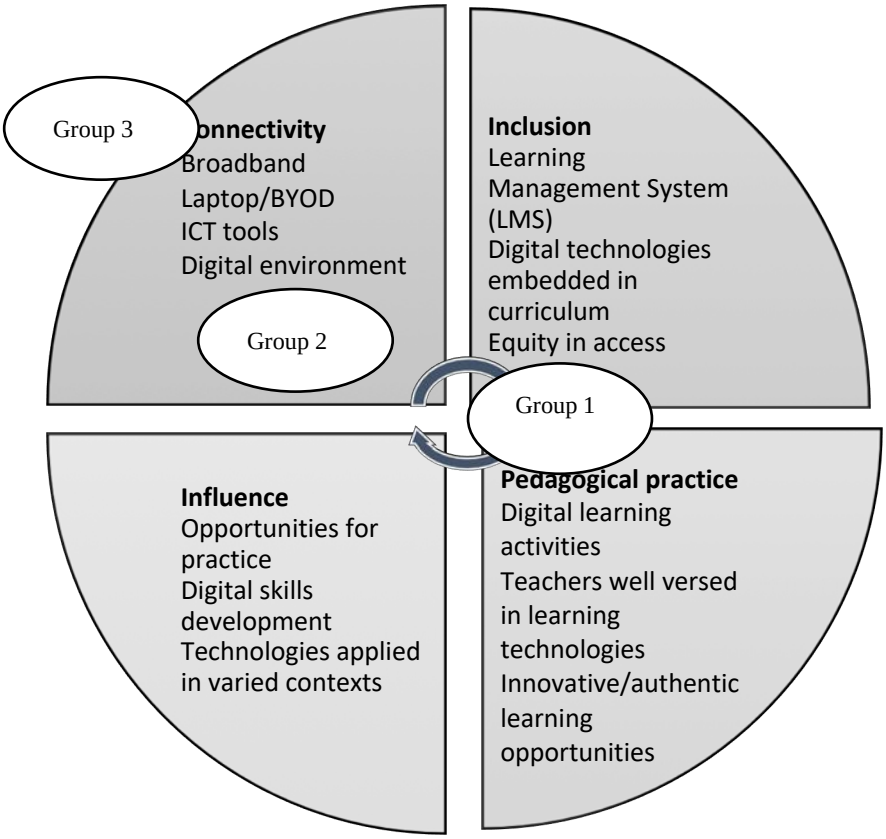


Figure 46 Student reported school technical identity concept map

6.6 Comparison of university online enrolment experiences

Figure 47 illustrates that half of the group had enrolment issues, similar to the Study 1 finding. Again, students with a digital curriculum were less likely to have enrolment issues (Table 28).

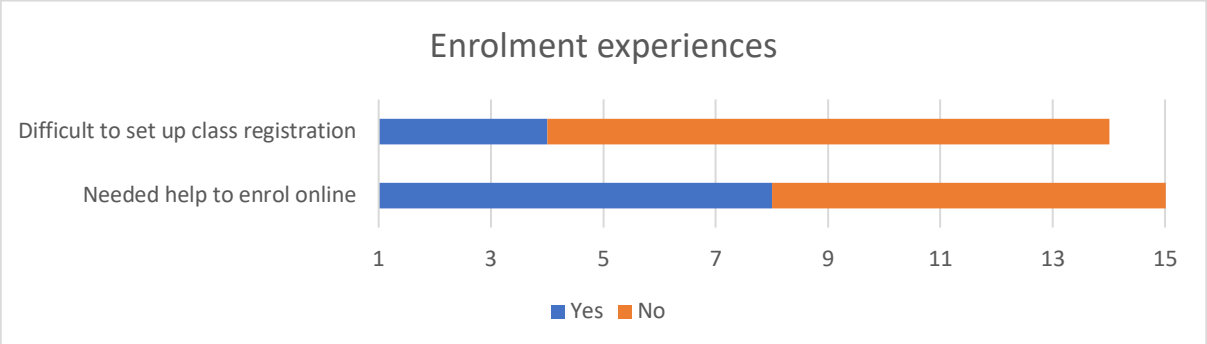


Figure 47 Enrolment experience

6.7 Demographics and digital access

The withdrawal of the school-issued laptops scheme from some schools is cause for concern. The roll out of the BYOD scheme has created a level of disadvantage not experienced by students who had school-issued laptops. Michelle, Max and Sara's lived experiences speak to an injustice being enacted in Australian secondary education. These

students' schools may not have had funding to maintain a class set of laptops in good working order or were not aware of the poor condition of the laptops. Nevertheless, the distribution of resources in these instances created inequity in the schools between students who could afford to purchase a digital device and those whose families could not afford to purchase a digital device.

6.8 Techno-biography outcomes

Table 32 outlines the Techno-biography results. Taken together with the mapped Techno-biography in Figure 48 and the school technical identity in Figure 46, a picture emerges that indicates the school technical identity has the greatest influence on the development of digital fluency. All respondents in Group 1 (Figure 46) who attended a school with an LMS were digitally fluent (except Michael). Respondents with strong school identities were also more likely to have developed a strong technical identity.

Access to a school LMS and digital learning environment at secondary school overrode sociocultural capital, socioeconomic status and geographic location's impact on digital proficiency. Therefore, a strong school technical identity alleviated disadvantage indicators.

Table 32 techno-biography results stage the Briggs & MaKice's (2012) digital fluency of participants. Constructed on Goode's technical identity theory the researcher mapped the digital fluency stage from participants' digital test ranking, sociocultural capital, technical identity and school identity. This staging is then illustrated in Figure 48 Techno-biography.

Table 30 Techno-biography results

Digital test ranking		
1. Lily	6. Cam	11. Max
2. Michelle (incomplete)	7. Laura	12. Emily (incomplete)
	8. Luke	13. Michael
3. Carla	9. Gina	14. Suzy
4. Paula	10. Ben	15. Jake *(incomplete)*
5. Sara		
Sociocultural Capital *Low 1 to 4 High*		
1. Lily 1	6. Cam 3	11. Ben 1
2. Michelle 1	7. Laura 2	12. Max 1
3. Carla 3	8. Emily 2	13. Michael?
4. Paula 3	9. Luke?	14. Suzy 1
5. Sara 1	10. Gina?	15. Jake 1
Technical identity *Weak 1 to 4 Strong*		
1. Lily 4	6. Cam 4	11. Ben 2
2. Michelle 3	7. Laura 4	12. Max 2
3. Carla 4	8. Emily 3	13. Michael 3
4. Paula 4	9. Luke 2	14. Suzy 2
5. Sara 4	10. Gina 2	15. Jake 1
School technical identity *Group 1-3*		
1. Lily 1	6. Cam 1	11. Ben 3
2. Michelle 1	7. Laura 1	12. Max 2
3. Carla 1	8. Emily 2	13. Michael 1
4. Paula 2	9. Luke 2	14. Suzy 3
5. Sara 1	10. Gina 2	15. Jake 3
Stages of digital fluency		
Stage 4	**Stage 3**	**Stage 2**
Lily 4	Luke 3	Suzy 2
Michelle 4	Gina 3	Jake 2
Carla 4	Ben 3	
Paula 4	Max 3	
Sara 4	Emily 3	
Cam 4	Michael 3	
Laura 4		

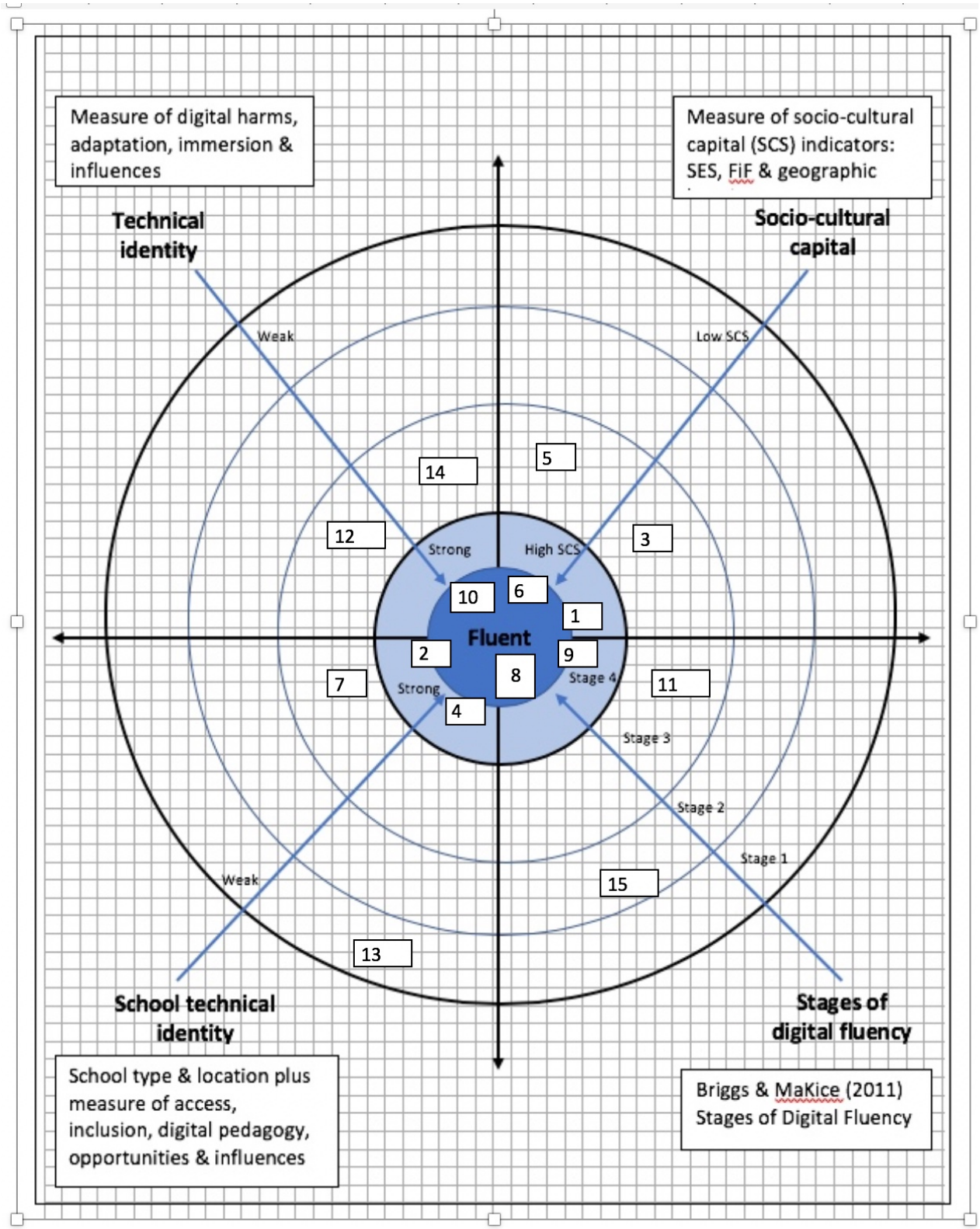


Figure 48 Mapped Techno-biography

Legend	1. Sara	5. Ben	9. Cam	13. Jake
	2. Carla	6. Laura	10. Paula	14. Gina
	3. Max	7. Emily	11. Michael	15. Suzy
	4. Michelle	8. Lily	12. Luke	

6.9 Study 3 Results and Implications

Participants who attended secondary schools with an LMS or digital curriculum and strong pedagogical approaches to learning technologies rated the highest school technical identity (Table 32). Lily, Carla, Sara, Cam, Laura, Michelle and Michael rated strongly in school technical identity and were digitally fluent. Michael was not identified as digitally fluent but again his dyslexia may have impacted on his ability to complete the tasks.

Paula rated low in school technical identity but achieved digital fluency. A review of her in-depth interviews indicates a strong technical identity and personal immersion in technology which may have overridden her school technical identity.

Lily's school curriculum had embedded learning technologies across all year levels with significant infrastructure in place to support teachers to teach with digital technologies. This whole-of-school focus on digital technologies enabled Lily to be immersed in a digital environment and develop Beetham and Sharpe's (2010) digital identity (cited in (JISC, 2014). Lily, Carla, Sara, Cam, Laura and Michelle had access, awareness, time, exposure, opportunity, and purpose to practice and upskill thereby maintaining a level of digitally proficiency not seen in other study participants. Their schools also had many elements from the creative classroom research model espoused by the European Commission Institute for Prospective Technology Studies including ICT infrastructure, connectivity and innovation (Bocconi et al., 2012).

Lily, Michelle and Sara rated highly in disadvantage indicators. For example, they were from low SES, first-in-family and rural backgrounds. This suggests their digital fluency level is at odds with the literature. For example Warschauer and Matuchniak (2010) study conclude low SES schools were less likely to have the technological infrastructure to support and maintain a digital learning environment. However, in this case, although Lily, Michelle and Sara's schools did not have an LMS, the school's development of a digital curriculum share drive closely matched the structure of an LMS.

Michelle's digital fluency level was significant predominantly due to the introduction of a BYOD scheme at her school. The BYOD scheme disadvantaged Michelle as her family could not afford to purchase a device. Michelle's achievement of digital fluency may be more of a reflection of her tenacity and drive to succeed which overrode disadvantage and was supported by the school's digital curriculum.

Table 30 aligns the research questions and propositions with the research outcomes as evidenced in Study 3.

Table 30 Review of Propositions 1-4

Research Question	Proposition	Proposition description	Research Outcome
RQ_1. What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide? RQ_2. Is digital fluency a precursor to preparedness for university study? RQ_3. What enhances and develops digital fluencies?	Proposition 1: Digital inequity	Differing levels of digital technology usage and application in schools contributes to the digital divide.	Lack of access to a learning management system or digital curriculum at secondary school generated differing levels of digital skills which in turn could contribute to digital inequity
	Proposition 2: Digital harms	Digital issues early in higher education could impact on sociocultural capability referred to as digital harms.	Bring your own device schemes is creating inequality in secondary schools. Respondents who did not have access to a school LMS were less likely to report being prepared for study in a digital environment and/or preparedness for university study.
	Proposition 3: Digital Ease	The digitally fluent can move from one platform to another with ease.	Digital fluency is enhanced by prior experience and immersion.
	Proposition 4: Digital Immersion	Student immersed in a digital environment prior to commencing university are less likely to be impacted by the digital divide.	Access to a learning management system or digital curriculum at secondary school increased self-reported preparedness for university study and a digital learning environment.

6.10 Conclusion

Reporting on RQ_1 “What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide?”; RQ_2 “Is digital fluency a precursor to preparedness for university study?”; and RQ_3 “What enhances and develops digital fluencies?”, Study 3 has established a link between the distribution and application of digital resources in secondary schools as a precursor for digital fluency and preparedness for university study.

In applying Goode's (2010) Technology Identity Theory, Lily, Carla, Paula, Sara, Cam, Laura and Michelle demonstrate a melding of their technology identity with their sense of self. Comments such as, "technology is the norm" and, "I don't remember not using technology", illustrate a belief in their own abilities to operate with ease in a digital environment (Goode, 2010). Again this self-belief in digital technology displayed by Lily, Michelle and Sara is at odds with the discourse that students from first-in-family, low-SES communities and schools, backgrounds do not have the cultural and social capital to participate on a level playing field with those from higher-SES communities ((Devlin, 2013a; Gale & Parker, 2017; Luzeckyj, King, et al., 2011).

This study's Proposition of Digital Inequity suggests that differing levels of digital technology usage and application in schools contribute to the digital divide. Therefore, to identify three small rural schools which have transcended the divide by incorporating and implementing a whole-of-school approach to digital learning technologies validates embedding digital curriculum builds digital fluency.

Further research is required to ascertain whether this fluency applies to only these students or to other graduates of these schools. However, Study 3 provides evidence that schools which embrace and embed digital technologies throughout their curriculum have instilled a confidence of digital fluency.

Chapter 7 Discussion and Conclusion

7.1 Introduction

This concluding chapter reviews the study results and discusses the implications for theory and practice. Discussion then moves to a review of the thesis limitations before proceeding to areas of recommended further research. The chapter concludes with recommendations for government education policy. If the Australian higher education sector is to produce business leaders of the future the digital divide has to be conquered.

7.2 Discussion and results

This thesis has investigated whether a digital divide exists in business students in Australian higher education, the role of digital fluency in preparedness for university, and factors that increase and advance digital fluency.

The research examined three factors. Firstly, the thesis identified a digital divide in higher education related to socioeconomic, sociocultural and/or geographic status. Secondly, the thesis provided evidence that this divide is predicated on the distribution and application of school digital technologies resources e.g. school-issued laptops, Learning Management Systems and the development of digital fluency. Thirdly, the thesis explored the business students' digital experience and established how digital fluency leads to preparedness for university studies. From these investigations, the thesis provided evidence to conclude that the lack of digital fluency is a barrier in business studies in Australian higher education.

The three studies established a relationship between socioeconomic and sociocultural status, school type and geographic indicators and the digital divide. The digital divide was evident in Study 1, which found access and prior digital experience assisted in building digital fluency. The study also identified that digital fluency led to perceived preparedness for university study and learning in a digital environment. This link was further illuminated in Study 2, with participants outperforming others based on their secondary school digital environment and experience. Study 3 reinforced this relationship with the exploration of the participants' transition to university through the investigation of their prior digital access and experience and sociocultural background.

The formation of the participants' Techno-biographies demonstrated that digital identity and fluency was built on prior digital experience. Participants educated in an immersive digital environment had numerous opportunities to practice and gain digital proficiency which in turn led to digital fluency. These digital fluent participants reported they had been well prepared by their secondary school for university study.

Students identified as not digitally fluent were more likely to consider not being prepared for university or learning in a digital environment.

The research has also shown certain conditions have to be met before digital fluency can be achieved. To use a metaphor, in research on keys to smallholder forestry, Byron (2001) refers to finding a key to unlock the greatest potential gain. Byron (2001) states conditions under which outcomes can be reached are like “a door with many locks”, and all locks have to be opened before potential can be realised. Byron’s metaphor can be applied to the development of digital fluency in secondary school graduates. In order to unlock the door to digital fluency, four keys are needed. If any of the keys are missing, the secondary school graduate would struggle to achieve digital fluency. The four keys or conditions that have to be met to be digitally fluent align to Beetham and Sharpe pyramid introduced in Chapter 2, I have, I can, I do, I am and are:

1. Access and experience in a digital environment;
2. Opportunities to learn in a digital curriculum;
3. Experiences in creating, not just consuming, digital knowledge and;
4. Constructing a technical identity through digital immersion.

Therefore, the research has determined that digital fluency was achieved through experience and immersion in a digital environment. Figure 49 proposes considerations for building digital fluency in commencing university students who may not be digitally prepared to study in a digital learning environment. Building digital fluency in a university student requires an awareness of the student’s past experience. Universities have to immerse students in a digital environment … which may be a foreign environment for the student therefore supports are required. The university student must be provided with opportunities to practise within a supportive environment. These opportunities help to instill resilience and proficiency and will most likely lead to digital fluency.

Figure 49 Considerations for building digital fluency

The design of many digital learning environments assumes students are digitally fluent. Therefore, preparation of students to study in a digital learning environment is paramount.

Figure 50 illustrates a series of considerations in the development of blended and online programs.

- **Connectivity:** Introduce existing technologies before moving to new and or emerging technologies. This scaffolding approach would build confidence.
- **Experience:** Awareness of disadvantage indicators and opportunities for practise.
- **Influence:** Minimum requirements that help build familiarity and enable an equivalence of experience. Technologies should be applied in varied contexts.
- **Pedagogy:** Digital activities but not for the sake of them. Ensure the technology fits the outcome. Provide professional development for academics in the use of learning technologies. Promote opportunities to create and collaborate.

However, of greatest importance is the need to orientate, scaffold and support the digital experience. The higher the level of complexity, the higher support required.

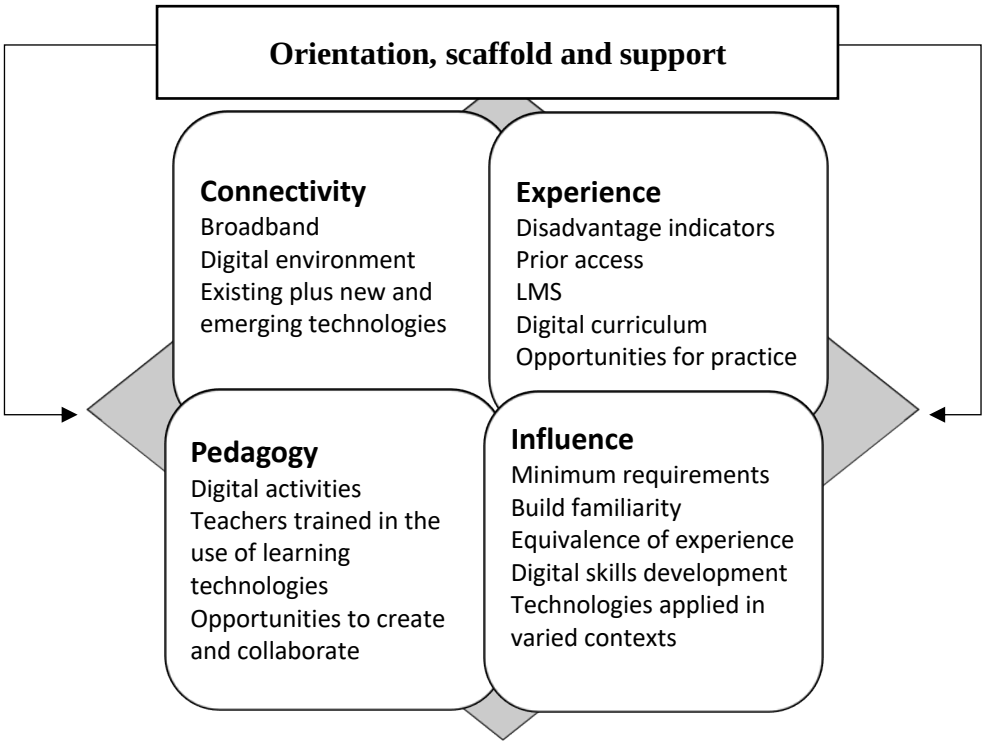


Figure 50 Blended and online considerations to build digital fluency

7.3 Key findings of the thesis

The resourcing of secondary schools with school-issued laptops did not increase digital fluency or perceived preparedness for university study. However, the implementation of a digital curriculum or LMS produced significant outcomes in the development of digital fluency. Table 31 illustrates the 10 key findings of the thesis.

Table 31 Key Findings

Key Findings
RQ_1 **What is the relationship between socioeconomic, sociocultural/ geographic indicators and the digital divide?** 1. Socioeconomic, sociocultural and geographic indicators contribute to a digital divide 2. Resourcing secondary schools with laptops without implementing a digital curriculum does not assist in the development of digital fluency 3. Secondary schools with the appropriate distribution, allocation and usage of digital resources e.g. digital curriculum, are more likely to produce digitally fluent students 4. Students with access to the above digital resources are more likely to situated in high socioeconomic, high sociocultural and urban secondary schools 5. Students from low socioeconomic, low sociocultural backgrounds and rural/regional areas are more likely to develop digital fluency if their secondary school has the appropriate distribution, allocation and usage of digital resources e.g. digital curriculum.
RQ_2 **Is digital fluency a precursor to preparedness for university study?** 6. Digital fluency is a precursor to preparedness for university study 7. Digital fluency is more likely to develop in students who are immersed in a digital environment. 8. Students without access to a learning management system or digital curriculum during secondary school were less prepared for university study 9. Students without access to a learning management system or digital curriculum during secondary school are less prepared for a digital learning environment at university
RQ_3. **What enhances and develops digital fluency?** 10. Digital immersion enhances and builds digital fluency

These findings illustrate the influence of digital immersion on the formation of fluency. Resourcing schools without a clear digital curriculum does not increase digital fluency. The three studies culminate in a concept model in Figure 51 which illustrates the link between the distribution of resources, digital fluency and preparedness for university study. The link between sociocultural indicators, digital resources and digital mindset and technical identity has been defined in the thesis.

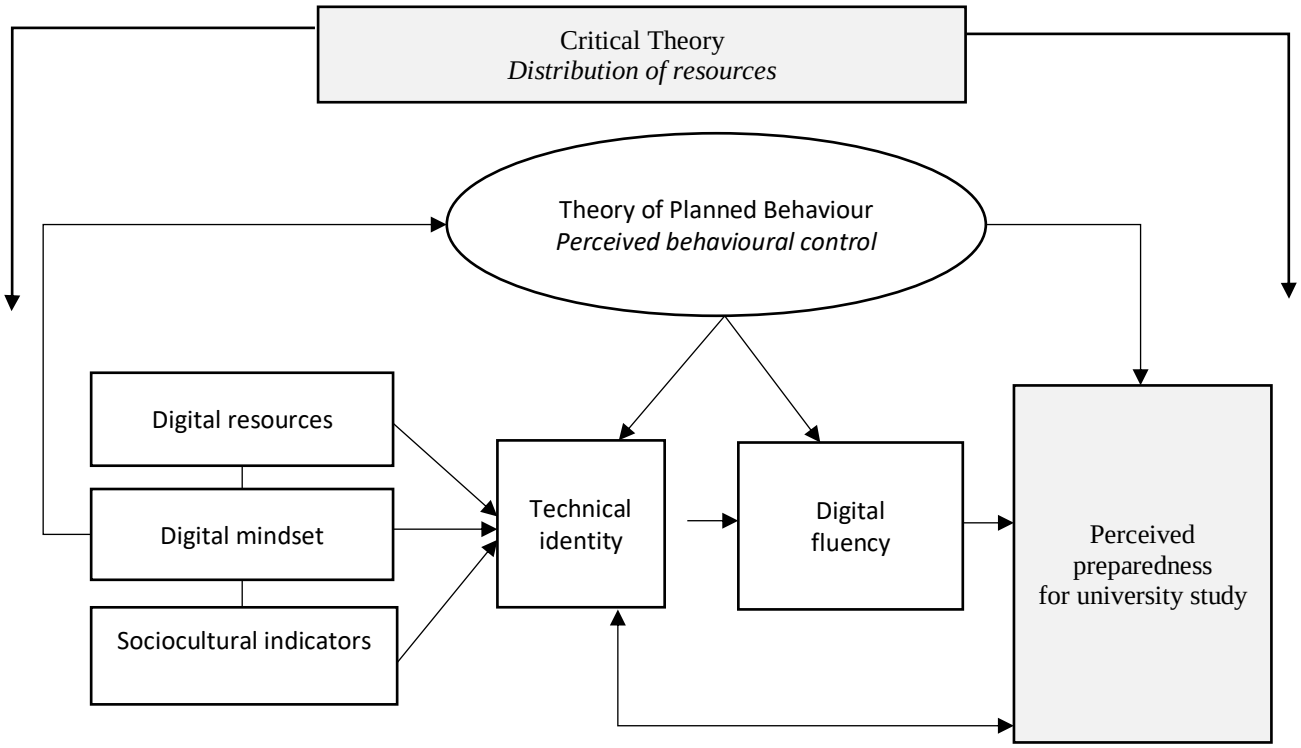


Figure 51 Preparedness for university concept model

Situating the thesis in a social justice perspective has addressed societal inequalities within Australian education systems. The study participants' digital experiences were primarily influenced by their school type which in turn enforced a digital divide. The Australian Government's "Digital Education Revolution" was to build a digitally fluent cohort to live and work in a digital world (DEEWR, 2008). The plan was to redistribute resources to ensure students had access to digital resources. This brings to mind Devlin (2013a) statement:

> It can be seductive to think that, if non-traditional students are clever enough, or try or persevere enough or believe enough in their own ability, they can succeed at university. It can be tempting to think that, with 'skill and will', university students from low socioeconomic status will flourish (p. 943).

This thesis has established that resourcing secondary schools with laptops did not produce digitally fluent graduates. Rather it was the implementation of a digital curriculum that impacted on the development of digital fluency, supporting Noddings (2011) assertion that:

> Distributing elite knowledge more justly will not in itself effect the redistribution of a society's material goods, and the effort may well act against redistribution by causing 1) a redefinition of elite knowledge, 2) deprivation of knowledge that could be

> genuinely useful to oppressed groups, and 3) a widespread sense that society has 'tried' and that the failure of groups who must do the ill-paid work of society is their own fault (p. 241).

Noddings (2011) and Devlin (2013) both address blaming the victim, and assert that the redistribution of resources alone cannot and does not decrease inequality. Of particular concern is that policymakers could suggest that resourcing schools with digital devices did not produce the desired results and that they could overlook the systemic issues confronting disadvantaged groups.

Critical Theory's ontology is shaped by structural insights and this thesis has illuminated some of the structural inequalities impacting on students transitioning to university. If a student is unfamiliar with digital environments, access to a digital device will not assist in navigating a university digital learning environment.

7.4 Theoretical and practical contribution

Tables 35 and 36 illustrate the theoretical and practical contributions of the thesis.

Table 31 Theoretical contributions of thesis

1. Provides empirical data on the link between digital fluencies and preparedness for study in a digital environment and/or preparedness for university study
2. Provides an analysis of a digital learning environment's impact on the student experience
3. Conceptualises the growing inequalities arising from the widening digital divide within a social justice framework
4. Applies Critical Theory and TPB to the examination of the distribution and allocation of resourcing secondary schools, contributing to the advancement of understanding of the utility of commonly used theories
5. Examines the digital divide from a student's perceptive
6. Assists in developing a critical consciousness about the impact of the digital divide on the student
7. Applies a student lens to identifing purposeful strategies to build digital fluency
8. Determines the types of approaches required to build student digital capacities
9. Builds on work by Devlin (2013a) and Gale and Tranter (2011) on social justice in higher education and the widening participation agenda.

Table 32 Practical contributions of thesis

1. Contributes to the development of strategies within the “widening participation” agenda
2. Supports the need for the establishment of a digital curriculum in secondary schools
3. Supports the need for the introduction of learning management systems in secondary schools
4. Supports the need for professional development of secondary school teachers in technology pedagogies
5. Supports the development of 21st century skills
6. Provides recommendations for further research on effective structures to enhance digital fluencies and improve the student experience.

7.5 Limitations of thesis

The small sample size in Study 2 “Digital test” and Study 3 “Interview” is a noteworthy limitation of the thesis. Only 15 regional university students participated in Study 2 and Study 3 with no urban university students represented. As discussed in Chapter 3, in order to complete the digital test online the participant would require a level of digital fluency. The decision not to conduct the digital test at the urban university may have skewed the results towards a regional and rural perspective. Nevertheless, this focus on regional and rural areas illuminates the disadvantages encountered by these communities.

The other limitation of the thesis is the over-reliance on self-reported digital skills in Study 1 “Digital Divide Questionnaire”. Participants may have been likely to rate their digital skills higher than their actual digital skills. However, the use of digital fluency mindset, attitudes and influences question responses aligned with the self-reported digital skills.

Self-reported school identity also contributes to the limitations of the thesis. The inclusion of secondary school inputs would have strengthened the proposed school technical identity model. Secondary school interviews and reviews were not included in the studies due to constraints in the PhD research design and time limitations.

The final limitation that needs acknowledgment is that self-reported and actual digital skills and fluency stages were not linked to academic performance or to digital fluency. It would be of great interest to identity whether a lack of digital fluency impacts negatively on academic performance.

7.6 Areas for further research

As a PhD research project, this thesis has endeavoured to explore the development and impact of digital fluency in higher education. There are many threads in the research that could not be explored in depth. Further research areas could include:

- A large-scale digital fluency study in Australian higher education
- Digital fluency impacts on the preparedness of disadvantaged and under-represented students for university study
- Bring Your Own Device schemes' implications for digital fluency
- Disadvantage and Bring Your Own Device
- Digital curriculum/LMS implications in secondary schools
- Building teacher capacity in digital pedagogies in secondary schools
- School technical identity
- Business student academic performance and digital fluency.
-

7.7 Implications for theory and practice

The thesis began by investigating reasons why first-year business students were having difficulty navigating the university online and blended programs. The university that is the primary focus of the research reported in this thesis had implemented support structures to assist students to work within a digital learning environment. These supports included online help, step-by-step instructions and an intuitive instructional design. However, these support measures did not address the underlying issue.

The finding by Coldwell-Neilson (2018) of the mismatch of tertiary educators' expectations of a digitally prepared student and the reality of differing levels of digital skills needed to be unpacked.

The researcher had assumed the digital fluency of the students would be adequate for university-level study, primarily because many of the student cohort had access to school-issued laptops during secondary schooling. This student cohort or generation fitted the age profile of Prensky's (2011) digital native. If universities are preparing business students to take their place in an ever-changing digital world, universities need to produce graduates who can create, interpret and evaluate information, who move with ease in a digital environment to solves problems and create and generate knowledge. Universities need to graduate the digitally fluent.

The implications of this thesis are:

- A digital divide is present in our schools and universities
- Resourcing disadvantaged schools does not on its own increase digital fluency
- Digitally resourcing schools without clear curriculum direction or appropriate teacher professional development in digital pedagogy does not increase digital fluency

- Digital proficiency, as opposed to access, is contributing to a digital divide
- There is a relationship between disadvantage indicators and levels of digital fluency
- Assumptions cannot be made about the digital fluency of university students
- Digitally underprepared students could be further disadvantaged if unsupported in a digital learning environment
- Universities should implement digitally immersive learning environments that scaffold and build fluency
- The cycle of digital fluency should be considered for students transitioning to university study.

7.8 Conclusion

If the digital divide is to be conquered, universities cannot continue to assume the digital fluency of commencing students. This thesis has presented research that demonstrates a digital divide in both higher education and secondary schools. This divide is impacting on students' sense of preparedness and their learning experiences. The thesis's proposition that the digital divide is predicated on the digital proficiency has been supported.

Unless effective support structures and curriculum design that build digital fluency are embedded in education, inequality will continue to grow. Further investment is required to build educators' digital skills to facilitate learning environments that promote digital fluency and prepare students for a 21st century workforce. If education is to be transformative it should be supportive and accessible for all.

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Appendices

Appendix 1 Theoretical Concept Table for Study 1

<table>
<tr><td colspan="3">Question Block 1 Socio-cultural capital and school technical identity</td></tr>
<tr><td>Research Question 1.
What is the relationship between low socio economic and/or geographic status, the digital divide and digital fluency?

Research Question 2.
Is digital fluency a precursor to positive student experience?

Research Question 3.
What enhances and develops digital fluencies?
Theoretical Contribution 1
a) An analysis of digital learning environment's impact on student success
b) Conceptualise the growing inequalities arising from the widening digital divide within a social justice framework</td><td><u>The Digital Divide</u>
The digital divide in this study is not on access but one of opportunity, ability and efficacy in the use of digital technologies. Questions relating to access were included to ascertain if access was a variable or should the research focus on the use of digital technologies. Further questions relate to the ability to use a digital platform to enrol or apply. This situated the study in the impact of socio-cultural capital.
<u>Cultural Capital and Socio-Economic Status</u>
(Devlin, 2013a) addresses university-specific socio-cultural capability and defines cultural capital as "proficiency in and familiarity with dominant cultural codes and practices" (p.940). Within the university sector socio-cultural capital are the norms, values and expectations which enable a familiarity and comfort to develop amongst the 'ruling class' (Devlin, 2013a). "Cultural capital is a notion that is critical to understanding the experiences of student from low socio-economic status in higher education" (Devlin, 2013a, p. 940).
Questions on enrolment were included to ascertain if university enrolment processes created barriers to low socioeconomic and or first in family student cohorts.</td><td>Login ID:
1. What secondary school did you attend?
2. I had a school issued laptop during my secondary schooling
3. I had a personal computer or laptop during my secondary schooling
4. I have used computers/digital technologies throughout my secondary schooling
5. My school had a Learning Management System
6. It was difficult to enrol online at university
7. I couldn't enrol online
8. I needed help to enrol online. If yes, who helped you? Family/Friends/Staff
9. I needed to contact the student centre for help to enrol.
10. It was difficult to set up my class registrations</td></tr>
<tr><td colspan="3">Question Block 2 Digital fluency attitudes, mindset and influences</td></tr>
<tr><td>Research Question 1.
What is the relationship between low socio economic and/or geographic status, the digital divide and digital fluency

Research Question 2.
Is digital fluency a precursor to positive student experience?</td><td><u>Technology Identity Theory</u> (J. Goode, 2010)
J. Goode (2010) re-conceptualised how to analyse the digital divide and situates this study in a sociocultural context. J. Goode (2010) use of narrative inquiry examines the development of technology identity and how this identity influences our approach to digital technologies and our academic experiences. These techno-biographies informed the development of the questionnaire and assisted to establish the sociocultural and academic influences digital technology skills.</td><td>11. I was well prepared by my school for university level study
12. I was well prepared by my school to study in a digital learning environment
13. I would rate myself as having excellent digital technology skills
14. I grew up using computers/digital technologies</td></tr>
</table>

Research Question 3. What enhances and develops digital fluencies? Theoretical Contribution 1 a) An analysis of digital learning environment's impact on student success Practical Contribution 1 a) Contribute to strategies within the 'widening participation' agenda	Questions related to university preparation, level of digital technology skills, parental influences and uses of digital technologies and if digital technologies were ever present in their upbringing and childhood experiences. Our technology identity shapes and influences our future (J. Goode, 2010). Digital Fluency (Briggs & Makice, 2012) (Briggs & Makice, 2012) define digital fluency as: "An ability to reliably achieve desired outcomes through use of technology" (p.63). As with achieving fluency in a language or musical instrument digital fluency requires exposure, experience and practice. Fluency is fluid particularly with digital fluency whereby the speed and complexity of the experience is ever changing (Briggs & Makice, 2012). In this instance questions related to assumptions, knowledge, skills and beliefs about digital technologies. The ability to adapt to change is an ever-present belief in the digitally fluent who see change as an opportunity. The use of digital technologies is easy like second nature Whereas the literacy stage sees only one way of using digital technologies and the pre-literacy stage often oversimplifies or underestimates digital technologies (Briggs & Makice, 2012).	15. My parents/caregivers actively use computers/digital technologies in the workplace and home 16. My parents/caregivers keep up with the latest trends in technology 17. I would rate my parents/caregivers as having good computer/digital technology skills 18. I feel it is important to be able to access the Internet any time I want 19. I think it is important to keep up with the latest trends in technology 20. I believe there is one "right way" to use digital technologies 21. I can quickly learn how to use a new technology 22. I am able to jump from one kind of digital technology to another to achieve my goals 23. I recognise the potential uses for digital technologies 24. I take comfort with the fact that there is no "best" way to use a technology 25. I think technologies, not people, always cause success or failure 26. I think high social media use always causes a decrease in face-to-face communication 27. I often oversimplify or underestimate the role of a new technology 28. I understand the types of potential value in using social media 29. I have a large number of followers on social media 30. I believe change is necessary

		31. I embrace change as opportunity
Question Block 3 Critical Literacies		
Research Question 1. What is the relationship between low socio economic and/or geographic status, the digital divide and digital fluency Research Question 2. Is digital fluency a precursor to positive student experience? Research Question 3. What enhances and develops digital fluencies? Theoretical Contribution 1 c) An analysis of digital learning environment's impact on student success d) Conceptualise the growing inequalities arising from the widening digital divide within a social justice framework	<u>21st Century Skills & Critical Literacies</u> Digital fluency is a 21st Century skill (Dede, 2010). The ever-changing digital landscape requires business graduates to take their place in a work environment that is being reimagined (Crittenden & Crittenden, 2015). The introduction of artificial technologies (AI) and machine learning will redefine the workplace (Frey & Osborne, 2017). The graduate requires skills in collaboration, design thinking, problem solving, critical analysis and meta-cognition (Dede, 2010) (Silva, 2009). Therefore a 21st century learning environment would include opportunities for higher-level thinking (Crockett et al., 2012). Educators need to provide a learning environment that promotes the development of high level aptitude in information and technological fluency (Sharkey, 2013). <u>Digital Fluency</u> Digital fluency is more that the ability to be at ease within a digital environment, it is also the ability to reformulate and create knowledge (Q. Wang et al., 2013, p. 409). Information Fluency Information fluency is the ability to interpret, critically analyse and assess information and to extract the meaning and significance of knowledge. *(Crockett et al., 2012).* The questions in this section relate to 21st century skills that are primarily promoted as digital fluency and information fluency. The study is seeking to examine how the respond locates, interpret, analyses and evaluates information. <u>Digital Disorder</u> Weinberger (2007) digital disorder concept asserts that previously, books, physical index cards and library systems categorised information in a structured and orderly manner. These systems have now been replaced and surpassed by virtual information and communication technologies. According to (Dede, 2010) the nature of these information systems has led to "*people are inundated by enormous amounts of data that they must access, manage,*	32. I use the university Library One Search to research my assignments 33. I use university Lib Guides to research my assignments 34. I use Google or other search engines to research my assignments 35. I use Google Scholar to research my assignments 36. I Use Wikiperdia to research my assignments 37. I only use peer reviewed articles for my assignments 38. I use online referencing tools eg. Endnote, Cite this for me or Easy bib 39. I critically evaluate information by checking the content is fair, valid and current 40. I evaluate and interpret online sources by checking for bias

	integrate, and evaluate" (p.2). This virtual information is instantaneous, disorderly and voluminous and requires skill to collate, disseminate, structure, interpret and evaluate. Therefore "Rather than relying on a single method of organization with a fixed terminology (such as the Dewey Decimal System as a means of categorizing knowledge), modern information systems now can respond to natural language queries and can instantly sort digital data into whatever category structure best suits a particular person's immediate needs. This creates a new set of contextual 21st century skills centred on "disorderly" knowledge co-creation and sharing".(Dede, 2010) "Conventional, 20th century K-12 instruction emphasizes manipulating pre- digested information to build fluency in routine problem solving, rather than filtering data 2 derived from experiences in complex settings to develop skills in sophisticated problem finding".(Dede, 2010, p. 2)	
Question Block 4 Digital Literacies		
Research Question 1. What is the relationship between low socio economic and/or geographic status, the digital divide and digital fluency Research Question 2. Is digital fluency a precursor to positive student experience? Research Question 3. What enhances and develops digital fluencies? Theoretical Contribution 2 a) Provide empirical data on the link between digital fluencies, socioeconomic status and	<u>Digital Literacy</u> Briggs and Makice (2012, p. 120), four stages of fluency influenced the questions in this sector. A range of digital tools and platforms were addressed with students self-reporting their efficacy for each tool.	41. Microsoft Word or equivalent 42. Excel 43. PowerPoint 44. Email 45. Outlook calendar or equivalent 46. University learning management system 47. PebblePad 48. Online Tests 49. Posting to Blogs and Wikis 50. Adobe Acrobat Professional 51. Graphics packages eg. Adobe Photoshop, Microsoft Paint etc 52. Post material to social networking sites eg. Facebook, Instagram 53. Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat 54. Editing video and sound recordings

positive academic achievement and opportunities b) Examine the digital divide from a student's perceptive c) Develop a critical consciousness about the impact of the digital divide on student retention		55. Web searches

Appendix 2 Study 1 Questionnaire

Student number or Login ID:

1. What secondary school did you attend?	

Please respond to the following questions	Yes	No
2. I had a school issued laptop during my secondary schooling. If yes, please circle if you could: Take home or Use at School only	②	①
3. I had a personal computer or laptop during my secondary schooling	②	①
4. I have used computers/digital technologies throughout my secondary schooling	②	①
5. My school had a Learning Management System eg. Blackboard, Moodle etc	②	①
Think back to when you enrolled in the Bachelor of Business and answer the following questions	**Yes**	**No**
6. It was difficult to enrol online at university	②	①
7. I couldn't enrol online	②	①
8. I needed help to enrol online. If yes, circle who helped you to enrol: Family or Friends or University Staff	②	①
9. I needed to contact the student centre for help to enrol. If yes, circle how you sought assistance: Phone or email or Face to Face	②	①
10. It was difficult to set up my class registrations	②	①

Please indicate how strongly you agree or disagree with the following statements	Strongly agree	Agree	Agree somewhat	Undecided	Disagree somewhat	Disagree	Strongly disagree
11. I was well prepared by my school for university level study	⑦	⑥	⑤	④	③	②	①
12. I was well prepared by my school to study in a digital learning environment	⑦	⑥	⑤	④	③	②	①
13. I would rate myself as having excellent digital technology skills	⑦	⑥	⑤	④	③	②	①
14. I grew up using computers/digital technologies	⑦	⑥	⑤	④	③	②	①
15. My parents/caregivers actively use computers/digital technologies in the workplace and home	⑦	⑥	⑤	④	③	②	①
16. My parents/caregivers keep up with the latest trends in technology	⑦	⑥	⑤	④	③	②	①
17. I would rate my parents/caregivers as having good computer/digital technology skills	⑦	⑥	⑤	④	③	②	①
18. I feel it is important to be able to access the Internet any time I want	⑦	⑥	⑤	④	③	②	①
19. I think it is important to keep up with the latest trends in technology	⑦	⑥	⑤	④	③	②	①
20. I believe there is only one right way to use digital technologies	⑦	⑥	⑤	④	③	②	①
21. I can quickly learn how to use new technology	⑦	⑥	⑤	④	③	②	①
22. I am able to jump from one kind of digital technology to another to achieve my goals	⑦	⑥	⑤	④	③	②	①
23. I recognise the potential transformative uses for new digital technologies	⑦	⑥	⑤	④	③	②	①
24. I take comfort with the fact that there is more than one way to use a technology	⑦	⑥	⑤	④	③	②	①
25. I think technologies, not people, always cause success or failure	⑦	⑥	⑤	④	③	②	①
26. I think high social media use always causes a decrease in face-to-face communication	⑦	⑥	⑤	④	③	②	①

27. I often oversimplify or underestimate the role of a new technology	⑦	⑥	⑤	④	③	②	①
28. I understand the types of potential value in using social media	⑦	⑥	⑤	④	③	②	①
29. I have a large number of followers on social media	⑦	⑥	⑤	④	③	②	①
30. I believe change is necessary	⑦	⑥	⑤	④	③	②	①
31. I embrace change as opportunity	⑦	⑥	⑤	④	③	②	①
Please indicate how strongly you agree or disagree with the following statements	Always	Very frequently	Frequently	Sometimes	Rarely	Very rarely	Never
32. I use JCU Library One Search to research my assignments	⑦	⑥	⑤	④	③	②	①
33. I use JCU Lib Guides to research my assignments	⑦	⑥	⑤	④	③	②	①
34. I use Google or other search engines to research my assignments	⑦	⑥	⑤	④	③	②	①
35. I use Google Scholar to research my assignments	⑦	⑥	⑤	④	③	②	①
36. I use Wikipedia to research my assignments	⑦	⑥	⑤	④	③	②	①
37. I only use peer reviewed or academic articles for my assignments	⑦	⑥	⑤	④	③	②	①
38. I use online referencing tools eg. Endnote, Cite this for me or Easy bib	⑦	⑥	⑤	④	③	②	①
39. I critically evaluate information by checking that the content is fair, valid and current	⑦	⑥	⑤	④	③	②	①
40. I evaluate and interpret online sources by checking for bias	⑦	⑥	⑤	④	③	②	①

On a scale of 0 to 5 (with 0 being not competent at all to 5 being expert user) please indicate your competence with the following digital technologies.	5	4	3	2	1	0
41. Microsoft Word or equivalent	⑤	④	③	②	①	⓪
42. Excel	⑤	④	③	②	①	⓪
43. PowerPoint	⑤	④	③	②	①	⓪
44. Email	⑤	④	③	②	①	⓪
45. Outlook calendar or equivalent	⑤	④	③	②	①	⓪
46. LearnJCU	⑤	④	③	②	①	⓪
47. PebblePad	⑤	④	③	②	①	⓪
48. Online Tests eg LearnJCU quizzes, Aplia, Wiley	⑤	④	③	②	①	⓪
49. Posting to Blogs, Forums and Wikis	⑤	④	③	②	①	⓪
50. Creating Blogs, Forums or Wikis	⑤	④	③	②	①	⓪
51. Adobe Acrobat Professional	⑤	④	③	②	①	⓪
52. Graphics packages eg. Adobe Photoshop etc	⑤	④	③	②	①	⓪
53. Post material to social networking sites eg. Facebook, Instagram	⑤	④	③	②	①	⓪
54. Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat	⑤	④	③	②	①	⓪
55. Editing video and sound recordings	⑤	④	③	②	①	⓪
56. Web searches	⑤	④	③	②	①	⓪

Appendix 3 Theoretical Concept Table for Study 3

Theoretical and practical contributions	Research methodology 10-15 interviews Interview questions	Theoretical concepts and readings
Theoretical Contribution 1: a) An analysis of digital learning environment's impact on student recruitment and retention b) Conceptualise the growing inequalities arising from the widening digital divide within a social justice framework Theoretical contribution 2: a) Provide empirical data on the link between digital fluencies, socioeconomic and geographic status and positive academic achievement and opportunities b) Examine the digital divide from a student's perspective? c) Develop a critical consciousness about the impact of the digital divide on student retention Theoretical contribution 3: a) Apply a student's perspective to identify purposeful support strategies b) Recommend approaches to build student digital capacities c) Build on Devlin (2013a) and Gale and Tranter (2011) work on social justice in higher education and the widening participation agenda. Practical Contribution 1 Contribute to strategies within the 'widening participation' agenda	Short answer: Digital technologies and schooling 1. How did you use digital technologies in school? 2. In what way was your school issued laptop incorporated into your school's curriculum? 3. What did your school do to prepare you for university? 4. What could your school have done to prepare you for university?	Socio-Economic Status (Devlin, 2013a) Bridging socio-cultural Incongruity University-specific socio-cultural capability "Cultural capital is a notion that is critical to understanding the experiences of student from low socio-economic status in higher education. Cultural capital has been defined as 'proficiency in and familiarity with dominant cultural codes and practices' (Aschaffenburg and Mass 1997, 573). Bourdieu (1977, 1984) suggests that the primary vehicle for the transmission of the 'ruling class' culture is the education system, although the influence of the home is also key" (p. 940) (Devlin & O'Shea, 2012)"..in light of Collier and Morgan's (2008) work outlined earlier and the fact that students from LSES backgrounds often do not have the cultural and social capital of students from higher socio-economic backgrounds"(p.394) (Gale & Parker, 2017) 1st in Family & Cultural Capital (Luzeckyj, King, et al., 2011)*"Cultural capital is related to cultural acquisitions and reflects the way in which knowledge, skills and qualifications are valued" (p.92)* rural students more likely to be 1st in family School Technology Use (Warschauer et al., 2010) As the study reported, the high-SES schools" tended to invest more in professional development, hiring full-time technical support staff and developing lines of communication among teachers, office staff, media specialists, technical staff and administration that promoted robust digital networks. "This, in turn, "encouraged more widespread teacher use of new technologies." In comparison, "the low- SES schools had achieved less success in creating the kinds of support

		networks that made technology workable" (p . 581). Because teachers in low-SES schools were less confident that the equipment they signed up for would actually work, and that it if did not work, they would have available timely technical support, they were more reluctant to rely on technology in their lesson plans" (p.159)
Theoretical Contribution 1: a) An analysis of digital learning environment's impact on student retention b) Conceptualize the growing inequalities arising from the widening digital divide within a social justice framework Theoretical contribution 2: d) Provide empirical data on the link between digital fluencies, socioeconomic and geographic status and positive academic achievement and opportunities e) Examine the digital divide from a student's perspective? f) Develop a critical consciousness about the impact of the digital divide on student retention Theoretical contribution 3: d) Apply a student's perspective to identify purposeful support strategies e) Recommend approaches to build student digital capacities f) Build on Devlin (2013a) and Gale and Tranter (2011) work on social justice in higher education and the widening participation agenda.	Short answer: Cultural capital 5. Think back to when you enrolled. Did you have any problems enrolling? If so, what: How did you feel? 6. Have you ever contacted the business online team? If so, what was the reason? Was the issue resolved? How did you feel? 7. What were the differences between school and university digital use or environment?	Cultural Capital in Higher Education (Devlin, 2013a) Bridging socio-cultural Incongruity Noddings (2011) Philosophy of Education "Distributing elite knowledge more justly will not in itself effect the redistribution of a society's material goods, and the effort may well act against redistribution by causing 1) a redefinition of elite knowledge, 2) deprivation of knowledge that could be genuinely useful to oppressed groups, and 3) a widespread sense that society has "tried" and th at the failure of groups who must do the ill-paid work of society is their own fault". (p. 241) Lit Review: Preparedness for study in a digital learning environment is also acknowledged by Y. Lee, Choi, and Kim (2013). (Gale & Parker, 2017)) basic premise is that HE falling standards and the attrition crisis can be attributed to the media, Go8, peak industry groups and politicians. "We think one answer can be found in Pierre Bourdieu's (1986) account of cultural capital, which operates as a kind of certificate of cultural competence often institutionalized in academic qualifications" (p.88) "Cultural capital is a resource on which people draw in order to navigate social spaces or fields: a knowledge of things valued by the field, including a knowing of how the field operates and how to operate within it. Not all cultural capital has the same value or currency in a given field. People from more advantaged backgrounds tend to have larger reserves of the dominant cultural capital – that is, the cultural capital that dominates the field – enabling them to act like 'fish in

Practical Contribution 3: a) Provide recommendations for effective structures that enhance digital fluencies and improve the student experience		water' that 'does not feel the weight of the water, and it takes the world about itself for granted' (Bourdieu and Wacquant, 1992: 127). In education, this means that students who possess greater amounts of the cultural capital defining the field are able to navigate their way through curriculum, assessment and institutional requirements with relative ease, while others who possess less of the cultural capital dominating the field face greater difficulties: (p.89) Technology Identity Theory (J. Goode, 2010) "First, examining individual attitudes and beliefs around technology illuminates our understandings of the situational relevance of the digital divide, how it impacts the lived experiences of individuals and how these differences shape future opportunities" (p.509) "The results of this study underscore the role of the digital divide as an indicator of larger economic and social inequalities found across the education system; thus, the digital divide must be studied within this larger sociocultural context. Examining the technology identity of individuals informs our consideration of how beliefs about oneself and technology are developed, shape daily social interactions and influence future life plans" (p.510)
Theoretical Contribution 1: a) An analysis of digital learning environment's impact on student retention Theoretical contribution 2: a) Provide empirical data on the link between digital fluencies, socioeconomic and geographic status and positive academic achievement and opportunities b) Examine the digital divide from a student's perspective?	Short answer: Techno-biography & influences 8. Describe your attitude to digital technologies? 9. Describe your parents/caregivers' attitude to digital technologies? 10. How did you learn to use digital technologies? Who was your biggest influence?	Technology Identity Theory (J. Goode, 2010) "Beliefs about one's technology skills, beliefs about opportunities and constraints to use technology, beliefs about the importance of technology, and beliefs about one's own motivation to learn more about technology" (p. 498). Goode's Technobiography – (p.506) Digital Fluency (Briggs & Makice, 2012) Anti-Literacy; Pre-Literacy; Literacy; and Fluency "Fluency—An ability to reliably achieve desired outcomes through use of technology. Digital Fluency—An ability to reliably achieve desired outcomes through use of digital technology. This ability is

c) Develop a critical consciousness about the impact of the digital divide on student retention Practical Contribution 1: a) Contribute to strategies within the 'widening participation' agenda Practical contribution 2:Contribute towards the improvement of preparation of students with 21st century skills to take their place in a globalised business world.		helped or hindered by the situational forces and the digital fluency of others. A digitally fluent person knows not just what to do with a technology and how to do it, but also when and why to use it at all. Anti-Literacy—The first of the four stages of fluency, which is characterized by the rejection of the possibility that there might be value of using a technology. Pre-Literacy—The second of the four stages of fluency, which is characterized by an awareness of the potential value of using a technology, but a shortage of the ability to use it. Literacy—The third of the four stages of fluency, in which a person possesses the basic abilities that allow for the full use of a technology, but only knows the basics of what to do and how to do it." (p. 120)
Theoretical Contribution 1: a) An analysis of digital learning environment's impact on student retention b) Conceptualise the growing inequalities arising from the widening digital divide within a social justice framework Practical contribution 2: Contribute towards the improvement of preparation of students with 21st century skills to take their place in a globalized business world.	Short answer: Digital fluency 11. How often have you changed digital platforms eg. Phones, laptops, word? Do you make the change easily? How does learning a new digital platform make you feel? 12. Are you able to troubleshoot problems? If so, what strategies do you use?	Digital fluency Lit Review: A widening gap between those that have knowledge and those that do not is beginning to emerge with the "technological haves and have-nots" (Wei & Hindman, 2011). Selwyn (2009a) reinforces this gap or divide with the assertion, "concerns are beginning to be raised that digital technologies may be contributing to an increased disengagement, disenchantment and alienation of young people from formal institutions and activities" (p. 369). Digital Fluency Lit Review: Digital fluency is the ability to achieve goals, problem-solve and/or collaborate through the use of technology to achieve what has been described as "the ability to reformulate knowledge and produce information to express oneself creatively and appropriately in a digital environment" (Q. Wang et al., 2013, p. 409).

Appendix 4 Pearson Chi-square for Significance

Variables	*n*	Chi-square
1. My school had a learning management system * Socio Economic Status	248	$\chi^2(2) = 29.680$ $p < .001$
2. My school had a learning management system * Rural, Regional City, Urban	334	$\chi^2(3) = 28.193$ $p < .001$
3. My school had a learning management system * University	406	$\chi^2(1) = 8.816$ $p < .003$
4. My school had a learning management system * I had a school issued laptop during my secondary schooling	398	$\chi^2(1) = 14.114$ $p < .001$
5. My school had a learning management system * Well prepared by school to study in a digital learning environment	404	$\chi^2(2) = 25.956$ $p < .001$
6. My school had a learning management system * I have used computers/digital technologies throughout my secondary schooling	405	$\chi^2(1) = 8.565$ $p < .003$
7. My school had a learning management system * Who helped	196	$\chi^2(2) = 9.611$ $p < .008$
8. My school had a learning management system * I would rate myself as having excellent digital technology skills	403	$\chi^2(2) = 7.684$ $p < .021$
9. My school had a learning management system * I believe there is only one right way to use digital technologies	404	$\chi^2(2) = 6.332$ $p < .053$
10. My school had a learning management system * I am able to jump from one kind of digital technology to another to achieve my goals	405	$\chi^2(2) = 5.885$ $p < .042$
11. My school had a learning management system * I have a large number of followers on social media	405	$\chi^2(2) = 9.889$ $p < .007$
12. My school had a learning management system * Proficiency in outlook calendar or equivalent	388	$\chi^2(2) = 9.427$ $p < .009$
13. My school had a learning management system * I had a school issued laptop during my secondary schooling	398	$\chi^2(1) = 14.114$ $p < .001$
14. My school had a learning management system * Preparedness for university	404	$\chi^2(2) = 9.164$ $p < .010$
15. My school had a learning management system * First in Family	345	$\chi^2(1) = 16.519p < .001$
16. My school had a learning management system * School Type	369	$\chi^2(3) = 24.374$ $p < .001$

17. My school had a learning management system * Proficiency in online tests and quizzes	392	$\chi^2(3) = 8.429$ $p < .015$
18. My school had a learning management system * Proficiency in editing video and sound recordings	378	$\chi^2(2) = 7.306$ $p < .026$
19. My school had a learning management system * Proficiency in posting to blogs, forums & wikis	377	$\chi^2(2) = 5.963$ $p < .051$
20. My school had a learning management system * Proficiency in posting to social networking sites	387	$\chi^2(3) = 6.306$ $p < .043$
21. My school had a learning management system * Proficiency in uploading videos to social networking sites	386	$\chi^2(2) = 6.554$ $p < .038$
22. My school had a learning management system * Proficiency in posting to social networking sites	387	$\chi^2(3) = 6.306$ $p < .043$
23. My school had a learning management system * critically evaluate information is fair, valid & current	393	$\chi^2(2) = 10.807$ $p < .005$
24. Rural, Regional City, Urban * I needed help to enrol online	332	$\chi^2(3) = 9.413$ $p < .024$
25. Rural, Regional City, Urban * I needed to contact the student centre for help to enrol	328	$\chi^2(3) = 14.738$ $p < .002$
26. Rural, Regional City, Urban * It was difficult to set up my class registration	319	$\chi^2(3) = 13.020$ $p < .005$
27. University * Rural, Regional City, Urban	335	$\chi^2(3) = 239.419$ $p < .001$
28. Rural, Regional City, Urban * Gender	299	$\chi^2(3) = 13.162$ $p < .004$
29. Rural, Regional City, Urban * Socio Economics Status	229	$\chi^2(4) = 147.005$ $p < .001$
30. Rural, Regional City, Urban * First in Family	295	$\chi^2(3) = 27.120$ $p < .001$
31. Rural, Regional City, Urban * School Type	332	$\chi^2(9) = 364.957$ $p < .001$
32. Rural, Regional City, Preparedness for university	333	$\chi^2(6) = 17.992$ $p < .006$
33. Rural, Regional City, Urban * Used computers/digital technologies throughout secondary schooling	334	$\chi^2(3) = 33.072$ $p < .001$
34. Rural, Regional City, * Urban	295	$\chi^2(3) = 27.120$ $p < .001$

35. Rural, Regional City, * Proficiency in posting to blogs, forums & wikis	309	$\chi^2(6) = 13.972$ $p < .030$
36. Rural, Regional City, * Proficiency in uploading videos to social media	315	$\chi^2(6) = 13.536$ $p < .035$
37. Rural, Regional City, * Uses university online search to research assignments	334	$\chi^2(6) = 35.943$ $p < .001$
38. Rural, Regional City, Uses Wikipedia to research assignments	334	$\chi^2(6) = 52.396$ $p < .001$
39. Rural, Regional City, * Uses peer review or academic articles in assignments	322	$\chi^2(6) = 23.179$ $p < .001$
40. Rural, Regional City, * uses online referencing tools	321	$\chi^2(6) = 12.928$ $p < .044$
41. University * I have used computers/digital technologies throughout my secondary schooling		$\chi^2(6) = 12.928$ $p < .044$
42. University * I needed help to enrol online	404	$\chi^2(1) = 4.977$ $p < .026$
43. University * Who	197	$\chi^2(2) = 17.906$ $p < .001$
44. University * I needed to contact the student centre for help to enrol	400	$\chi^2(1) = 19.370$ $p < .001$
45. University * Where	138	$\chi^2(2) = 17.141$ $p < .001$
46. University * It was difficult to set up my class registration	390	$\chi^2(1) = 15.938$ $p < .001$
47. University * Used computers/digital technologies throughout secondary schooling		$\chi^2(1) = 6.042$ $p < .014$
48. University * Grew up using computers/digital technologies	404	$\chi^2(2) = 6.179$ $p < .046$
49. University * Preparedness for university	407	$\chi^2(2) = 9.377$ $p < .009$
50. University * I use University library search to research my assignments	408	$\chi^2(2) = 56.354$ $p < .001$
51. University * I use Wikipedia to research my assignments	408	$\chi^2(2) = 31.270$ $p < .001$
52. University * I only use peer reviewed or academic articles for my assignments	408	$\chi^2(2) = 18.452$ $p < .001$
53. University * University learning management system	394	$\chi^2(2) = 9.915$ $p < .007$

54. University * Socio Economic Status	249	$\chi^2(2) = 70.819$ $p < .001$
55. University * First in Family	348	$\chi^2(1) = 27.689$ $p < .001$
56. University * School Type	371	$\chi^2(3) = 76.507$ $p < .001$
57. I had a school issued laptop during my secondary schooling * Socio Economic Status	248	$\chi^2(2) = 5.976$ $p < .050$
58. I had a school issued laptop during my secondary schooling * School Type	363	$\chi^2(3) = 28.016$ $p < .001$
59. I had a school issued laptop during my secondary schooling * I had a personal computer or laptop during my secondary schooling	397	$\chi^2(1) = 3.859$ $p < .049$
60. I had a school issues laptop during my secondary schooling * I have used computers/digital technologies throughout my secondary schooling	398	$\chi^2(1) = 14.424$ $p < .001$
61. I had a school issues laptop during my secondary schooling * I would rate myself as having excellent digital technology skills	397	$\chi^2(2)$ 6.653 $p < .036$
62. I had a school issued laptop during my secondary schooling * I believe there is only one right way to use digital technologies	397	$\chi^2(2)$ 7.112 $p < .029$
63. I had a school issued laptop during my secondary schooling * I think technologies, not people, always cause success or failure	397	$\chi^2(2)$ 10.248 $p < .006$
64. I had a school issued laptop during my secondary schooling * I think high social media use always causes a decrease in face to face communication	395	$\chi^2(2)$ 6.467 $p < .039$
65. I had a school issued laptop during my secondary schooling * I often oversimplify or underestimate the role of a new technology	399	$\chi^2(2)$ 7.191 $p < .027$
66. I had a school issued laptop during my secondary schooling * I understand the types of potential value in using social media	398	$\chi^2(2)$ 7.006 $p < .030$
67. I had a school issued laptop during my secondary schooling * Proficiency in Power Point	383	$\chi^2(2)$ 10.958 $p < .004$
68. I had a school issued laptop during my secondary schooling * Proficiency in outlook calendar or equivalent	381	$\chi^2(2)$ 14.925 $p < .001$
69. I had a school issued laptop during my secondary schooling * Proficiency in uploading videos to social media	379	$\chi^2(2)$ 6.369 $p < .041$
70. I needed help to enrol online * School Type	368	$\chi^2(3) = 9.260$ $p < .026$

71. I needed help to enrol online * I needed to contact the student centre for help to enrol	399	$\chi^2(1) = 77.290$ $p < .001$
72. I needed help to enrol online * I had a school issued laptop	223	$\chi^2(1) = 5.692$ $p < .017$
73. I needed help to enrol online * It was difficult to set up my class registration	389	$\chi^2(1) = 34.492$ $p < .001$
74. I needed help to enrol online * I use Wikipedia to research my assignments	403	$\chi^2(1) = 8.249$ $p < .016$
75. I needed help to enrol online * I use google scholar to research my assignments	400	$\chi^2(2) = 7.999$ $p < .018$
76. I needed help to enrol online * Proficiency in graphics packages eg. Adobe Photoshop etc	354	$\chi^2(2) = 7.459$ $p < .024$
77. I needed help to enrol online * Proficiency in Excel	388	$\chi^2(2) = 6.352$ $p < .042$
78. I needed help to enrol online * First in Family	343	$\chi^2(1) = 6.434$ $p < .011$
79. I needed help to enrol online * Preparedness for university	403	$\chi^2(2) = 11.831$ $p < .003$
80. Preparedness for university * I needed help to enrol online	403	$\chi^2(2) = 11.831$ $p < .003$
81. Preparedness for university * I needed to contact the student centre for help to enrol	399	$\chi^2(2) = 8.400$ $p < .015$
82. Preparedness for university * It was difficult to set up my class registration	389	$\chi^2(2) = 20.689$ $p < .001$
83. Preparedness for university * Gender	351	$\chi^2(2) = 11.994$ $p < .002$
84. Preparedness for university * Geographic location	333	$\chi^2(6) = 17.992$ $p < .006$
85. Preparedness for university * School Type	369	$\chi^2(6) = 20.857$ $p < .002$
86. Preparedness for university * Parents keep up with the latest trends in technology	406	$\chi^2(4) = 22.229$ $p < .000$
87. Preparedness for university * Often oversimplify or underestimate the role of a new technology	407	$\chi^2(4) = 10.818$ $p < .029$
88. Preparedness for university * Proficiency in adobe acrobat	360	$\chi^2(4) = 10.213$ $p < .037$

89. Preparedness for university * Use university online library	406	$\chi^2(4) = 21.597$ $p < .001$
90. First in Family * Preparedness for university a.1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.46.		$\chi^2(6) = 12.928$ $p < .044$
91. First in Family * Socio Economic Status	244	$\chi^2(2) = 17.592$ $p < .001$
92. First in Family * School Type	318	$\chi^2(3) = 20.060$ $p < .001$
93. First in Family * Who helped to enrol	167	$\chi^2(2) = 7.704$ $p < .021$
94. First in Family * I needed to contact the student centre for help to enrol	340	$\chi^2(1) = 7.774$ $p < .005$
95. First in Family * Where	113	$\chi^2(2) = 9.287$ $p < .010$
96. First in Family * It was difficult to set up my class registration	331	$\chi^2(1) = 6.763$ $p < .009$
97. First in Family * Only one right way to use digital technologies	347	$\chi^2(2) = 7.419$ $p < .024$
98. First in Family * I use Wikipedia to research my assignments	347	$\chi^2(6) = 9.112$ $p < .011$

Appendix 5 Factor Analysis

Factor Analysis: Question Block 3

	Rotated Component Matrix[a]						
Factor	Question block 3	Component					
		1	2	3	4	5	6
FAC1 Fluency Mindset	I can quickly learn how to use new technology	.783					
	I am able to jump from one kind of digital technology to another to achieve my goals	.807					
	I recognise the potential transformative uses for new digital technologies	.750					
	I take comfort with the fact that there is more than one way to use a technology	.638					
	I would rate myself as having excellent digital technology skills	.638				.	
FAC2 Parental Influences	My parents/caregivers actively use computers/digital technologies in the workplace and home		.782				
	My parents/caregivers keep up with the latest trends in technology		.821				
	I would rate my parents/caregivers as having good computer/digital technology skills		.875				
FAC3 Pre Fluency Mindset	I believe there is only one right way to use digital technologies			.546			
	I think technologies, not people, always cause success or failure			.651			
	I think high social media use always causes a decrease in face-to-face communication			.613			
	I often oversimplify or underestimate the role of a new technology			.686			
	I have a large number of followers on social media			.486			

FAC4 Fluency Attitude	I believe change is necessary				.849		
	I embrace change as opportunity				.822		
FAC5 School Influences	I was well prepared by my school for university level study					.790	
	I was well prepared by my school to study in a digital learning environment					.748	
FAC6 Literacy Mindset	I feel it is important to be able to access the Internet any time I want						.691
	I think it is important to keep up with the latest trends in technology						.825
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						
	a. Rotation converged in 7 iterations.						

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.779
Bartlett's Test of Sphericity	Approx. Chi-Square	2434.232
	df	210
	Sig.	.000

Factor Analysis: Question Block 4

	Rotated Component Matrix[a]			
Factor	Question Block 4	Component		
		1	2	3
FAC1 Critical Literacies	I critically evaluate information by checking that the content is fair, valid, and current	.887		
	I evaluate and interpret online sources by checking for bias	.878		
FAC2 Research Literacies	I use Google or other search engines to research my assignments		.640	
	I use Google Scholar to research my assignments		.583	.
	I use Wikipedia to research my assignments		.693	

FAC4 Academic Research Literacies	I only use peer reviewed or academic articles for my assignments			.764
	I use the university online library to research my assignments			.781
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
	a. Rotation converged in 4 iterations.			

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.615
Bartlett's Test of Sphericity	Approx. Chi-Square	423.268
	df	28
	Sig.	.000

Factor Analysis: Block 5 Digital Literacies

	Rotated Component Matrix[a]				
Factor	Question Block 5	Component			
		1	2	3	4
FAC1 Creating Literacies	Posting to Blogs, Forums and Wikis	.746			.
	Creating Blogs, Forums or Wikis	.863			
	Adobe Acrobat Professional	.755			
	Graphics packages eg. Adobe Photoshop etc	.727			
FAC2 Digital Literacies	Microsoft Word or equivalent		.812		
	Excel		.709		
	PowerPoint		.838		
	Email		.661		.
FAC3 Consuming Literacies	Post material to social networking sites eg. Facebook, Instagram			.839	
	Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat			.872	
FAC4 University systems Literacies	LearnJCU				.653
	Online Tests eg LearnJCU quizzes, Aplia, Wiley				.753
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
	a. Rotation converged in 6 iterations.				

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.790
Bartlett's Test of Sphericity	Approx. Chi-Square	2053.836
	df	105
	Sig.	.000

Factor Analysis: Question Block 3, 4 & 5

	Rotated Component Matrix[a]						
Question block 3 - Digital mindsets, attitudes & influences		Component					
		1	2	3	4	5	6
FAC1 Fluency Mindset	I can quickly learn how to use new technology	.783					
	I am able to jump from one kind of digital technology to another to achieve my goals	.807					
	I recognise the potential transformative uses for new digital technologies	.750					
	I take comfort with the fact that there is more than one way to use a technology	.638					
	I would rate myself as having excellent digital technology skills	.638				.	
FAC2 Parental Influences	My parents/caregivers actively use computers/digital technologies in the workplace and home		.782				
	My parents/caregivers keep up with the latest trends in technology		.821				
	I would rate my parents/caregivers as having good computer/digital technology skills		.875				
FAC3 Fluency Attitude	I believe change is necessary				.849		
	I embrace change as opportunity				.822		
FAC4 School Influences	I was well prepared by my school for university level study					.790	
	I was well prepared by my school to study in a digital learning environment					.748	

Question Block 4 - 21st Century Skills							
FAC5 Critical Literacies	I critically evaluate information by checking that the content is fair, valid, and current	.887					
	I evaluate and interpret online sources by checking for bias	.878					
Question Block 5 - Digital skills							
FAC1 Creating Literacies	Posting to Blogs, Forums and Wikis	.746			.		
	Creating Blogs, Forums or Wikis	.863					
	Adobe Acrobat Professional	.755					
	Graphics packages eg. Adobe Photoshop etc	.727					
FAC2 Digital Literacies	Microsoft Word or equivalent		.812				
	Excel		.709				
	PowerPoint		.838				
	Email		.661		.		
FAC3 Consuming Literacies	Post material to social networking sites eg. Facebook, Instagram			.839			
	Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat			.872			
FAC4 University systems Literacies	LearnJCU				.653		
	Online Tests eg LearnJCU quizzes, Aplia, Wiley				.753		

Appendix 6 Reliability Scales

Reliability Scale 1: Fluency Mindset

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.819	.820	5

Item Statistics			
	Mean	Std. Deviation	N
I can quickly learn how to use new technology	5.7282	1.02637	401
I am able to jump from one kind of digital technology to another to achieve my goals	5.6484	1.02399	401
I recognise the potential transformative uses for new digital technologies	5.7606	1.00625	401
I take comfort with the fact that there is more than one way to use a technology	5.8728	.93343	401
I would rate myself as having excellent digital technology skills	5.3616	1.12535	401

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I can quickly learn how to use new technology	22.6434	9.710	.701	.547	.757
I am able to jump from one kind of digital technology to another to achieve my goals	22.7232	9.551	.735	.563	.746
I recognise the potential	22.6110	10.418	.588	.386	.791

transformative uses for new digital technologies					
I take comfort with the fact that there is more than one way to use a technology	22.4988	11.336	.484	.284	.818
I would rate myself as having excellent digital technology skills	23.0100	9.985	.562	.394	.801

Reliability Scale 2: Parental Influences

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.841	.840	3

Item Statistics			
	Mean	Std. Deviation	N
My parents/caregivers actively use computers/digital technologies in the workplace and home	5.3515	1.54670	404
My parents/caregivers keep up with the latest trends in technology	4.5396	1.64337	404
I would rate my parents/caregivers as having good computer/digital technology skills	4.5025	1.58857	404

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted

My parents/caregivers actively use computers/digital technologies in the workplace and home	9.0421	8.829	.664	.442	.817
My parents/caregivers keep up with the latest trends in technology	9.8540	7.847	.736	.547	.747
I would rate my parents/caregivers as having good computer/digital technology skills	9.8911	8.266	.716	.522	.768

Reliability Scale 3: Pre-Fluency Mindset

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.603	.604	5

Item Statistics			
	Mean	Std. Deviation	N
I believe there is only one right way to use digital technologies	3.5350	1.61409	400
I think technologies, not people, always cause success or failure	3.7350	1.66334	400
I think high social media use always causes a decrease in face-to-face communication	5.1425	1.47568	400
I often oversimplify or underestimate the role of a new technology	4.4050	1.39493	400
I have a large number of followers on social media	4.0975	1.65222	400

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I believe there is only one right way to use digital technologies	17.3800	15.665	.418	.221	.515
I think technologies, not people, always cause success or failure	17.1800	15.080	.446	.242	.497
I think high social media use always causes a decrease in face-to-face communication	15.7725	17.931	.280	.123	.586
I often oversimplify or underestimate the role of a new technology	16.5100	17.143	.392	.179	.534
I have a large number of followers on social media	16.8175	17.242	.265	.083	.599

Reliability Scale 4: Fluency Attitude

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.734	.734	2

Item Statistics			
	Mean	Std. Deviation	N
I believe change is necessary	5.7359	1.14776	409
I embrace change as opportunity	5.7946	1.09673	409

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I believe change is necessary	5.7946	1.203	.580	.336	.
I embrace change as opportunity	5.7359	1.317	.580	.336	.

Reliability Scale 5: School Influences

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.701	.702	2

Item Statistics			
	Mean	Std. Deviation	N
I was well prepared by my school for university level study	5.0517	1.41763	406
I was well prepared by my school to study in a digital learning environment	5.3177	1.35174	406

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I was well prepared by my school for university level study	5.3177	1.827	.540	.292	.
I was well prepared by my school to study in a digital learning environment	5.0517	2.010	.540	.292	.

Reliability Scale 6: Literacy Mindset

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.585	.598	2

Item Statistics			
	Mean	Std. Deviation	N
I feel it is important to be able to access the Internet any time I want	6.3170	1.03166	407
I think it is important to keep up with the latest trends in technology	5.6929	1.31925	407

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I feel it is important to be able to access the Internet any time I want	5.6929	1.740	.426	.182	.
I think it is important to keep up with the latest trends in technology	6.3170	1.064	.426	.182	.

Reliability Scale 7: Critical Literacies

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.795	.796	2

Item Statistics			
	Mean	Std. Deviation	N

I critically evaluate information by checking that the content is fair, valid and current	5.2987	1.24911	395
I evaluate and interpret online sources by checking for bias	5.0253	1.31927	395

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I critically evaluate information by checking that the content is fair, valid and current	5.0253	1.740	.661	.437	.
I evaluate and interpret online sources by checking for bias	5.2987	1.560	.661	.437	.

Reliability Scale 8: Research Literacies

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.403	.408	3

Item Statistics

	Mean	Std. Deviation	N
I use Google or other search engines to research my assignments	6.0815	1.24112	405
I use Google Scholar to research my assignments	4.7877	1.85604	405
I use Wikipedia to research my assignments	3.1926	1.95809	405

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I use Google or other search engines to research my assignments	7.9802	9.000	.204	.047	.382
I use Google Scholar to research my assignments	9.2741	5.957	.293	.087	.196
I use Wikipedia to research my assignments	10.8691	5.921	.242	.061	.316

Reliability Scale 9: Academic Research Literacies

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.502	.509	2

Item Statistics			
	Mean	Std. Deviation	N
I only use peer reviewed or academic articles for my assignments	4.7828	1.56813	396
I use JCU Library One Search to research my assignments	4.7828	1.90623	396

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
I only use peer reviewed or academic articles for my assignments	4.7828	3.634	.342	.117	.
I use JCU Library One Search to	4.7828	2.459	.342	.117	.

research my assignments					

Reliability Scale 10: Creating Literacies

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.821	.823	4

Item Statistics			
	Mean	Std. Deviation	N
Posting to Blogs, Forums and Wikis	2.9619	1.24204	341
Creating Blogs, Forums or Wikis	2.7801	1.29989	341
Adobe Acrobat Professional	2.5601	1.32623	341
Graphics packages eg. Adobe Photoshop etc	2.5718	1.39272	341

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Posting to Blogs, Forums and Wikis	7.9120	11.263	.628	.648	.782
Creating Blogs, Forums or Wikis	8.0938	10.026	.768	.717	.716
Adobe Acrobat Professional	8.3138	10.922	.611	.419	.790
Graphics packages eg. Adobe Photoshop etc	8.3021	10.800	.579	.395	.807

Reliability Scale 11a: Digital Literacies

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.780	.802	4

Item Statistics			
	Mean	Std. Deviation	N
Microsoft Word or equivalent	4.3750	.73612	392
Excel	3.7092	1.11814	392
PowerPoint	4.1888	.89333	392
Email	4.3903	.79204	392

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Microsoft Word or equivalent	12.2883	4.917	.701	.536	.684
Excel	12.9541	4.320	.469	.254	.817
PowerPoint	12.4745	4.347	.699	.516	.665
Email	12.2730	5.130	.555	.405	.743

Reliability Scale 11b: Digital Literacies revised

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.819	.823	3

Item Statistics			
	Mean	Std. Deviation	N

Microsoft Word or equivalent	4.3690	.74488	393
PowerPoint	4.1858	.89420	393
Email	4.3868	.79413	393

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Microsoft Word or equivalent	8.5725	2.215	.723	.523	.708
PowerPoint	8.7557	1.904	.676	.475	.755
Email	8.5547	2.237	.633	.409	.789

Reliability Scale 12: Consuming Literacies

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.846	.852	2

Item Statistics

	Mean	Std. Deviation	N
Post material to social networking sites eg. Facebook, Instagram	4.2067	1.05970	387
Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat	3.9974	1.23946	387

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Post material to social networking sites eg. Facebook, Instagram	3.9974	1.536	.742	.551	.

Upload videos to social media eg YouTube, Facebook, Instagram, Snapchat	4.2067	1.123	.742	.551	.

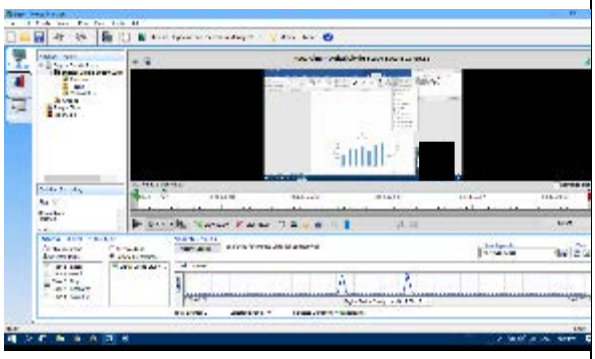
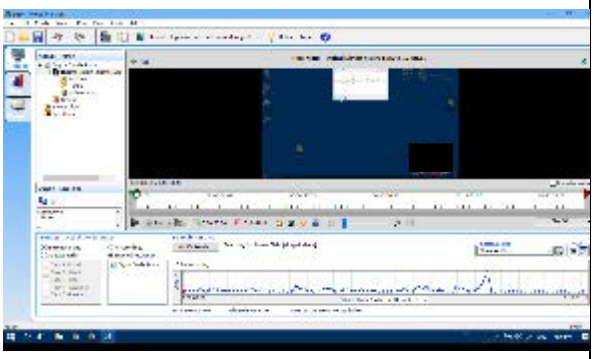
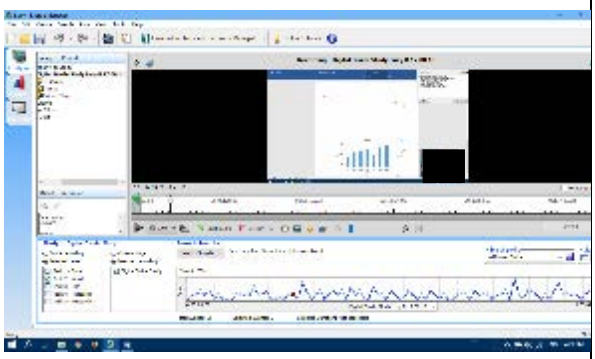
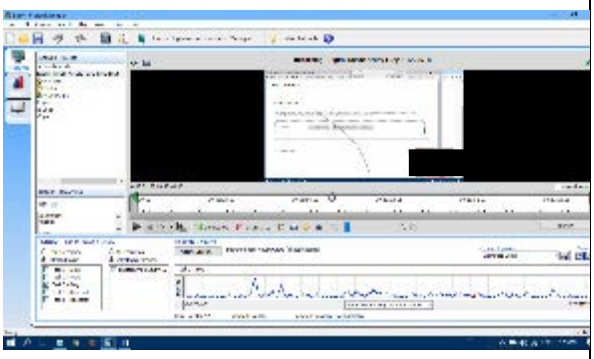
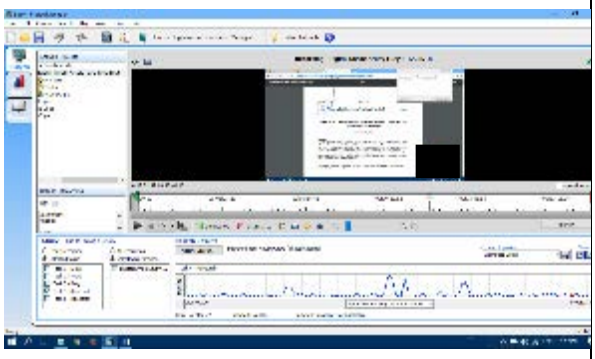
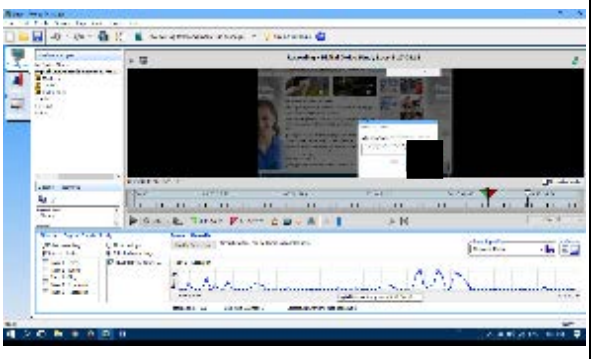
Reliability Scale 13: University Systems Literacies

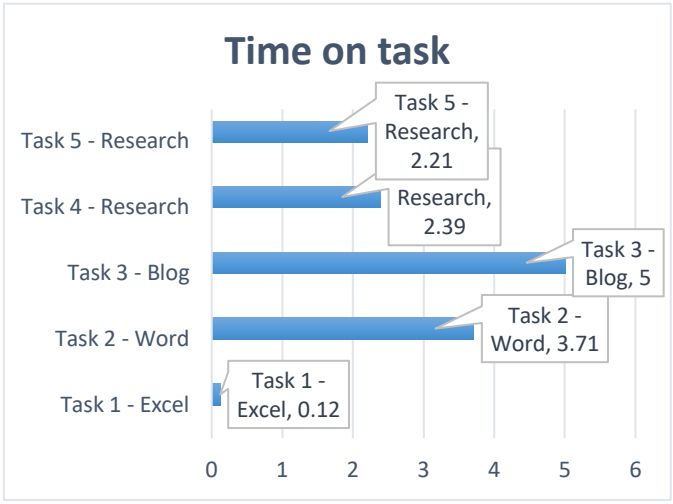
Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.662	.662	2

Item Statistics			
	Mean	Std. Deviation	N
LearnJCU	3.9847	.99988	393
Online Tests eg LearnJCU quizzes, Aplia, Wiley	3.8753	.97008	393

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
LearnJCU	3.8753	.941	.495	.245	.
Online Tests eg LearnJCU quizzes, Aplia, Wiley	3.9847	1.000	.495	.245	.

Appendix 7 Lily's Digital Test and Results

Task 1 Excel	Task 2 Word
	
Task 3 Blog	
	
Task 4 Research	Task 5 Media article
	


Time on task
Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 2.21
Research, 2.39
Task 3 - Blog, 5
Task 2 - Word, 3.71
Task 1 - Excel, 0.12
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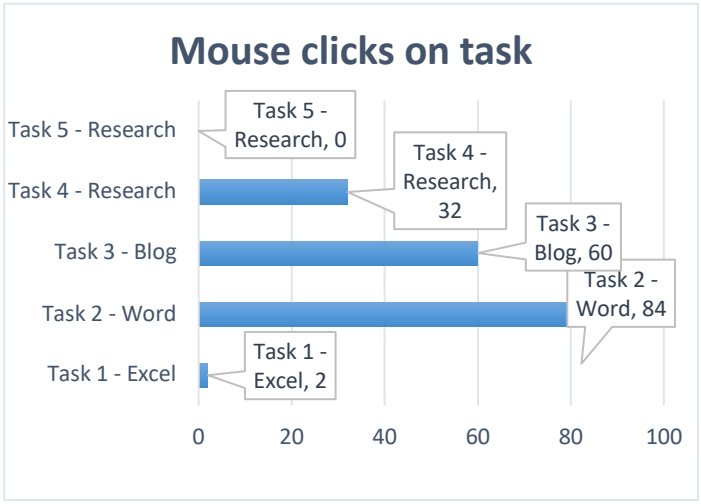
2
3
4
5
6


Mouse clicks on task
Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 0
Task 4 - Research, 32
Task 3 - Blog, 60
Task 2 - Word, 84
Task 1 - Excel, 2
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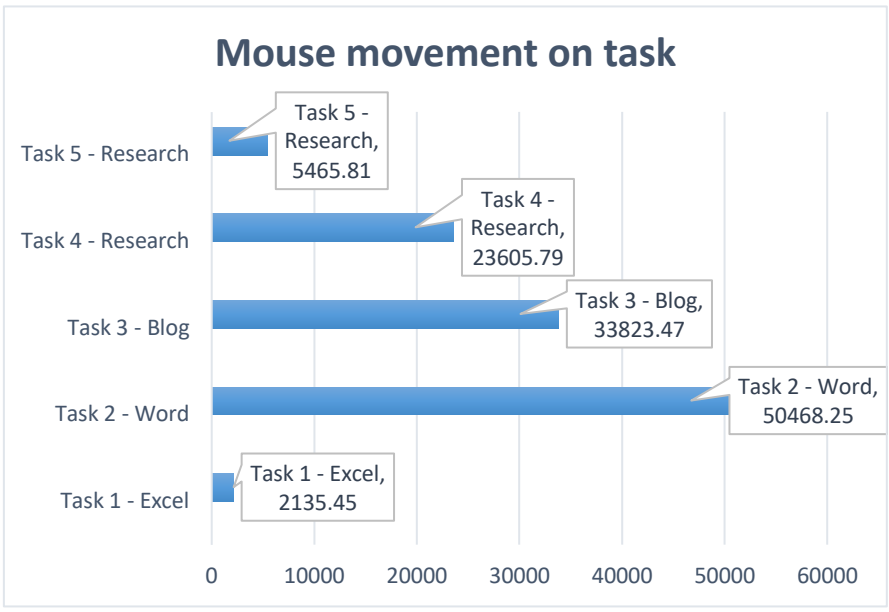
40
60
80
100


Mouse movement on task
Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 5465.81
Task 4 - Research, 23605.79
Task 3 - Blog, 33823.47
Task 2 - Word, 50468.25
Task 1 - Excel, 2135.45
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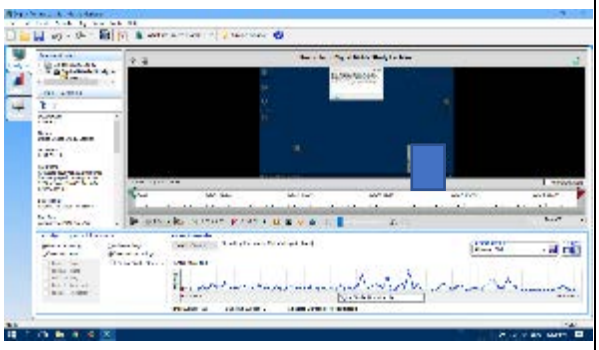
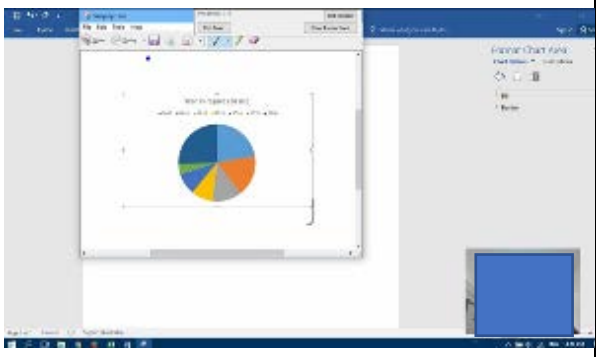
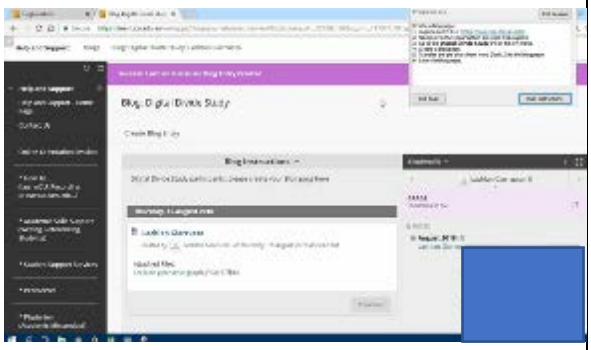
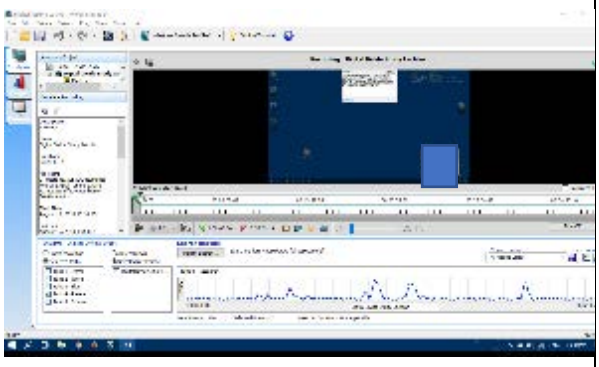
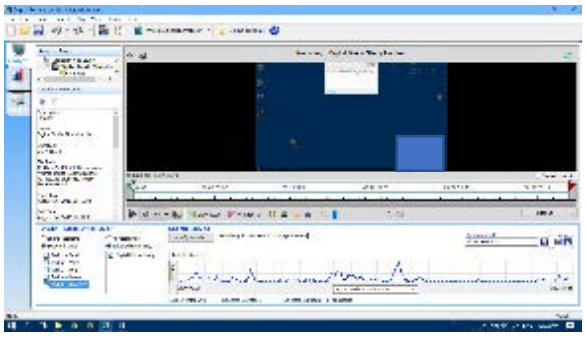
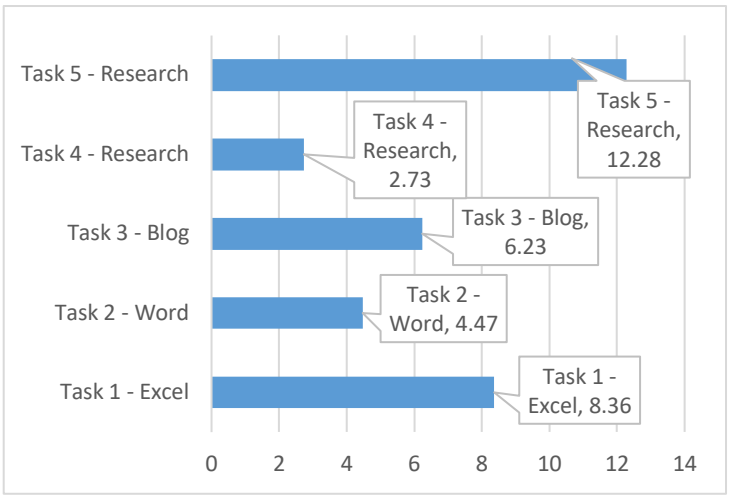
30000
40000
50000
60000

Appendix 8 Max's Digital Test and Results

Task 1 Excel	Task 2 Word
	
Task 3 Blog	
	
Task 4 Research	Task 5 Media article
	


Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 12.28
Task 4 - Research, 2.73
Task 3 - Blog, 6.23
Task 2 - Word, 4.47
Task 1 - Excel, 8.36
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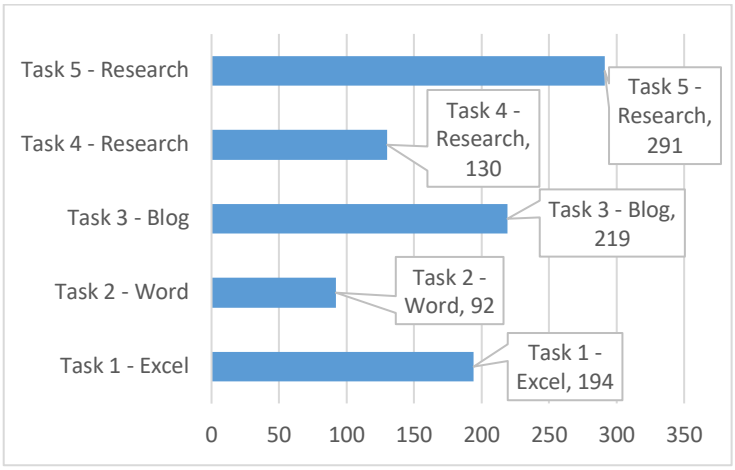
4
6
8
10
12
14


Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 291
Task 4 - Research, 130
Task 3 - Blog, 219
Task 2 - Word, 92
Task 1 - Excel, 194
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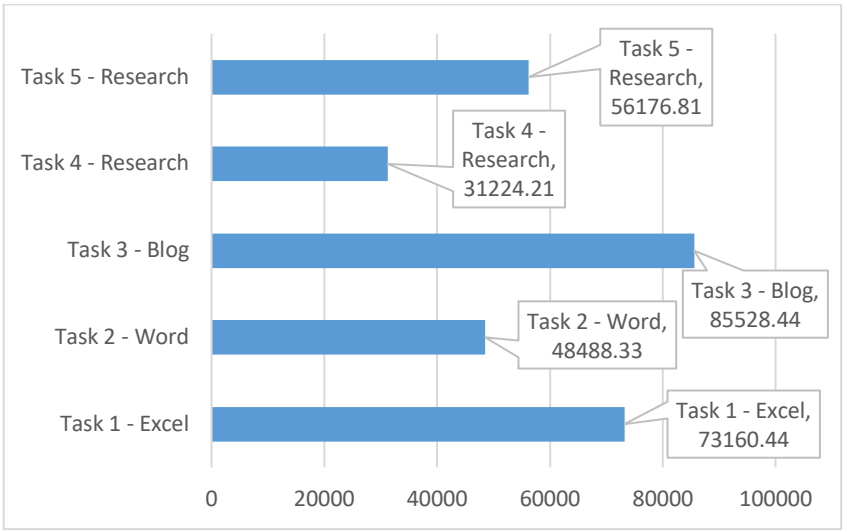
100
150
200
250
300
350


Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 56176.81
Task 4 - Research, 31224.21
Task 3 - Blog, 85528.44
Task 2 - Word, 48488.33
Task 1 - Excel, 73160.44
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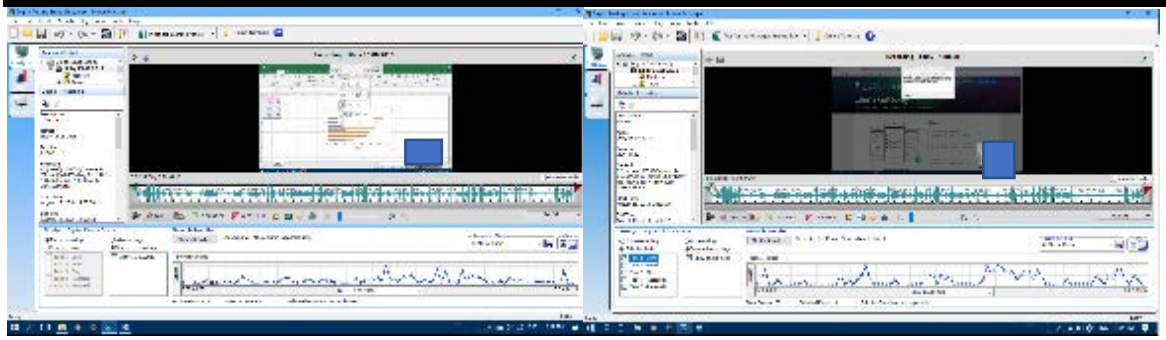
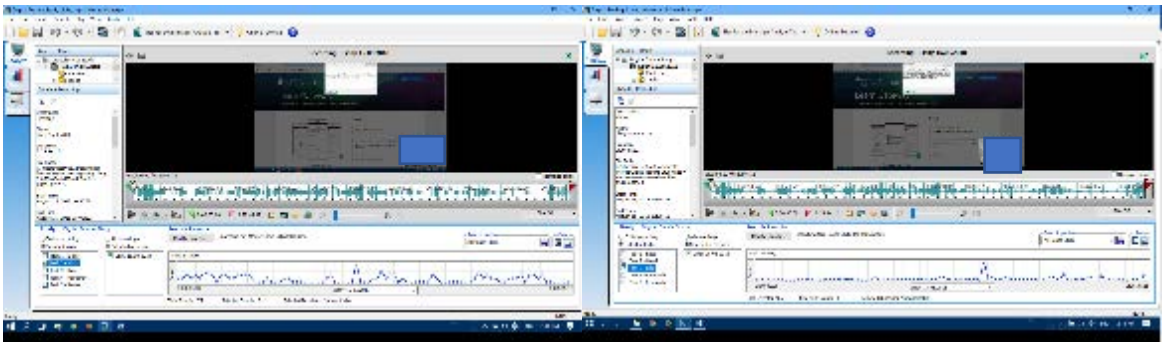
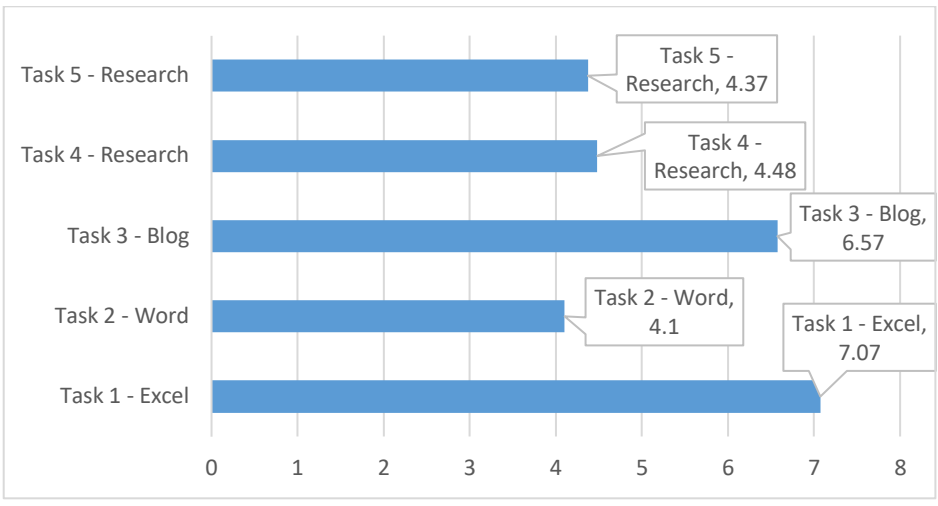
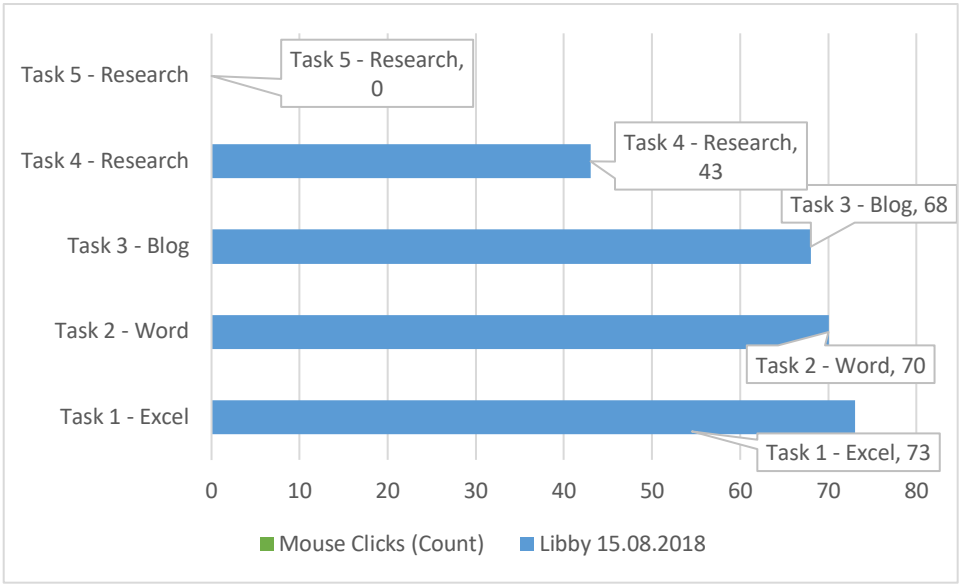
60000
80000
100000

Appendix 9 Laura's Digital Test and Results








Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 0
Task 4 - Research, 43
Task 3 - Blog, 68
Task 2 - Word, 70
Task 1 - Excel, 73
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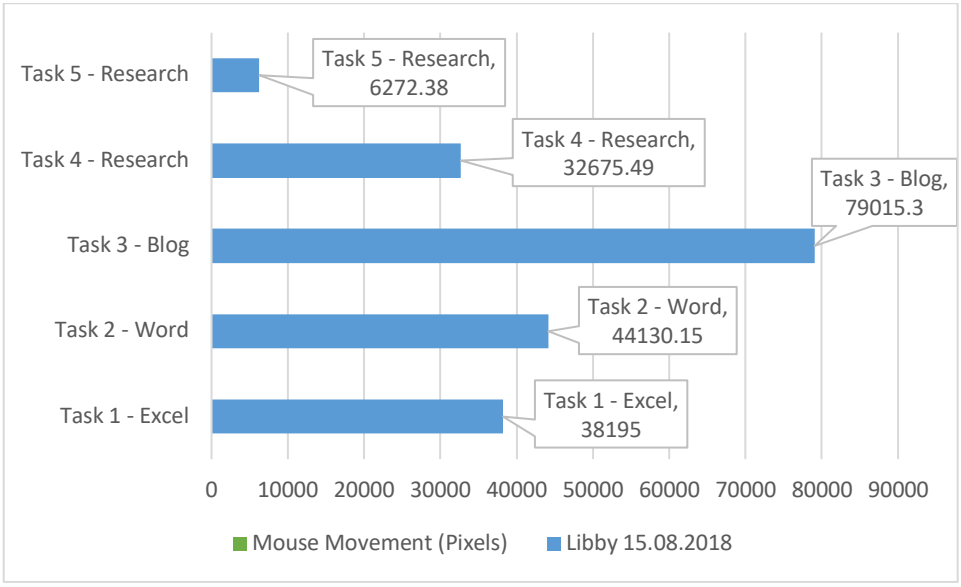
30
40
50
60
70
80
Mouse Clicks (Count)
Libby 15.08.2018


Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 6272.38
Task 4 - Research, 32675.49
Task 3 - Blog, 79015.3
Task 2 - Word, 44130.15
Task 1 - Excel, 38195
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30000
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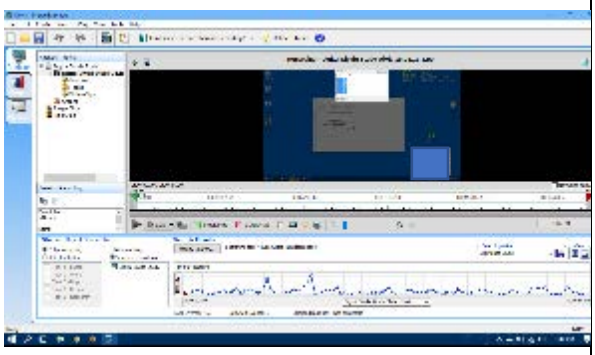
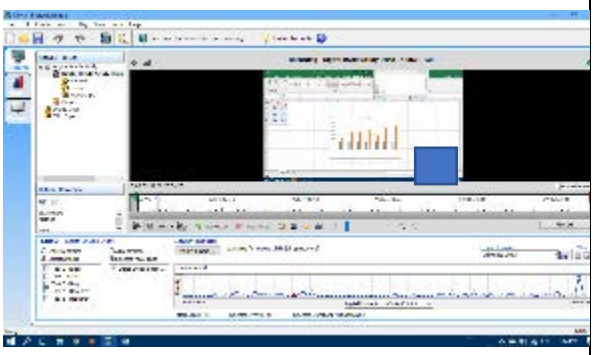
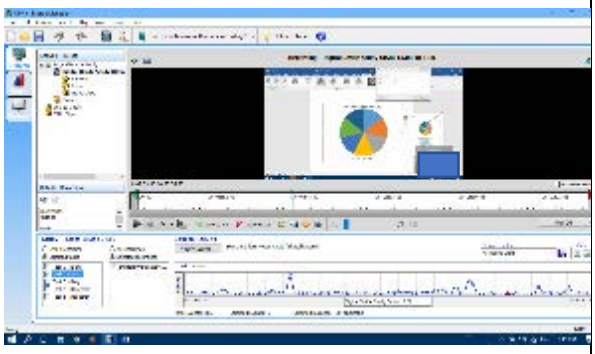
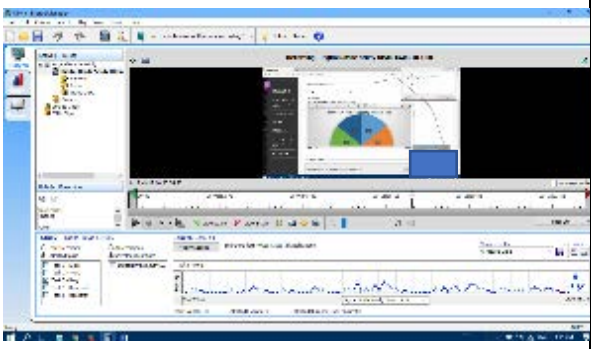
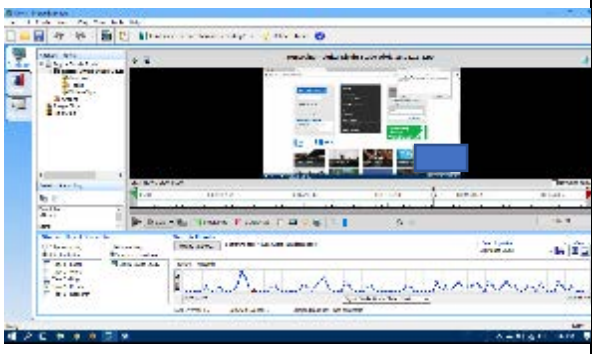
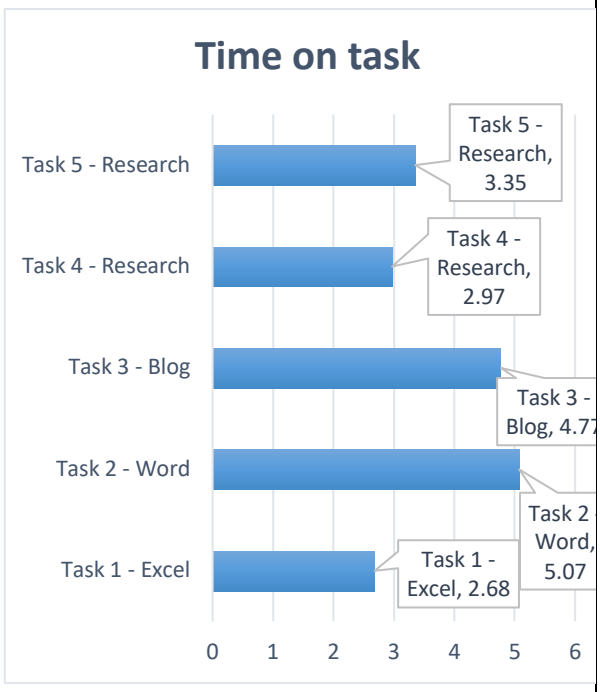
80000
90000
Mouse Movement (Pixels)
Libby 15.08.2018

Appendix 10 Paula's Digital Test and Results

Task 1 Excel`	Task 2 Word
	
Task 3 Blog	
	
Task 4 Research	Task 5 Media article
	


Time on task
Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 3.35
Task 4 - Research, 2.97
Task 3 - Blog, 4.77
Task 2 - Word, 5.07
Task 1 - Excel, 2.68
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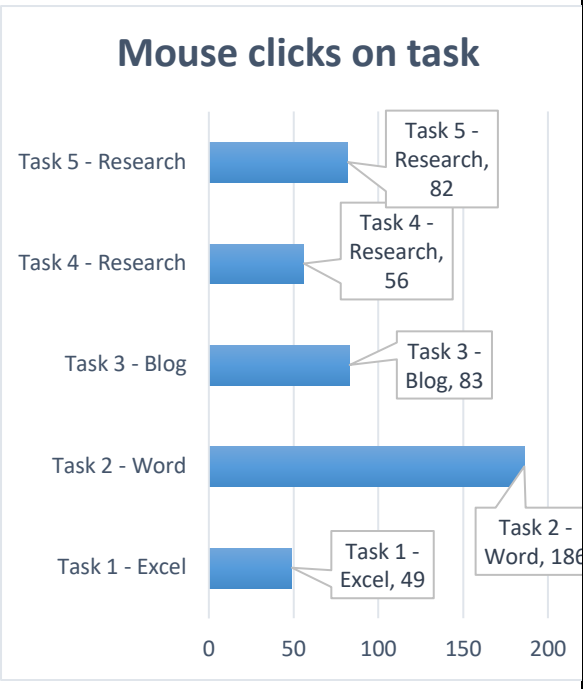
2
3
4
5
6


Mouse clicks on task
Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 82
Task 4 - Research, 56
Task 3 - Blog, 83
Task 2 - Word, 186
Task 1 - Excel, 49
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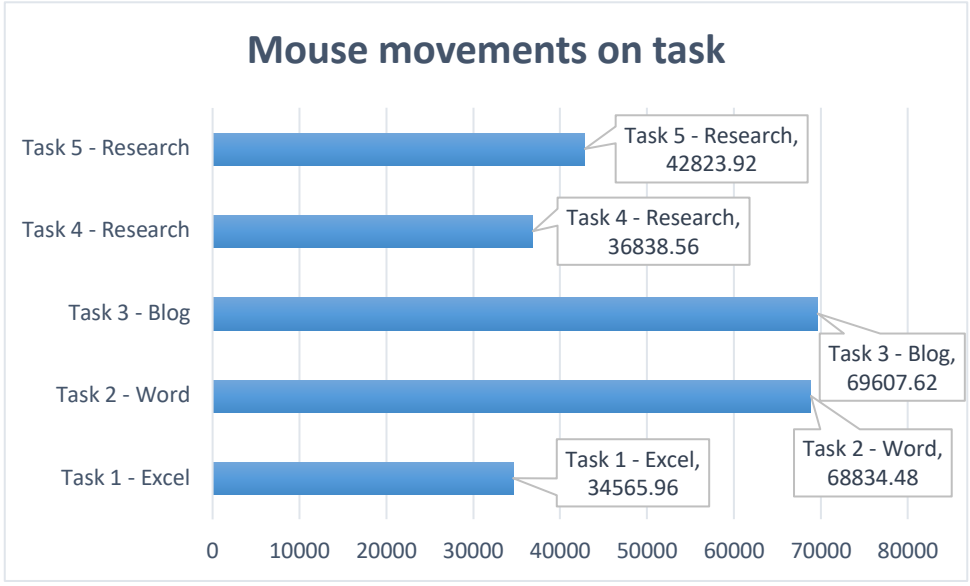
100
150
200


Mouse movements on task
Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 42823.92
Task 4 - Research, 36838.56
Task 3 - Blog, 69607.62
Task 2 - Word, 68834.48
Task 1 - Excel, 34565.96
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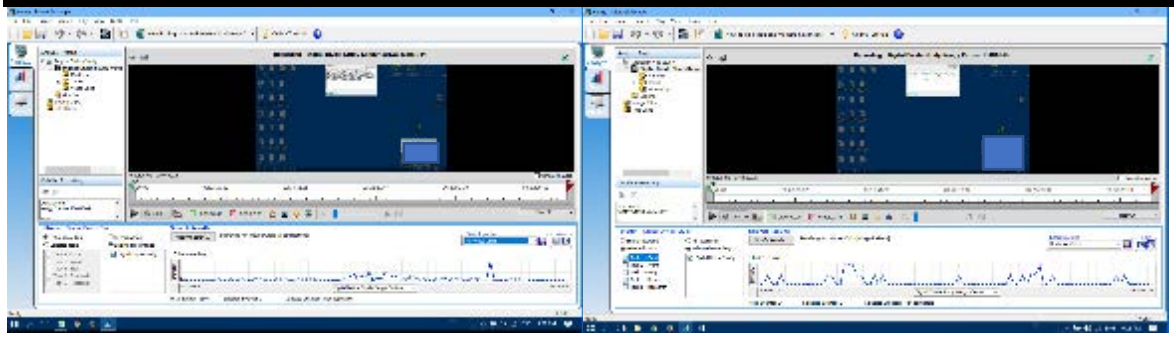
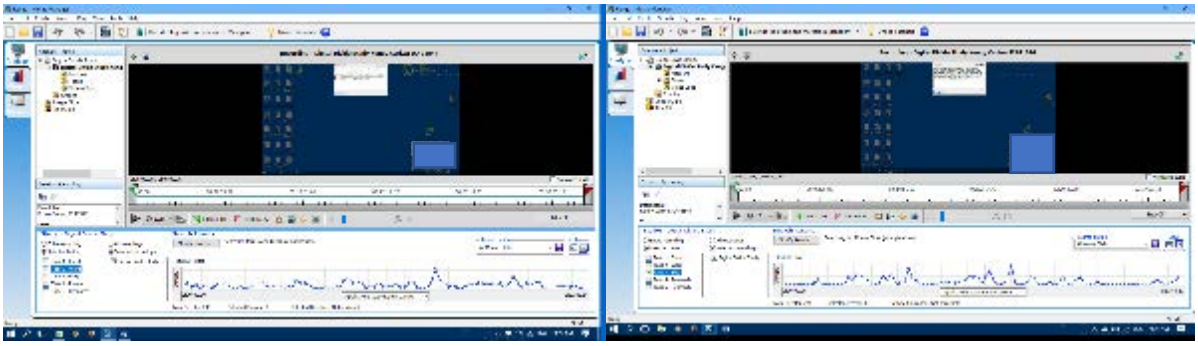
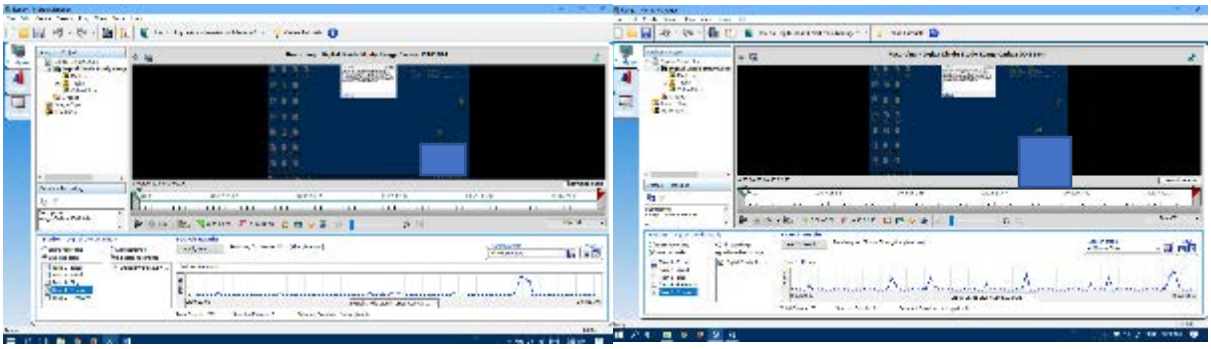
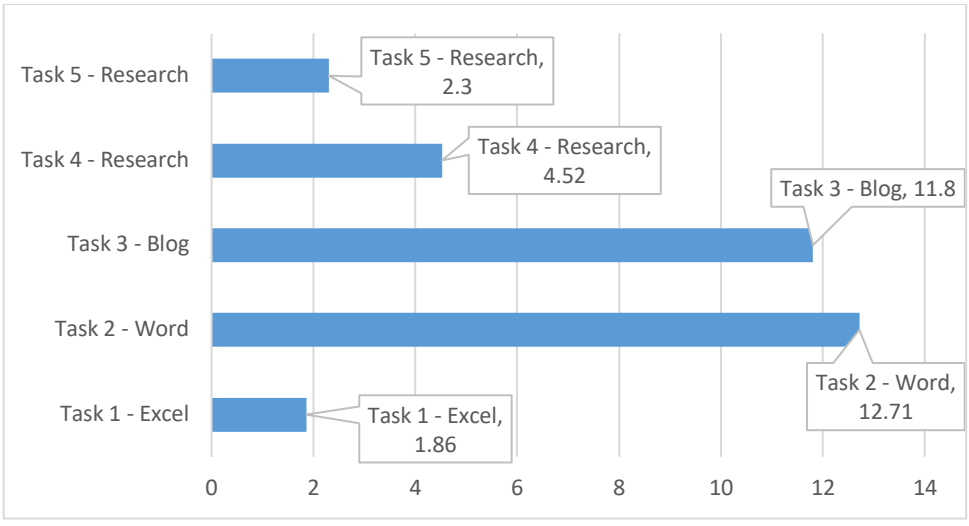
60000
70000
80000

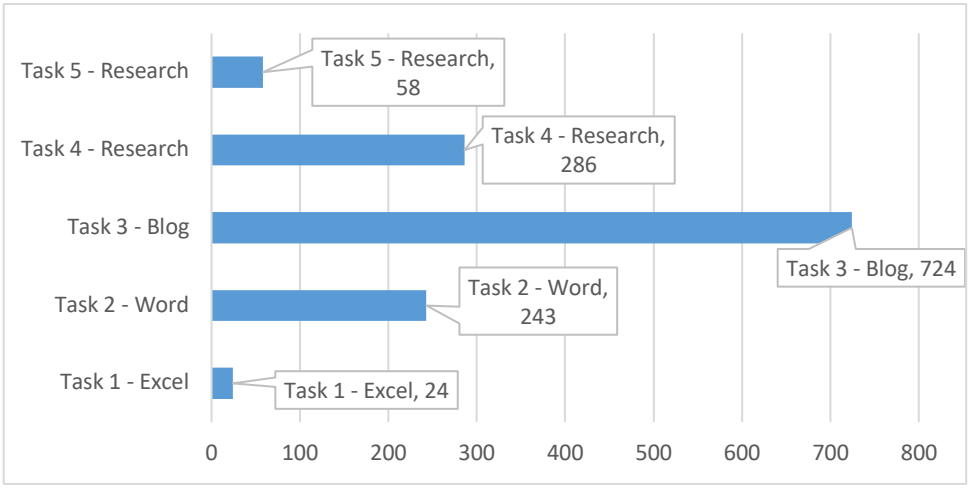
Appendix 11 Ben's Digital Test and Results

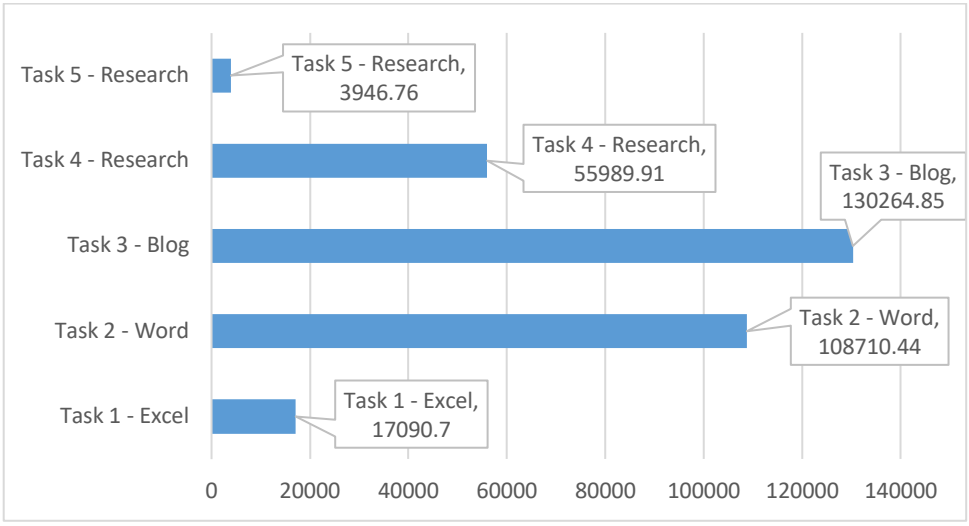




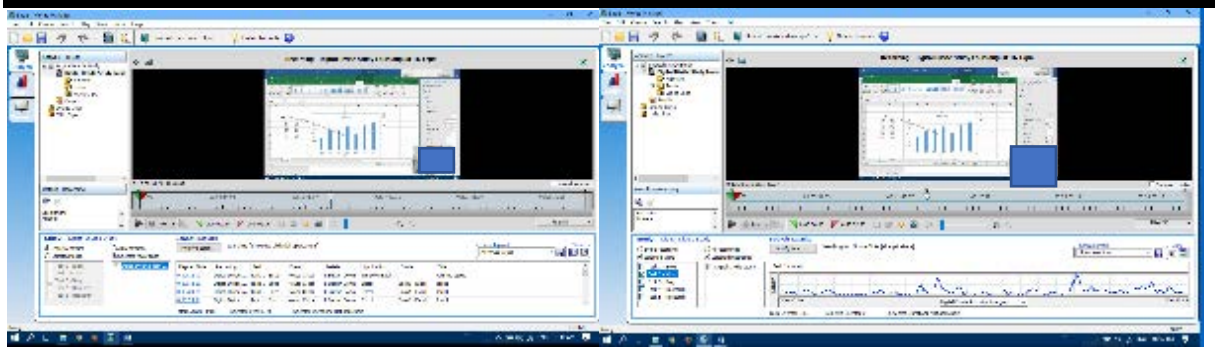


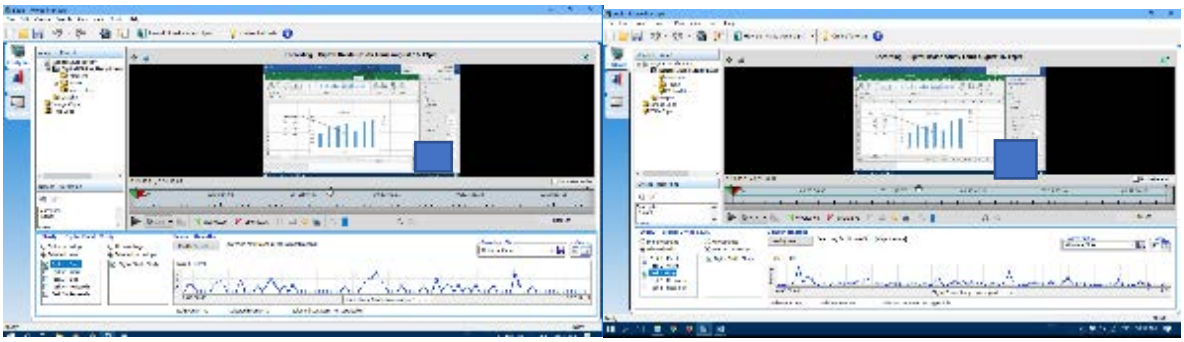


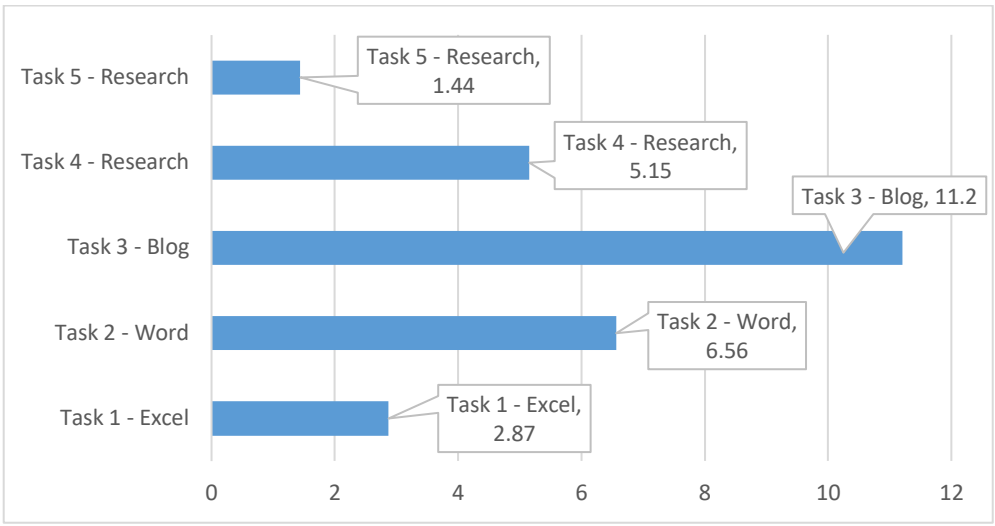




Appendix 12 Luke's Digital Test and Results






Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 1.44
Task 4 - Research, 5.15
Task 3 - Blog, 11.2
Task 2 - Word, 6.56
Task 1 - Excel, 2.87
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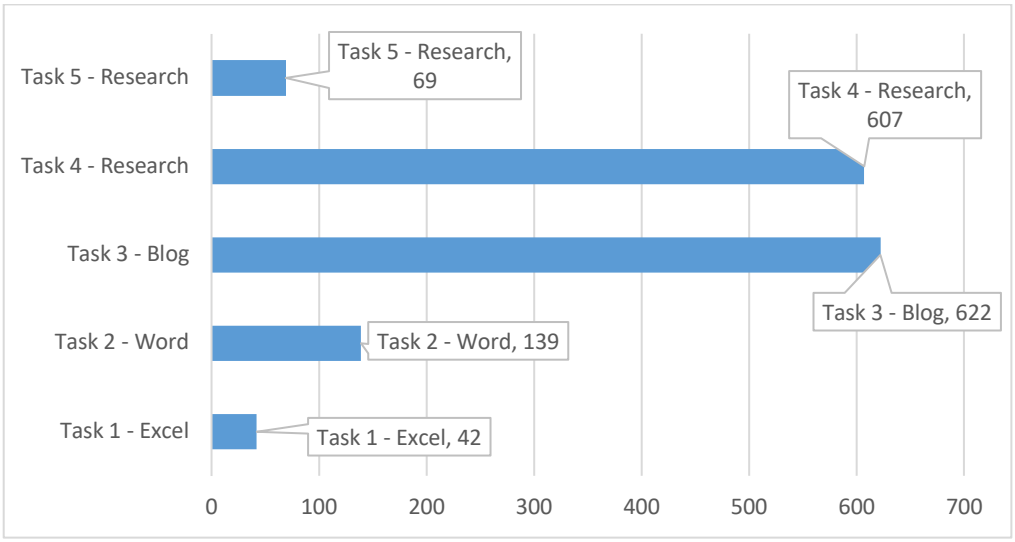
4
6
8
10
12


Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 69
Task 4 - Research, 607
Task 3 - Blog, 622
Task 2 - Word, 139
Task 1 - Excel, 42
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600
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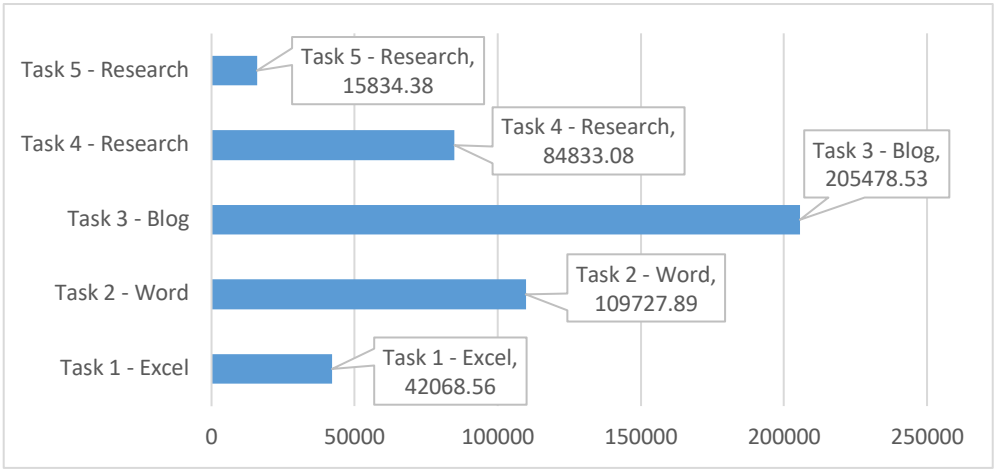
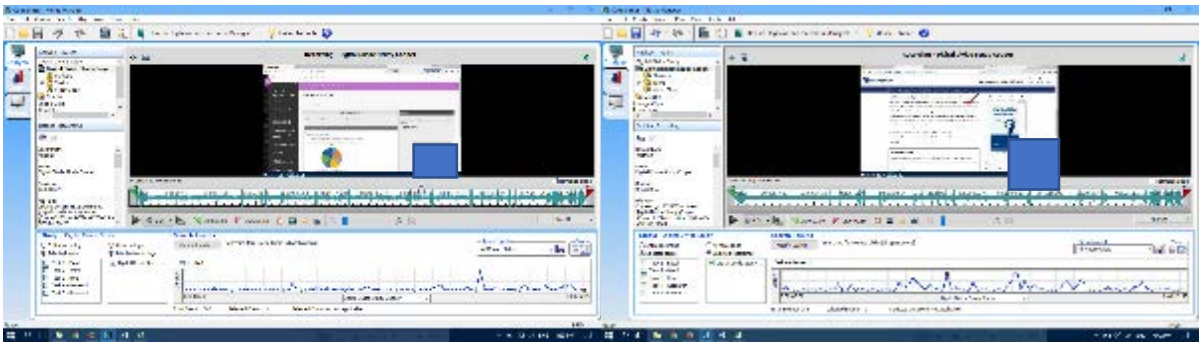
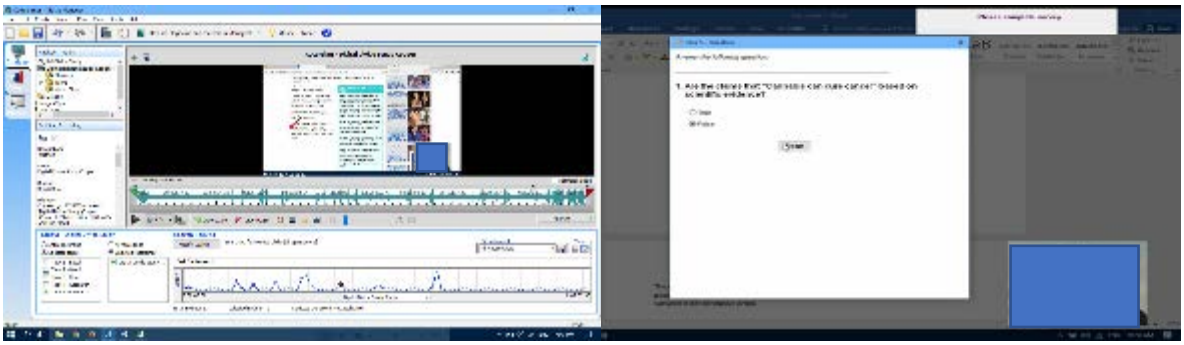
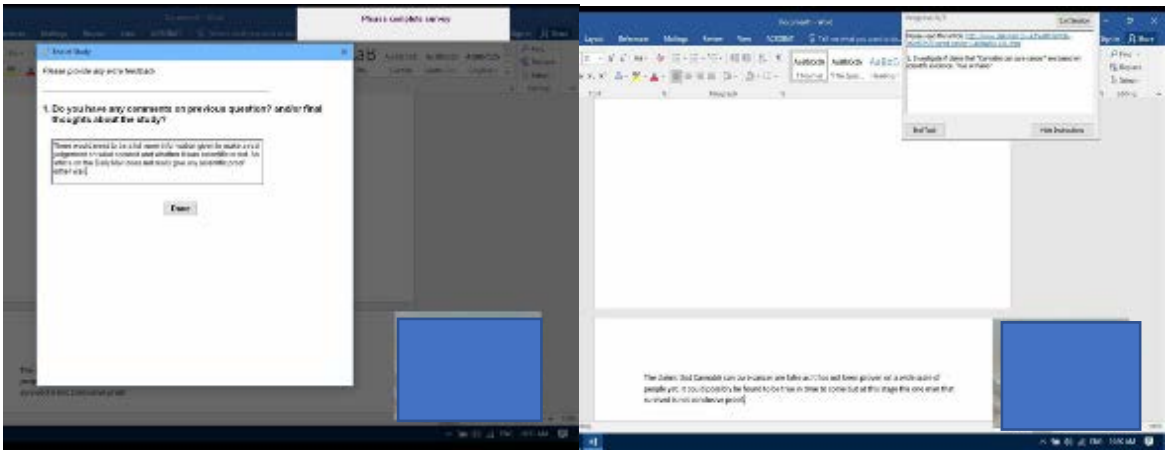


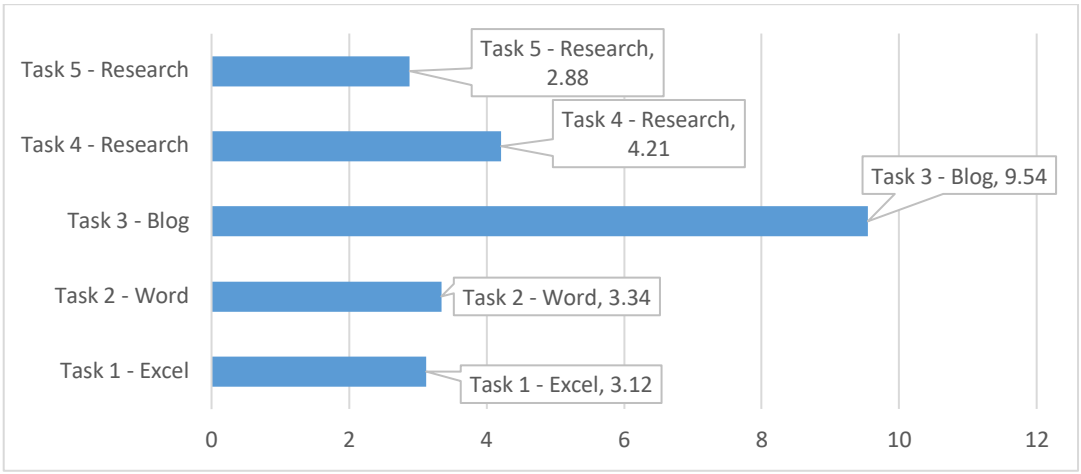
Appendix 13 Cam's Digital Test and Results



Blog completed successfully after multiple attempts.






Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 2.88
Task 4 - Research, 4.21
Task 3 - Blog, 9.54
Task 2 - Word, 3.34
Task 1 - Excel, 3.12
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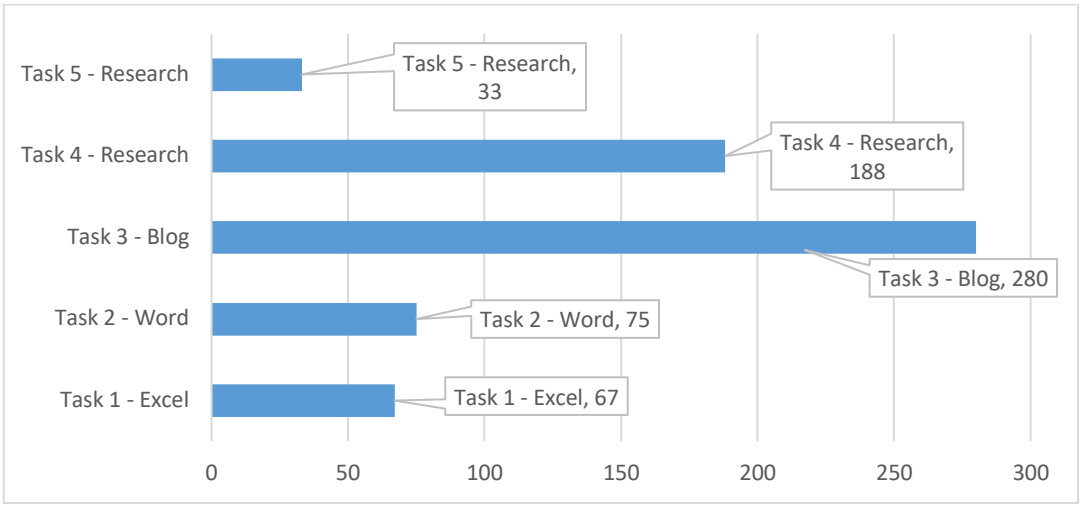
10
12


Task 5 - Research
Task 4 - Research
Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 33
Task 4 - Research, 188
Task 3 - Blog, 280
Task 2 - Word, 75
Task 1 - Excel, 67
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250
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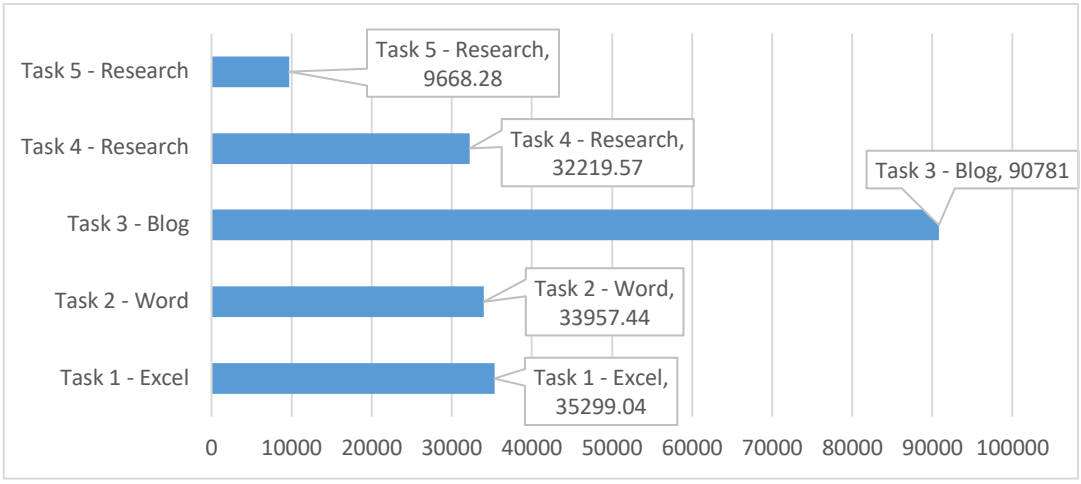
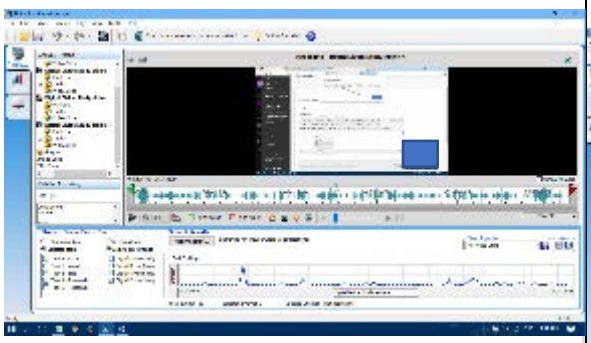
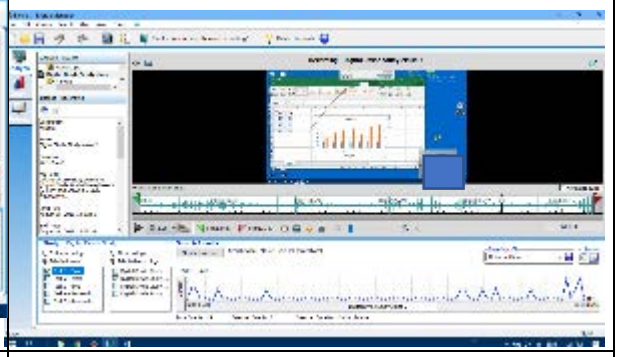
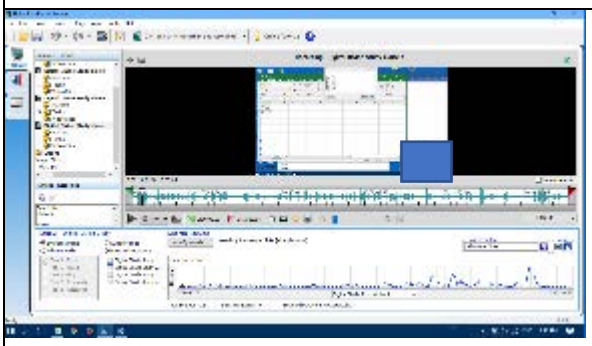
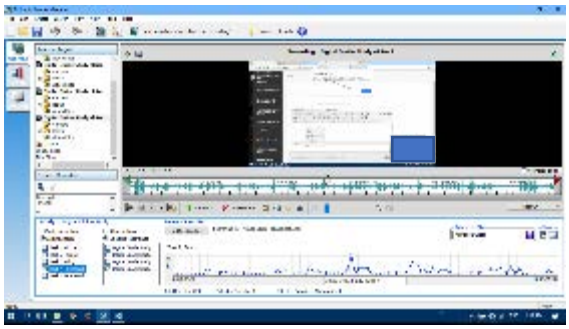


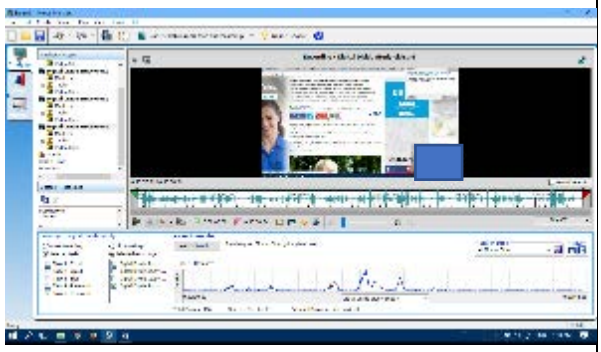
Appendix 14 Emily's Digital Test and Results

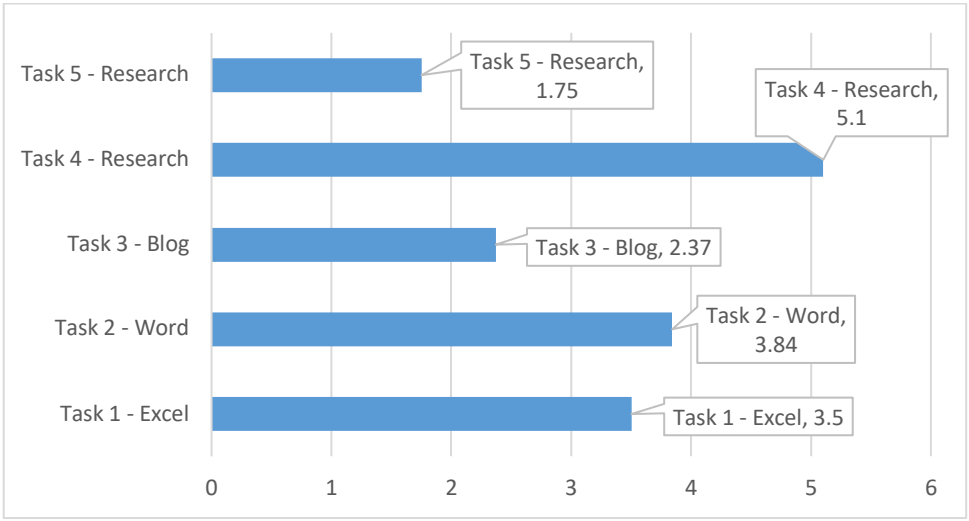











Task 5 - Research
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Task 3 - Blog
Task 2 - Word
Task 1 - Excel
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Task 2 - Word, 3.84
Task 1 - Excel, 3.5
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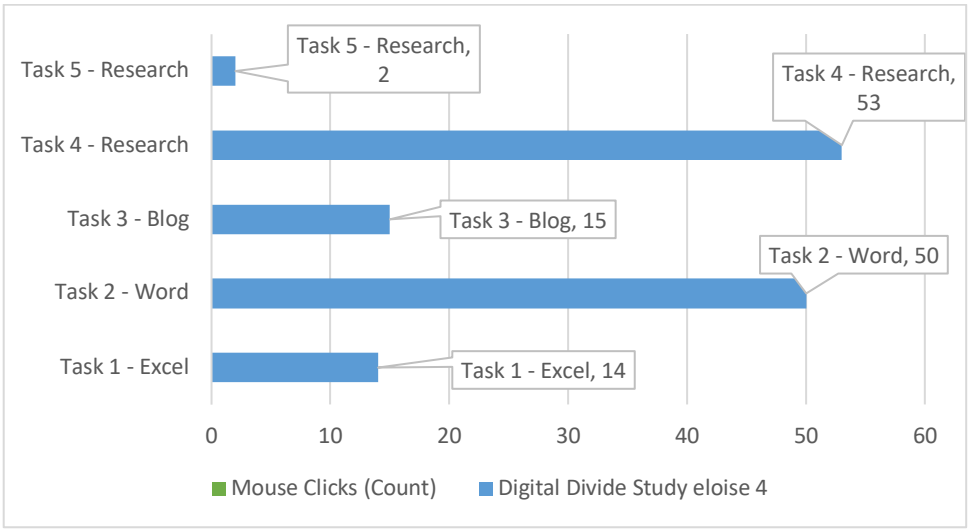
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Task 3 - Blog
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Task 1 - Excel
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Task 4 - Research, 53
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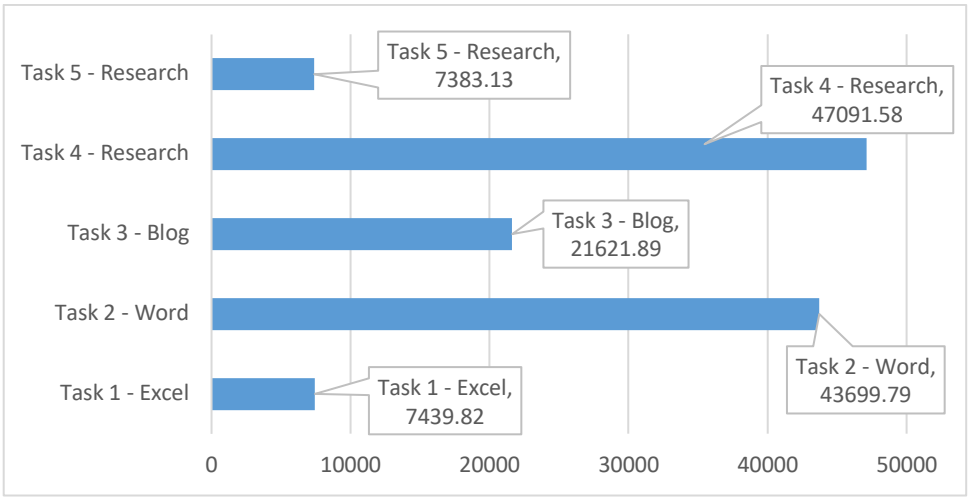
Digital Divide Study eloise 4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Task 3 - Blog
Task 2 - Word
Task 1 - Excel
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Task 4 - Research, 47091.58
Task 3 - Blog, 21621.89
Task 2 - Word, 43699.79
Task 1 - Excel, 7439.82
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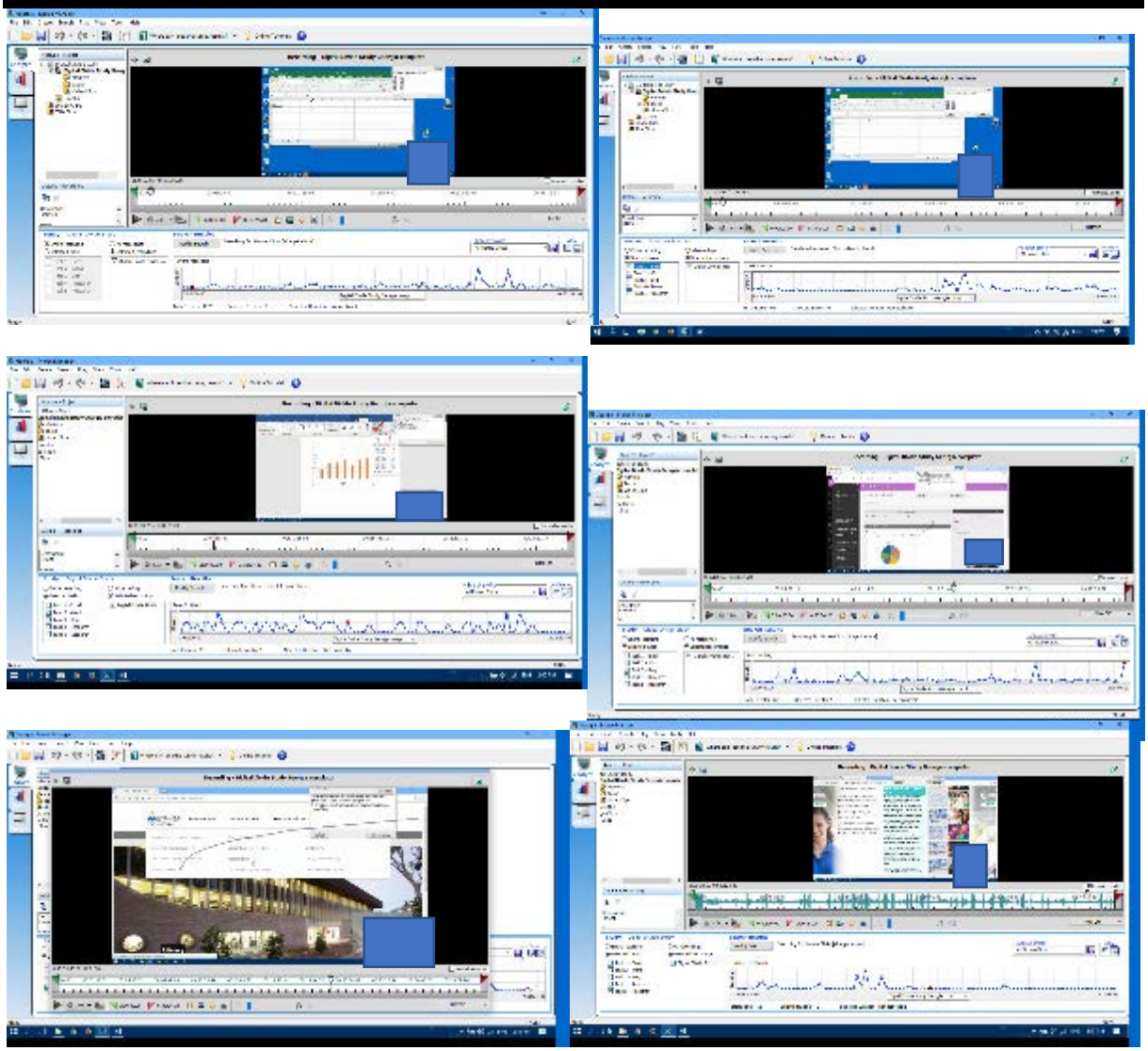
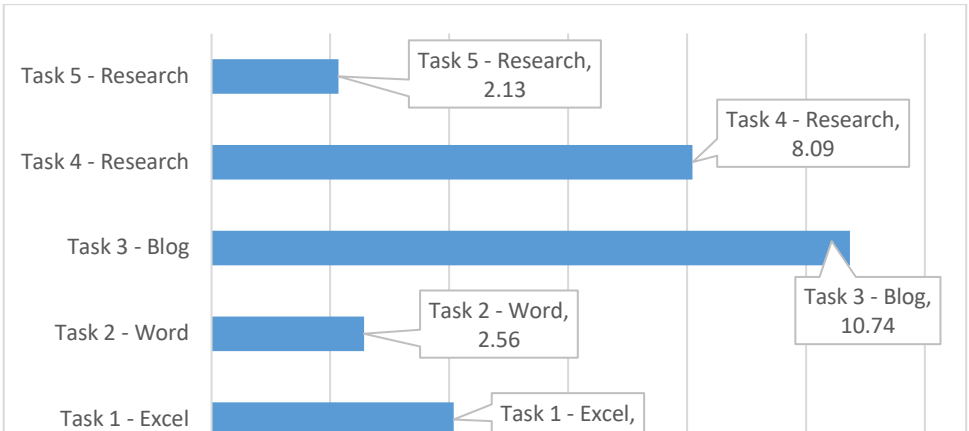
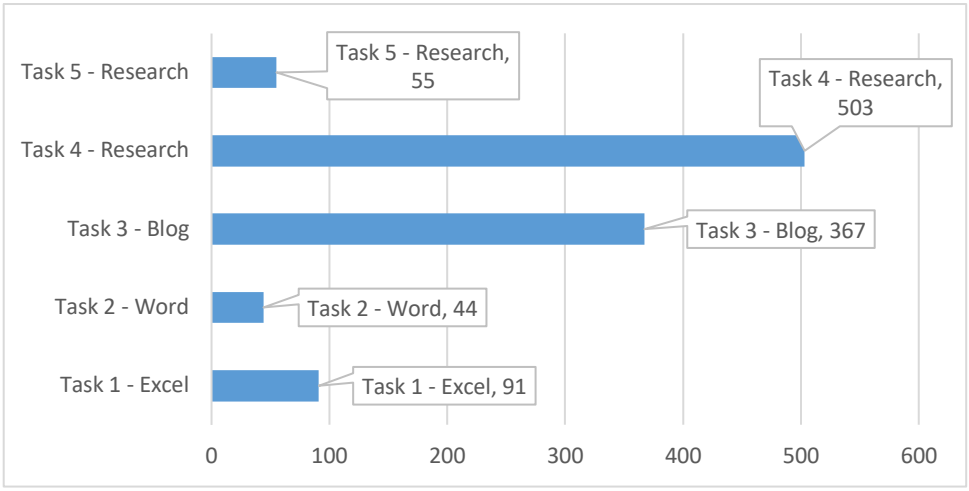
Appendix 15 Gina's Digital Test and Results



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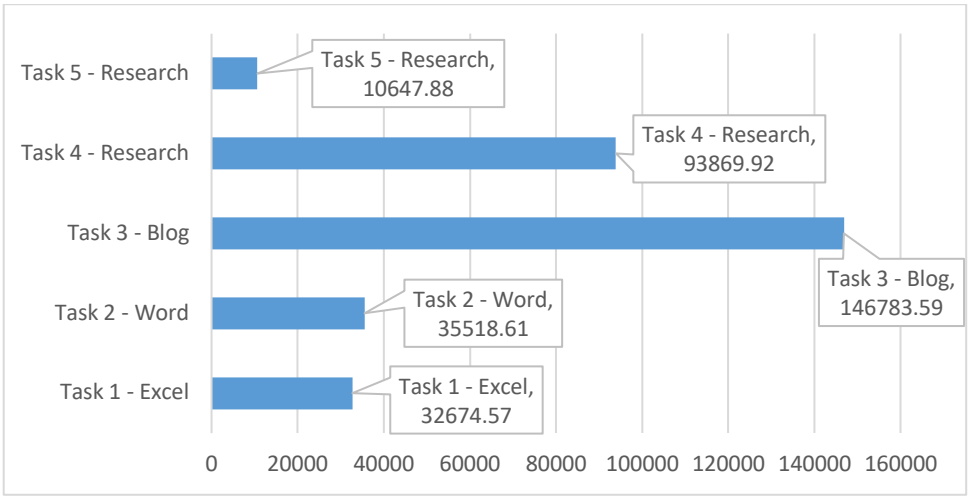
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Task 2 - Word, 35518.61
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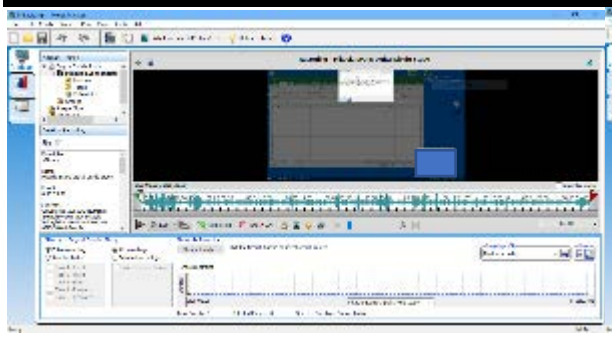
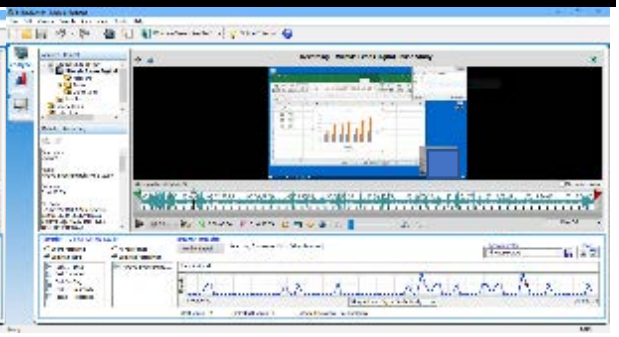
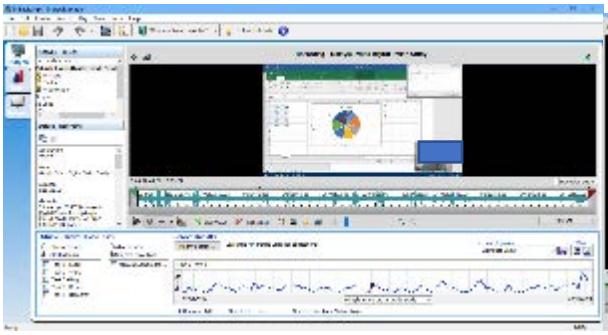
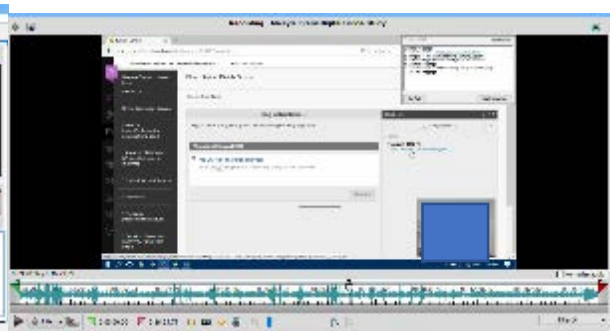
Appendix 16 Michelle's Digital Test and Results









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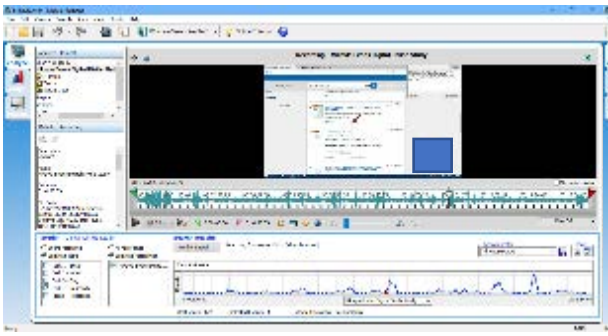

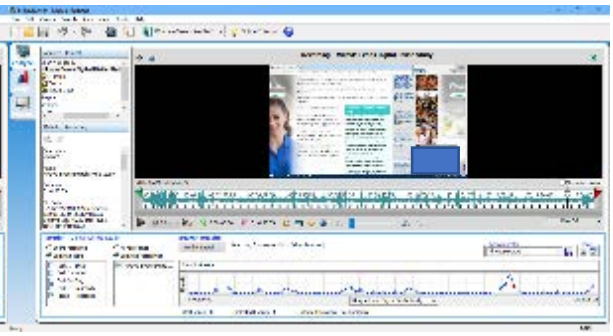

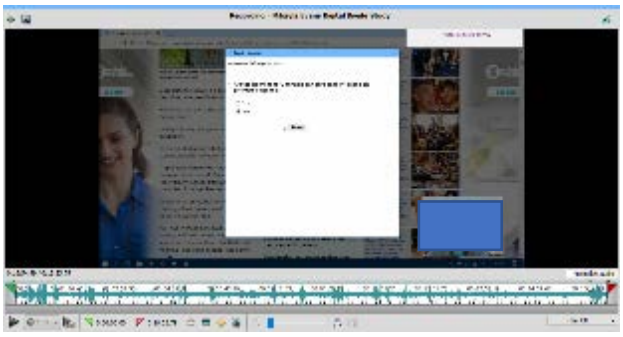

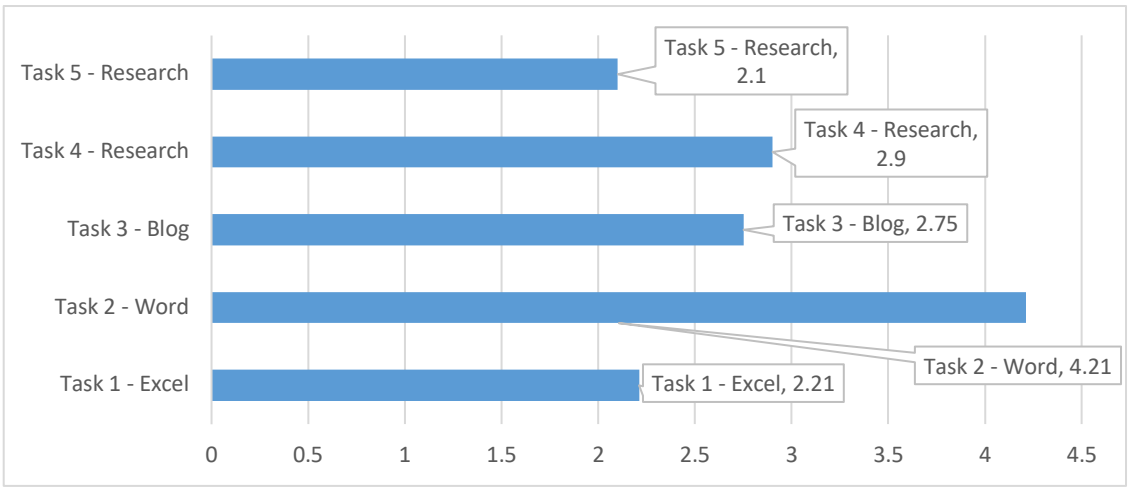
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Task 3 - Blog
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Task 1 - Excel
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Task 4 - Research, 2.9
Task 3 - Blog, 2.75
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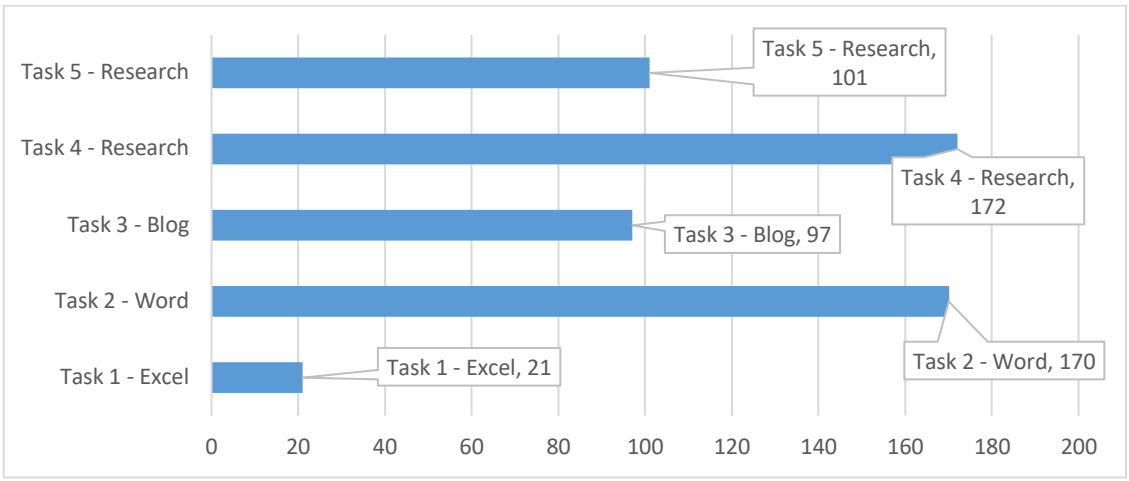
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Task 3 - Blog
Task 2 - Word
Task 1 - Excel
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Task 4 - Research, 172
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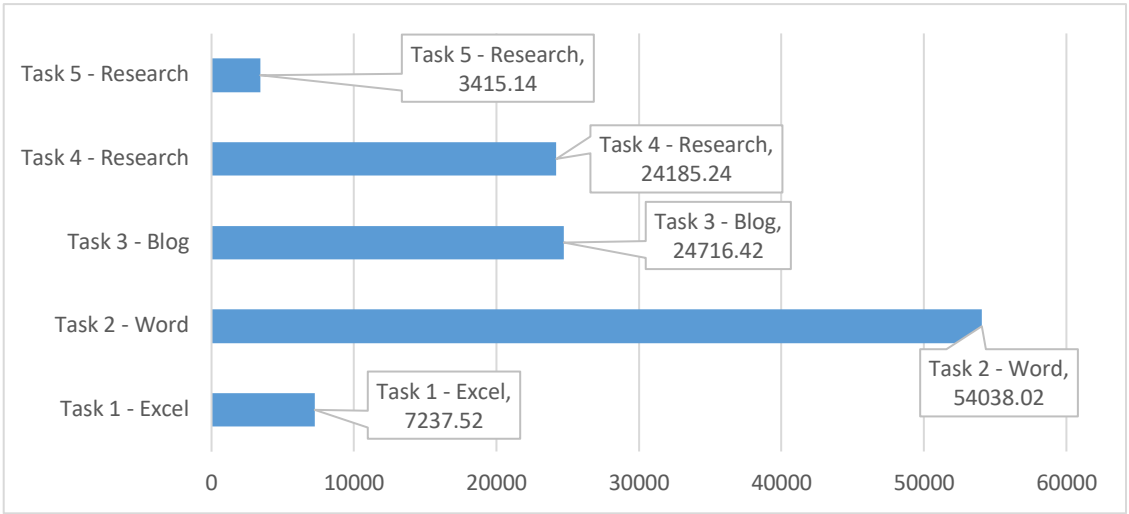
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Task 3 - Blog
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Task 1 - Excel
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Task 3 - Blog, 24716.42
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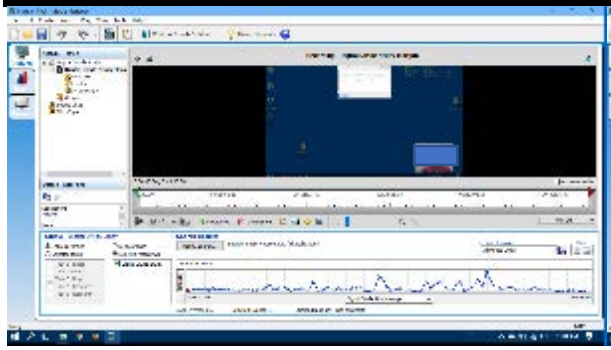
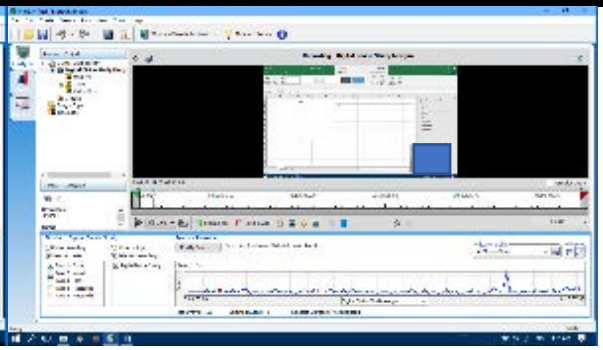
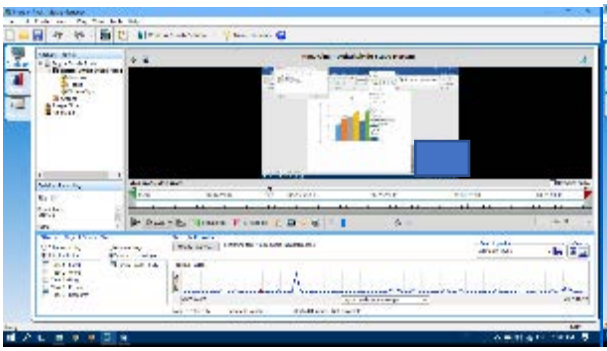
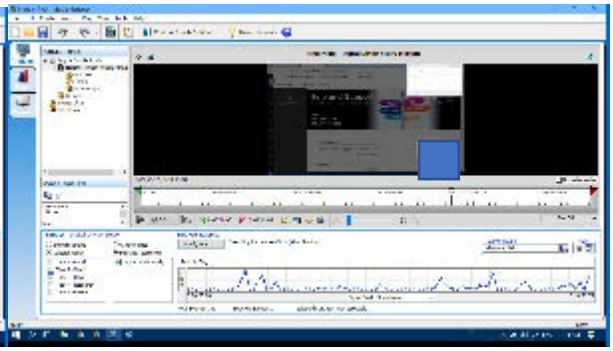
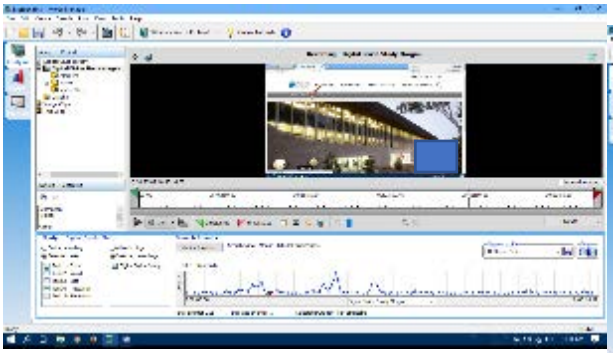
Appendix 17 Michael's Digital Test and Results

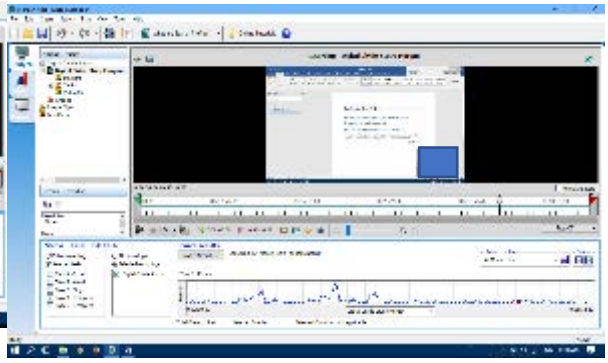


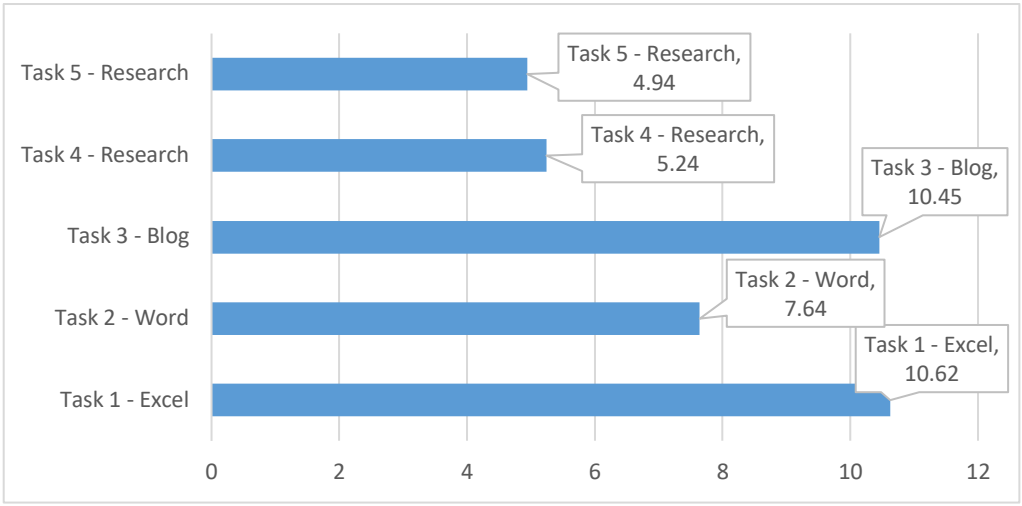








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Task 3 - Blog
Task 2 - Word
Task 1 - Excel
Task 5 - Research, 4.94
Task 4 - Research, 5.24
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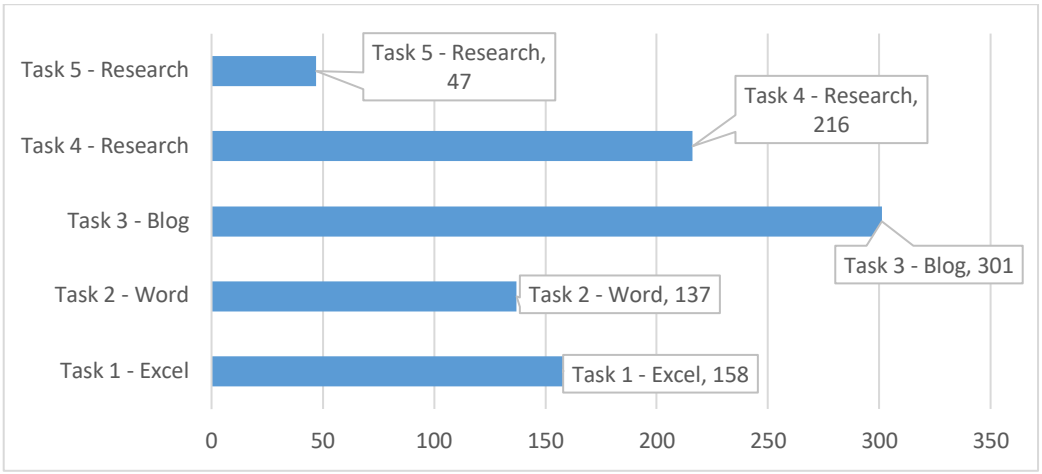
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Task 3 - Blog
Task 2 - Word
Task 1 - Excel
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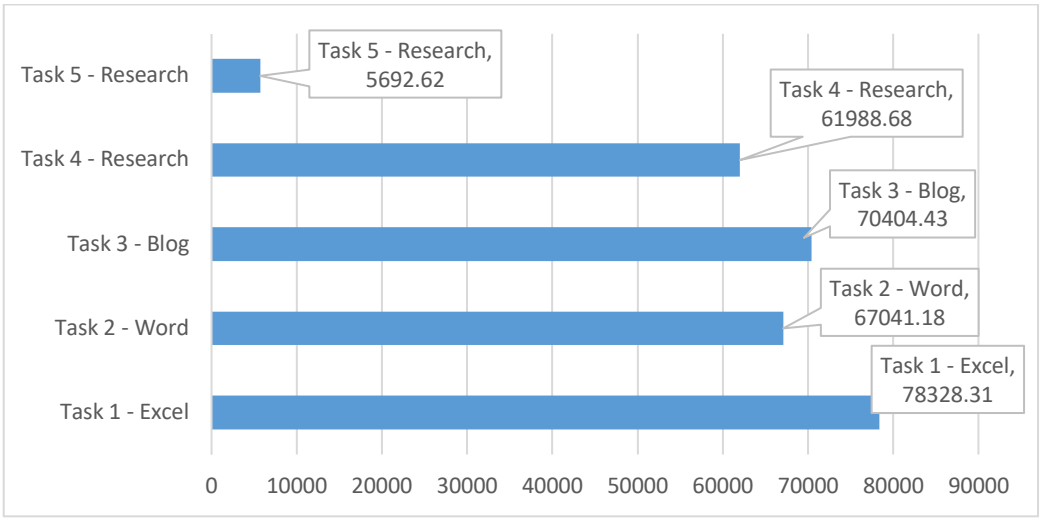
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Task 2 - Word, 67041.18
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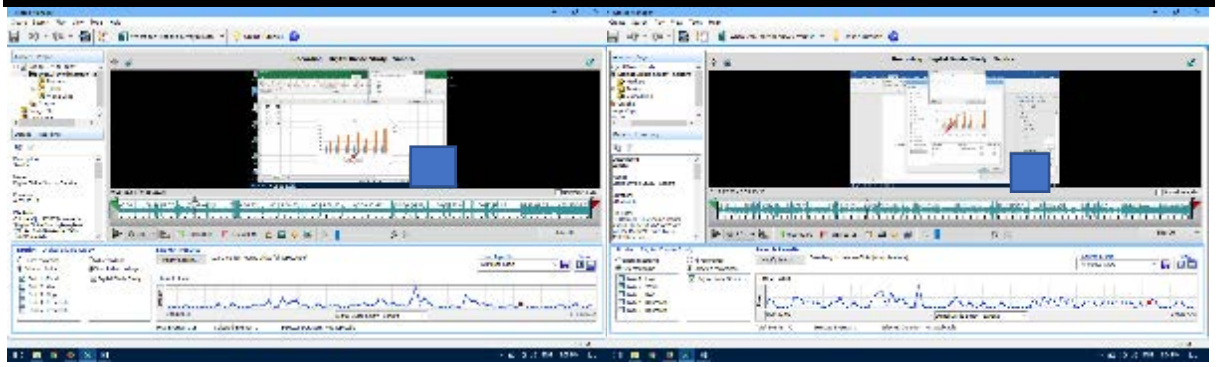
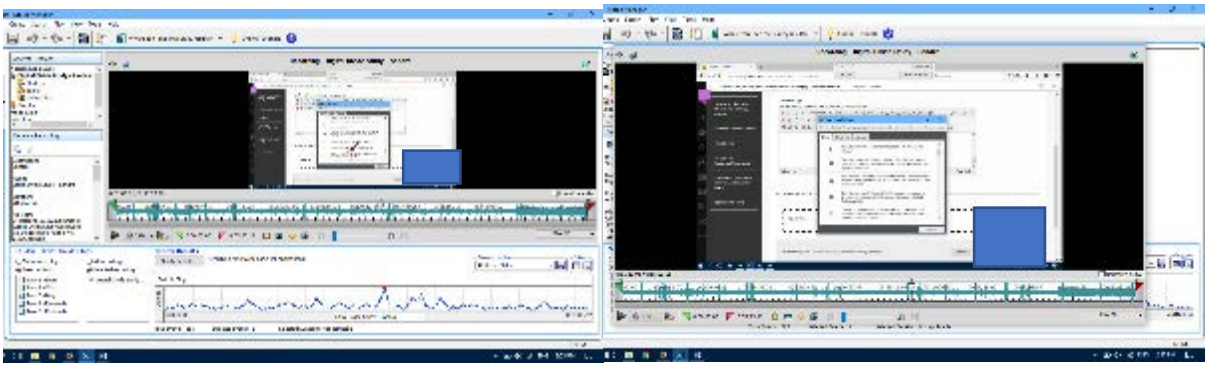
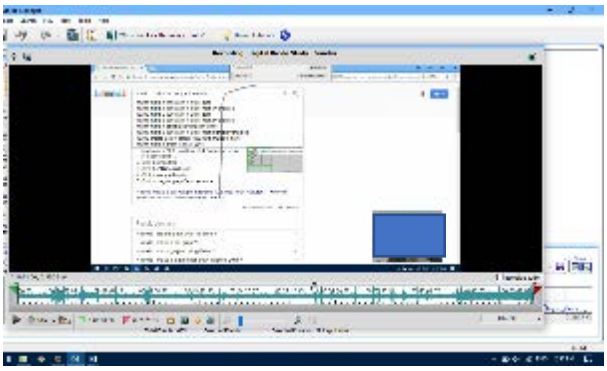
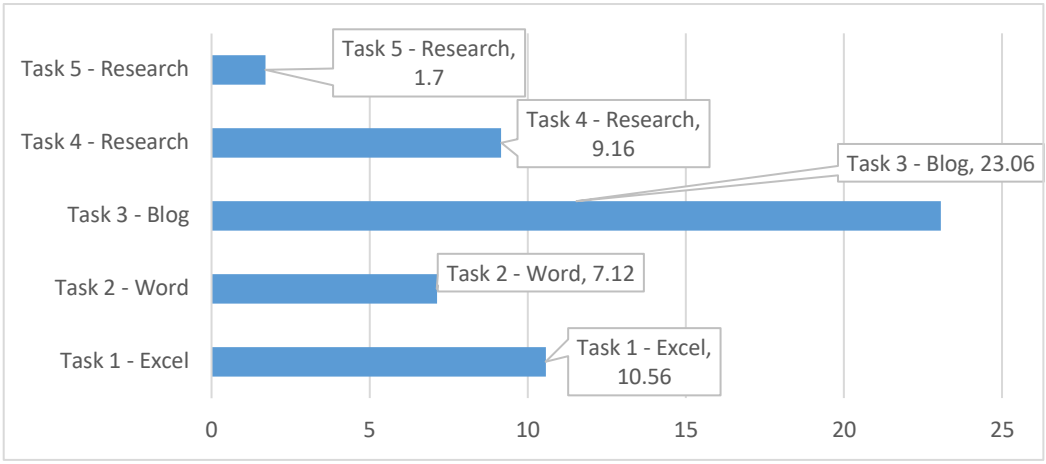
Appendix 18 Suzy's Digital Test and Results







Blog not completed.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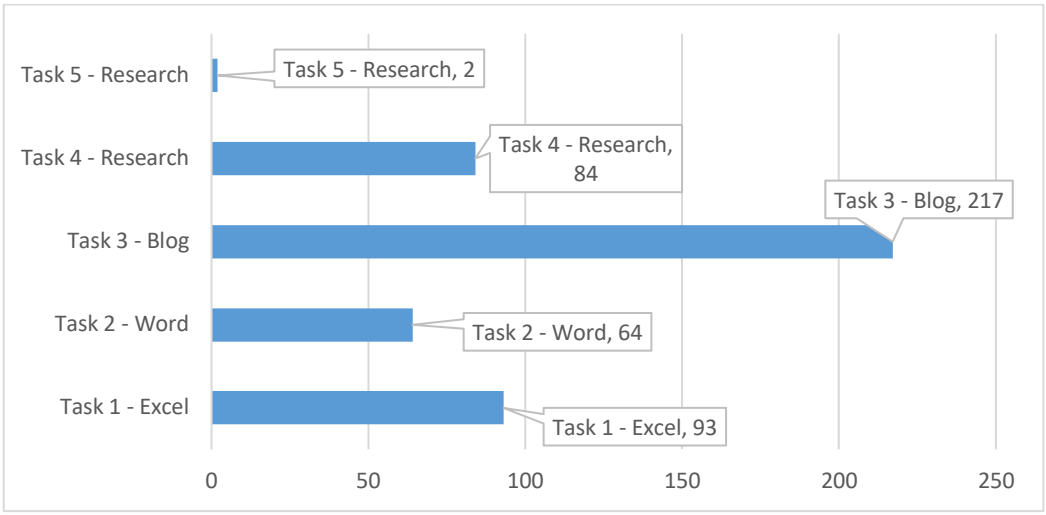
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Task 3 - Blog
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Task 1 - Excel, 93
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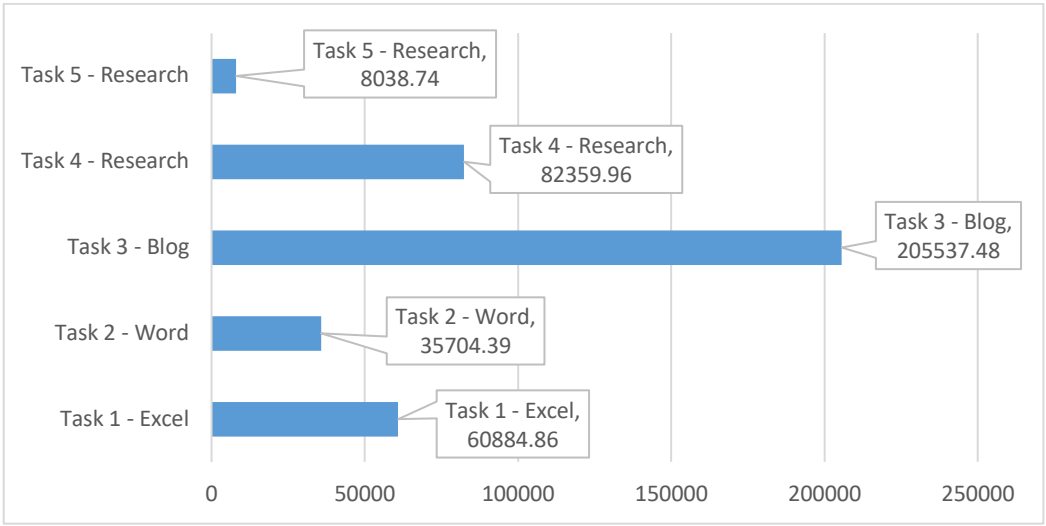
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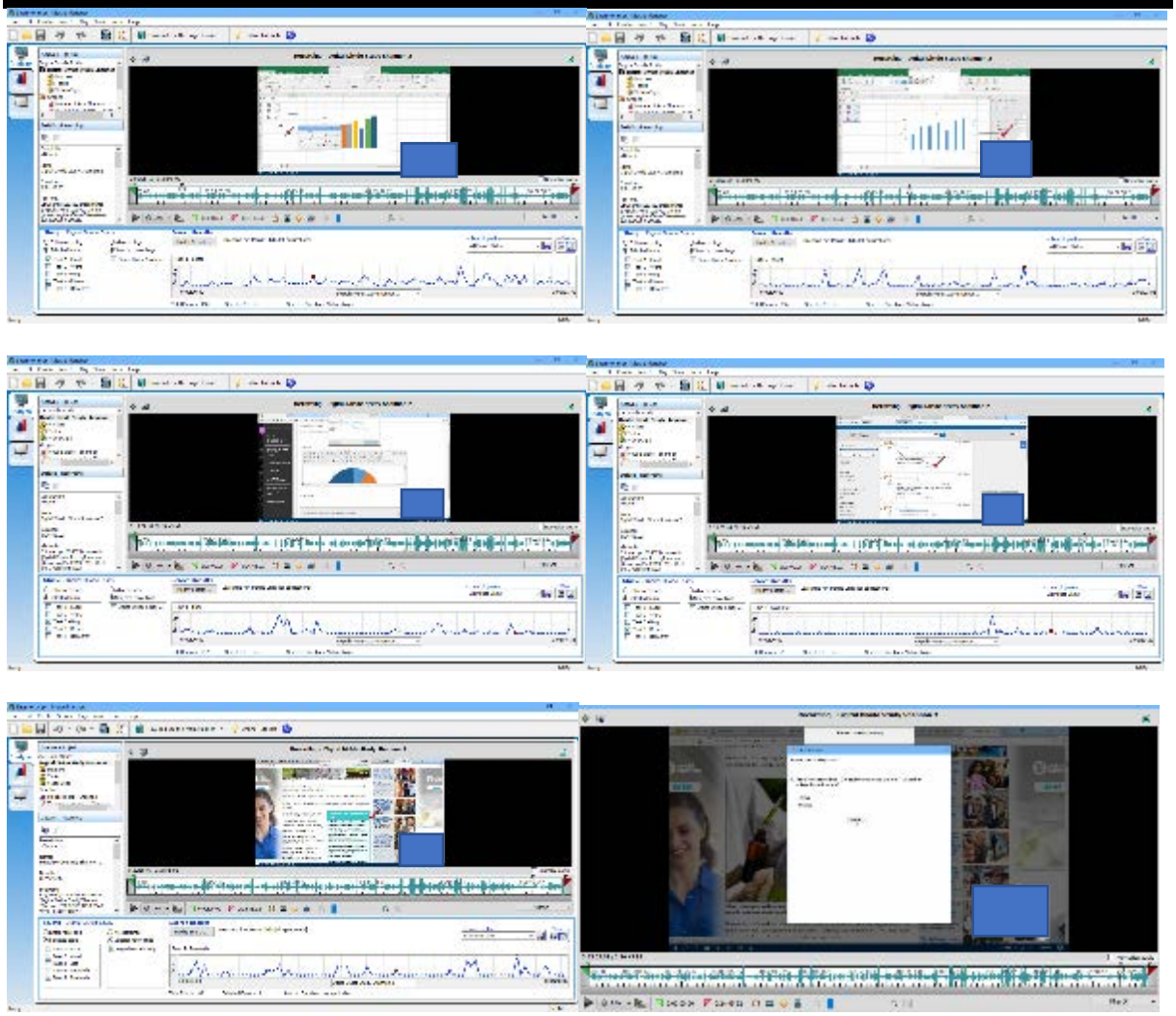
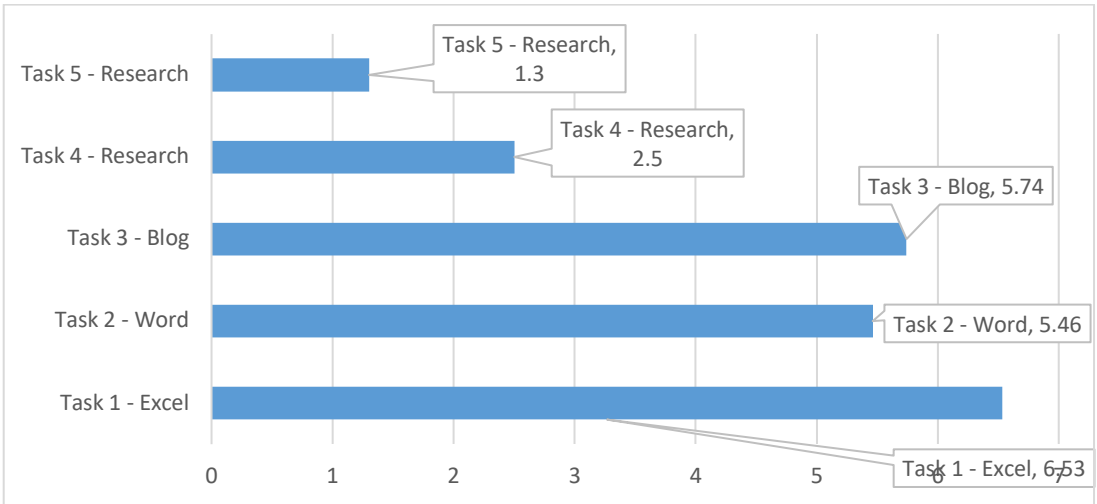
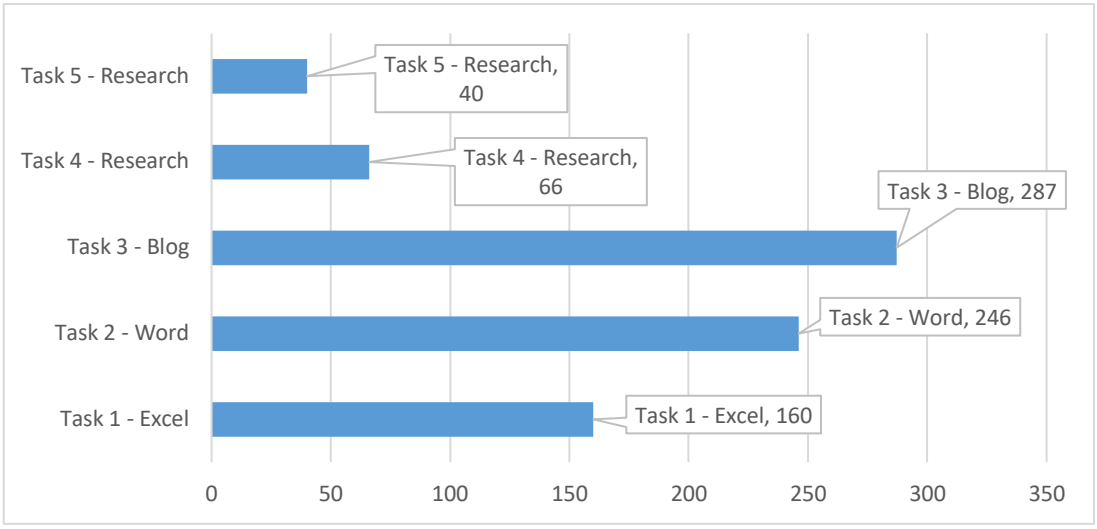
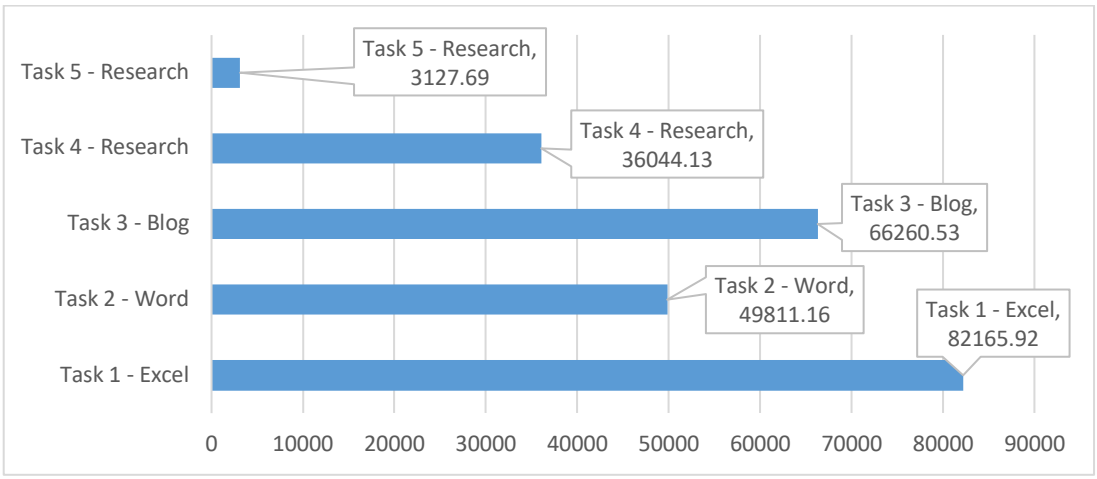
Appendix 19 Sara's Digital Test and Results

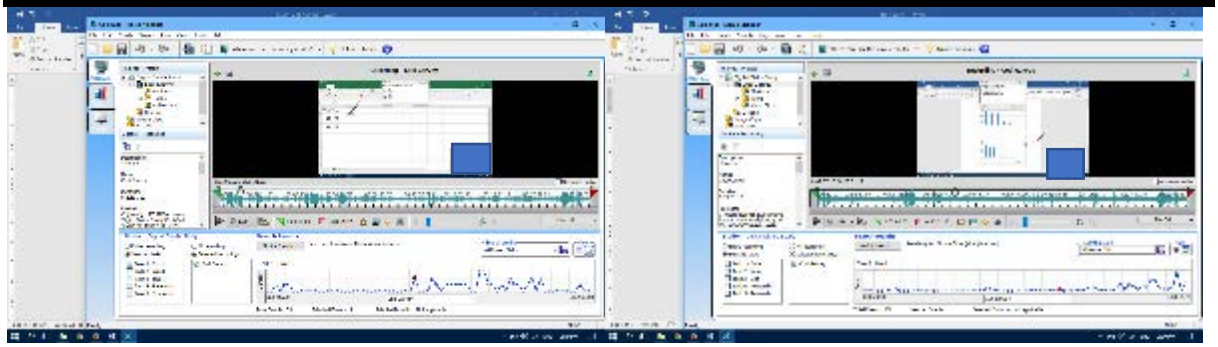


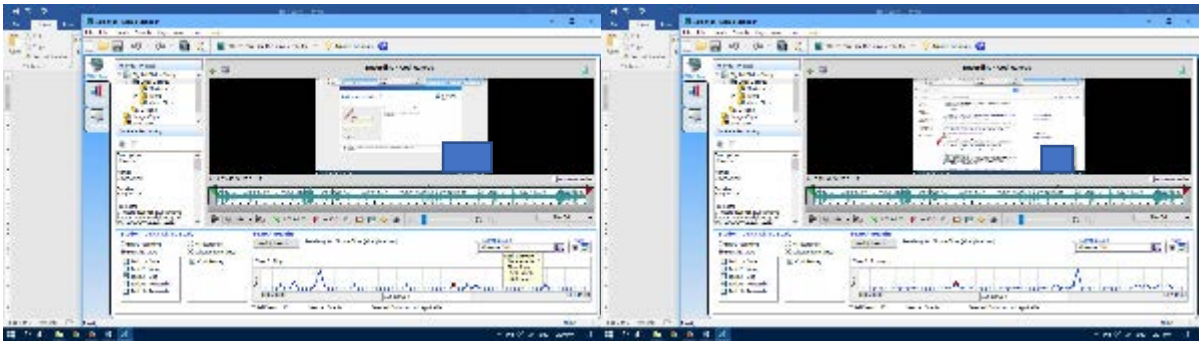




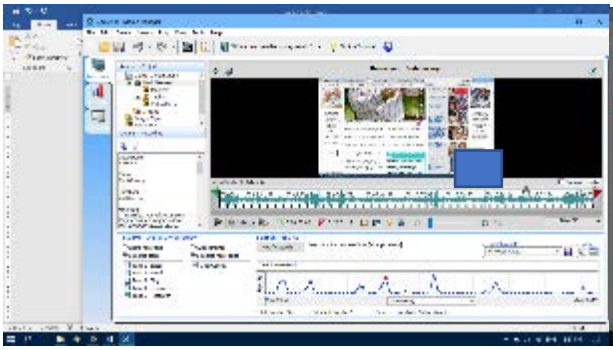


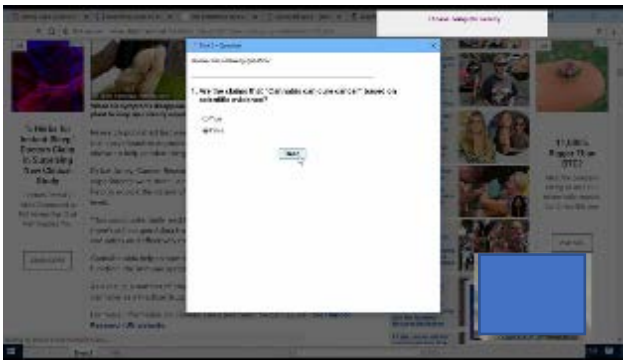
Appendix 20 Carla's Digital Test and Results

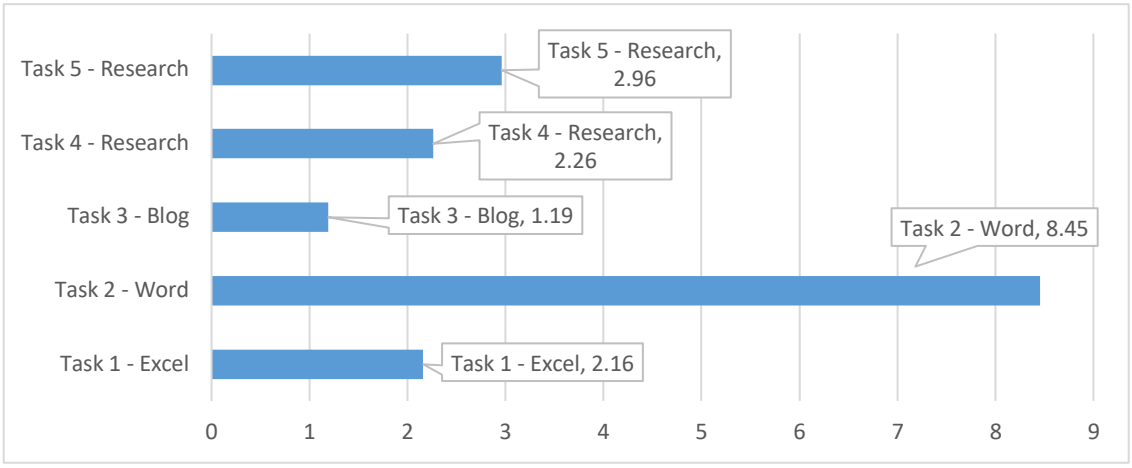


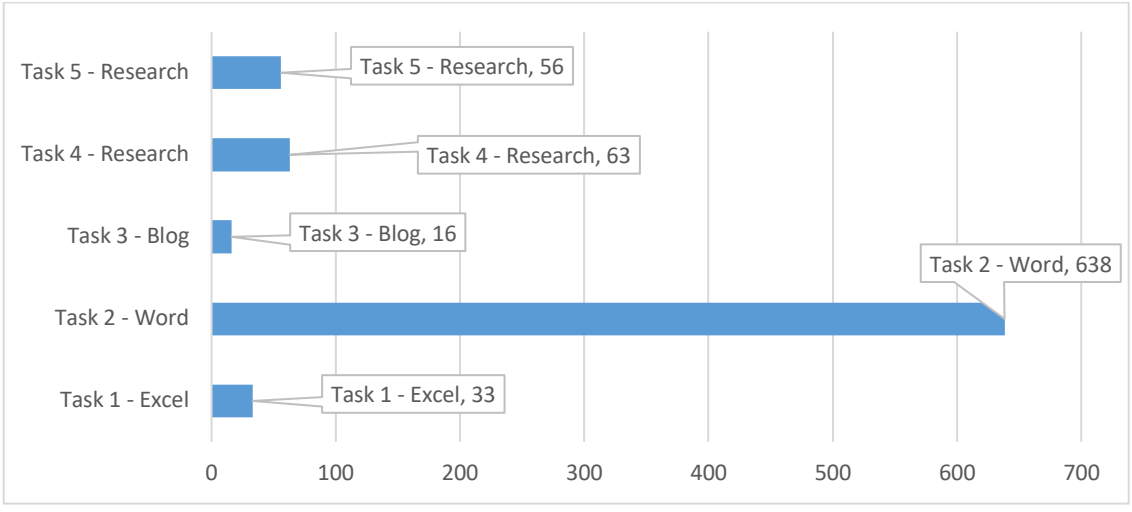


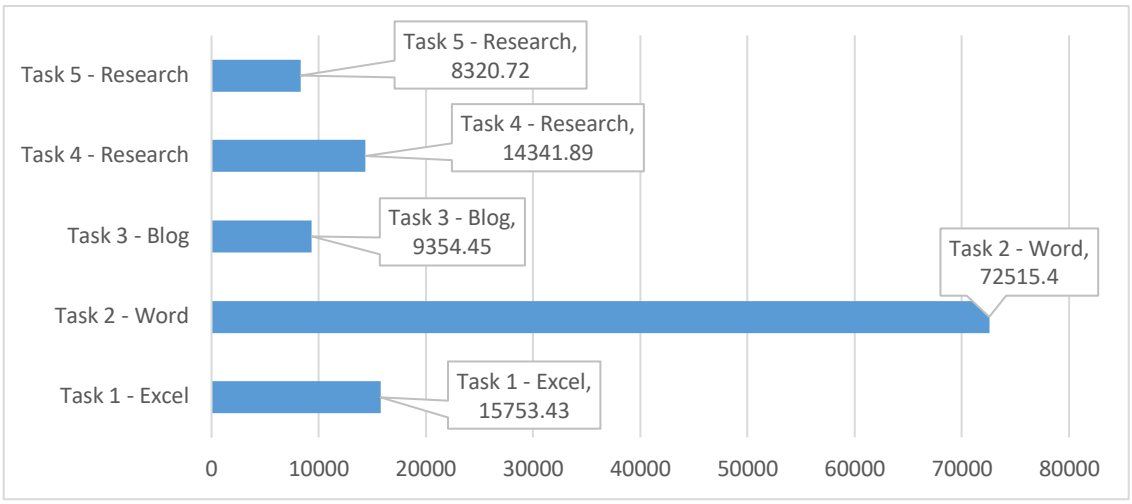
Carla could not access the blog







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