Higher Education Development Centre

The Role/Importance of Personal Computers to Support Learning in Higher Education

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Abstract

Background: This scoping study examines the degree to which students use their personal computers to support their undergraduate academic practice in their daily study habits.

Methods: Three data sources were used in this study. Computer activity data was extracted from the personal laptops of 18 third-year undergraduate students who self-reported as being skilled computer users. The second data source consisted of video data captured by four third-year undergraduate students of their personal study activity within their homes. The third dataset represented secondary data sourced from two local student surveys looking at student technology use from 2009-2012 and internationally acclaimed research-based EDUCAUSE studies also from 2009 to 2012.

Findings: Three core themes: (a) Computer-based Approach vs Paper-based Approach; (b) Production Activity vs Consumption Activity; and (c) Self-reports of Practice vs Actual Practice emerged from these datasets. An analysis of these themes revealed that for the participants involved: 1] paper-based approaches to study were preferred over digital despite the high rate of personal computer ownership and internet access; 2] students were more likely to engage in production than consumption activities using paper-based approaches to study; 3] there was a disparity between students' self-reports of their adoption of technology compared with their actual practice of both academic and non-academic use of computer technology. In addition, students' computer use presented a low level of alignment when compared between their academic course demands and their assignment schedule.

Discussion: The findings of this exploratory study illustrate a considerable disparity that appeared between what students thought they used computers for and what they actually did use them for. While the students' preference for paper-based approaches could be linked to unease or lack of awareness regarding academic software, evidence suggested that dependence on paper-based approaches in undergraduate education was due to an inherent focus on paper-based ethos. At the same time, the primary paper-based approach to production and consumption activities indicated that personal computers were not as crucial to undergraduate academic study as expected. This was supported by the lack of any clear pattern regarding students' daily computer use plotted against their course assignment schedule.

Keywords

academic work, actual practice, computer-based approach, consumption activity, e-learning, higher education, non-academic work, paper-based approach, personal computer, production activity, self-report of practice, study habit

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Dedication

I would like to dedicate this Master of Arts thesis, especially

to my beloved father and mother for their abundant love;

to the Chen family for opening my eyes to the world;

to my two younger brothers and sister-in-law for their affection and understanding;

to all those who love me dearly, you inspire me to understand the importance of hard work and higher education;

to all those I love deeply, you help me to focus on what is important in life and show teach me how to be authentic.

I would like to share the practical research experience and understanding of 'sustainable' education gained through my Masters study ~ *Your research will not necessarily be "the best", but it is important to know how to make yourself "better" in the journey; not to reach the "pinnacle", but to maintain a constant "state of progress".*

May you all be motivated to unleash your potentials and reach your dreams!

Chapter 1: Introduction

Background / Context

The use of Information and Communications Technology (ICT) has grown enormously in the last 10 years with computers and smart devices becoming indispensable to our daily lives. Younger generations today are more at ease online, weaving these devices into their work, learning, relationships and entertainment. Personal computers are seen as vital for those wishing to engage in higher education (Charter Colleges and Universities Participating in the National Higher Education ICT Initiative, 2003). While this is a claim that few of us would refute, we may be naïve as to how vital personal computers are. Much of the research pertaining to students' authentic learning experience, in regard to the role of computer technology to support their academic practice, is based on perception data rather than data concerning their actual practice. According to Conole, de Laat, Dillon and DeCicco (2008), "more in-depth research is needed to understand the nuances of how students are using technologies to support their learning" (p. 512). This study aimed to address this lack of knowledge by investigating the use of personal computers by students to support their study practice.

The respected and often-cited annual reports produced by EDUCAUSE on student use of Information and Communication Technologies suggest a significant number of students today fall into what is described as the Digital or Net Generation (Dobbins, 2005; Kennedy et al., 2009). It appears that students are comfortable with the increasing number of computer technologies present in our daily lives. The access to a range of digital devices, such as desktops, laptops, smart phones and tablets, enables users to capture, share, collaborate and publish in previously unavailable ways. It is undeniable that the internet provides easy access to vast quantities of information (Williamson, Bernath, Wright, & Sullivan, 2007) and, as a result, it is claimed that students today "think and process information fundamentally differently from their predecessors" (Prensky, 2001, p. 1). However, the degree to which this Digital or Net Generation can be regarded as "computer savvy" in terms of using academic software in order to excel in their studies, is still unclear. By computer savvy-ness I am referring to "the ability to use, manage, understand, and assess technology" (International Technology Education Association, 2000, p. 7). The difference between being part of the digital generation and being computer savvy could actually be deeper than most of us suspect or realise, especially within the higher education context. In other words, technology is expected to be at the heart of all aspects of a student's life in this current era. Their use of personally-owned technologies is extensive and their working environment is complex and multi-faceted (Conole et al., 2008). Therefore, knowledge of how students integrate these technologies into their study practice is essential (Butson & Thomson, 2011).

Technological literacy is about the capacity to understand the broader technological world and to use technological knowledge or capability to interact with technology (Pearson, Young, National Academy of Engineering. Committee on Technological Literacy., & National Research Council (U.S.), 2002). The concern is that students' level of computer literacy or computer savvy-ness for academic use is overshadowed or taken for-granted as a consequence of their use of computer-based devices for non-academic use. For example, a study that investigated students' use of informal learning spaces (Twitter) and how support for the use of these spaces could be achieved, found that one participant had used Twitter before while others managed to pick it up only after attending a briefing (Aspden & Thorpe, 2009).

A considerable portion of the current literature on computer use in academia suggests that student use of technology will result in students being efficient in their learning (Smith, Salaway, & Caruso, 2009). A number of studies claim that computer technology now plays a significant role in supporting undergraduate study (Aspden & Thorpe, 2009; Dahlstrom, Grunwald, de Boor, & Vockley, 2011; Guidry & BrckaLorenz, 2010; Smith & Caruso, 2010). Student responses in a recent EDUCAUSE report capture this well: "I could not live without the Internet and Google. How did we all exist without the Internet at our fingertips?" and "If I can't Google it, then it's probably not worth knowing." (Aviles, Philips, Rosenblatt, & Vargas, 2005, p. 18 & 20). It is interesting that students associate internet searching with higher education learning. Could it be that the students are treating computers as simply a device for accessing web-based information (Dahlstrom et al., 2011)? If so, are the production capabilities offered by computers subordinate to their consumption capabilities?

Furthermore, are the students using computer technology for academic or non-academic work? Recent studies (Dahlstrom et al., 2011; Smith & Caruso, 2010) reveal the high use of Facebook among students - an example of high non-academic use of computer technology. But to what degree has computer technology use in the non-academic world found its way into academia (Cowan, 2011)? In the 2010 EDUCAUSE report on a comparison of student and faculty academic technology use across disciplines, technology use in higher education was found to be low for both students and faculty (Guidry & BrckaLorenz, 2010). While students and faculty have different expectations or perceptions about the use of technology, and their use of technologies differs across contexts (Conole et al., 2008; Dahlstrom, 2011), it is unclear why both groups measure low use. What is clear is that the low level of adoption of computer technology by teachers may have an effect on students' use of computer technology for academic work. Students may expect teaching staff to model appropriate academic use of technology (Smith & Caruso, 2010). On the other hand, it may also suggest, as declared by Conole et al. (2008), that the students' use of technologies is intermingled with social or leisure activities and is almost indistinguishable from their academic use. Supposing it is the latter, does it mean that we have to accept that because students are active computer users that we assume their use will be the same for both academic and non-academic activity? Given the growing access to internet-based digital devices, why was academic use comparatively lower than non-academic use? The assumption would be to expect the reverse. These ambiguities reveal that the majority of the studies on student use of computer technologies do not distinguish between academic and non-academic use.

It is said that the existence of computer technology in students' lives has blurred the boundaries of traditional education (Middlehurst, 2003). There is now an array of approaches that students can use to integrate their favoured tools and interoperate with social software on the web (Tepper, 2003), as well as with institutional content management systems used by academic staff to deliver course materials (e.g., WebCT and Blackboard). Nevertheless, a study by Shaw and Marlow (1999) evaluating students' initial attitudes towards the use of ICT found that they prefer to learn in more traditional ways. The study found students were uncomfortable with using computers and preferred personal contact (Shaw & Marlow, 1999)

While there is a general acceptance within the research community investigating the impact of ICT on students' learning that computer technology has a positive effect (Mbah, 2010), there are some who advocate the reverse. For example, a study that was carried out in 2003 examining undergraduate students' perceptions of e-learning in a large-class environment concluded that students were generally negative about the experience (Concannon, Flynn, & Campbell, 2005). Moreover, there are comments such as "I don't like all this digital stuff. I don't like all the problems that come along with computers. I don't really understand most of it, and there's always something new to learn right after you get used to one thing." (Smith & Caruso, 2010, p. 7).

In addition, a UK survey stated that students do not want ICT to be a substitute for face-to-face teaching and/or social interaction (The Joint Information Systems Committee, 2007). In the 2010 ECAR Study of Undergraduate Students and Information Technology, Smith and Caruso found that the majority of students prefer only a moderate amount of technology use in a course. Students will not skip classes as they prefer to listen to the face-to-face lectures (Smith & Caruso, 2010), and prefer to read from printed text than to read online (Wheeler & Osborne, 2012) Although the students could have the choice to adapt appropriate technologies to their own personal learning needs (Conole et al., 2008) or to use "multiple methods, some 'traditional'[and] some e-learning" (Joint Information Systems Committee, 2007, p. 27), their preference for paper-based approaches when they are actually studying in a digitalised environment develops a contradictory and interesting scenario.

Given the arguments concerning students' computer savvy-ness, students' engagement with computer technology, as well as students' academic and non-academic uses of computer technology – what can we make of it regarding the impact of computer technologies on advancing learning in higher education? This study sought to examine how convenient access, easy approaches, and the proliferation of collaborative applications are associated with undergraduates' actual computer use to support and/or advance their learning by looking at the way students use their personal computers for academic purposes.

As noted earlier, investigations into undergraduate students' use of personal computer for their daily study is an emerging area of research. Research into eLearning has typically focused on learning which results from particular eTeaching approaches and on students' experience of institutional systems, while students' perspectives on, and use of, personal applications and approaches have been largely overlooked (Sharpe, Benfield, Lessner, & DeCicco, 2005). This point notwithstanding, studies that use student voice or student experience as a starting point can reveal new and often unexpected issues not identified in other types of research (Creanor, Trinder, Gowan, & Howells, 2006). For example, in a recent study exploring students' attitudes towards, and uptake of, technology in different contexts, it was found that ICT is viewed positively at work, and technology use at work is an important driver for its use in other areas (Edmunds, Thorpe, & Conole, 2012). This contradicts another study that examined students' use of ICT and expectations of learning methods, saying that the students' ways of learning remain static although there is a dramatic increase in their use of ubiquitous technologies (Littlejohn, Margaryan, & Vojt, 2010). In other words, how students think about learning and their actual studying practices will result in different outcomes for what they learn (Goodyear & Ellis, 2008). These "conceptions and approaches are not static traits", especially when dealing with ICT as they are "best conceived as a personal response to, or a situated interpretation of, the broader requirements of the study situation" (Goodyear & Ellis, 2008, p. 147).

Selwyn (2007) argues that universities that recognise the value of ICT have invested heavily in computer infrastructure for many years to extend both on-campus and distance delivery methods. Lai (2008), however, contends there must be a central driver for this investment, despite the technology developments over the past decade. In his work on the use of ICT to support the learning process, Lai believes that the adoption of ICT by the education sector was inevitable as educational institutions embraced the idea of the knowledge society. From this perspective, higher education had an obligation to be at the forefront of the emerging technology in the 21st century where digital literacy was clearly going to be an essential requirement for survival (Anderson, 2008; Goodfellow, 2011). So how has higher education performed since the turn of the new millennium? To what extent has computer literacy become an essential component within the higher education environment? Is computer technology a necessity in higher education study? To what extent are students aware of their use of computer technology in academic practices? The answers to these questions will require knowledge of the way in which students use, experience, and integrate computer technology into their learning, especially the learning that occurs outside the domains of lectures, tutorials, labs or field trips.

Purpose of the Study

This study aimed to investigate the role of personal computers in supporting undergraduate students' learning at the University of Otago, especially the learning they engaged in outside formal instructional contexts. While the literature shows an increasing number of undergraduate students own a computer and have a broadband connection (Aspden & Thorpe, 2009; Dahlstrom, 2011; Guidry & BrckaLorenz, 2010; Smith & Caruso, 2010), it is unclear to what extent these personal computers are utilised in their academic study. It was therefore valuable to determine the significance of personal computers in the daily study habits of undergraduate students, especially when computer technology has become increasingly commonplace in higher education. The investigation was framed around the questions listed below:

- To what extent do students use computer-based approaches in their daily academic practice as compared with paper-based approaches?
- How do students utilise their personal computer while studying, for producing and consuming knowledge?
- What is the divergence between students' self-reports of practice and actual practice with regard to students' computer technology use?

In this study, the focus was on the context(s) in which students integrate technology (applications and web services) to support their academic practice. Video and audio data capturing private study sessions were collected from four third-year undergraduate students and computer activity data was collected from 18 third-year undergraduate students. In addition, relevant findings from both local (University of Otago) and international (EDUCAUSE) studies were used to compare the findings with other studies. It is important to note that the study was not concerned with institutional learning management systems or eLearning, which are primarily concerned with learning that results from eTeaching practices. A considerable amount of research has already been undertaken in this area. While it was not a core aim of this study, students' expectations and perceptions concerning the use of technology in higher education in conjunction with traditional learning activities (e.g., paper based approaches) were gathered and used to support other data (viz., self-reports of computer literacy and computer use in academia).

This study thus sought to address the gap in the literature about how computer technology plays a part in undergraduate students' lives. Research has indicated that computer technologies are a necessary part of academic practice; and hence their usage is being promoted in higher education institutions to help students excel in their studies. This study was envisaged as an initial scoping study, the results of which will be the catalyst for further applied research in this emerging field.

Design and Method

Emerging from a social constructivist perspective (a term which will be made clearer in Chapter 2), the theoretical framework for this study drew on an interpretive, naturalist enquiry approach (Guba & Lincoln, 1989), which was underpinned by Constructivist Grounded Theory (Charmaz, 2006). The concept of an interpretive approach will be clarified later in this section and Constructivist Grounded Theory will be explained further in the section 'Research Structures and Processes' in the next chapter (Chapter 2). Using this research design, actual practice data-gathering methods were employed in order to reveal students' daily technological academic practices rather than through the more traditional approaches of questionnaires/surveys and interviews. The study sought to elicit students' points of view by asking them to engage in self-surveillance techniques through computer activity and computer engagement capture. These approaches offered a glimpse into study behaviours that are normally concealed.

Although the students might be more familiar with research methods such as survey and focus groups (Dahlstrom, 2011), Green, Rafaeli, Bolger, Shrout, and Reis (2006) suggested that students' participation might be secured by allowing them to play a "researcher-like" role in the study and experience the invested outcome of the study. Conole et al. (2008) also agreed that research should focus more on students' voice, their on-going use, experience, and perception of technologies to elicit and explore their e-learning strategies in different contexts. This was particularly true in this study in which I examined students' use of personal computers in their daily academic practices by using non-threatening and non-traditional methods (Aspden & Thorpe, 2009). To do this, I engaged students as peers and colleagues in collecting the data. This was particularly important regarding the invitation to allow me to install tracking software on their computers to capture computer-activity data. The same was true regarding their commitment to engage in filming themselves studying (Cohort Behavioural Data). It has been argued that such practice data-gathering methods may, in fact, uncover data which is not attainable by other traditional means (e.g., survey or questionnaire) (Butson & Thomson, 2011).

Three datasets were created from the data gathered. Two of these represented primary data collected from natural settings: Computer Activity Data (computer activities extracted from students' personal computers) and Cohort Behavioural Data (students' self-filming of their computer technology integration). In order to ascertain students' points of view about their computer literacy and computer use in their academic practices, the participants in these two datasets were invited to complete a questionnaire/survey at the beginning of the process and/or to have a quick informal talk during the data collection process. 22 third-year undergraduate students who self-reported as computer literate on both academic and non-academic computer use were selected (four for Cohort Behavioural Data and 18 for Computer Activity Data). These datasets aimed to capture the naturally occurring phenomenon of undergraduate students' computer technology integration in their actual academic practice.

A self-filming method and non-surveillance tracking software (ManicTime) was used to gather the naturalistic observations in order to get as close as possible to students' authentic or 'true' behaviours. They were a mixture of observation of students' actual computer practices (Computer Activity Data) and a focus on students' actual learning experiences with computer technology (Cohort Behavioural Data). While Computer Activity Data captured what students used their computers for, Cohort Behavioural Data was used to elicit data on how students used their computers within their study routines through capturing their practice on video. These datasets monitored students' practice as it occurred, in comparison to their reported practice post the event. The focus was thus on capturing what students did (and did not do) rather than what they said they did or did not do. As Starr and Fernandez (2007) noted, self-reported behaviours can be quite inaccurate for describing practice and thus the veracity of studies that use post-event capture to represent actual practice can be questioned. Furthermore, participants' "perspectives in action" (records of behaviour) and/or "perspectives of action" (accounts of behaviour) (Belk

& Kozinets, 2005, p. 132) should be taken into consideration in analysis. This can only be achieved with the use of actual practice data.

A third secondary dataset was created from local surveys on student computer use undertaken at the University of Otago beween 2009 and 2012 (Higher Education Development Centre in 2009 and Information Techology Services in 2012) and the renowned EDUCAUSE reports on student use of technology published between 2009 and 2012. Higher Education Development Centre (HEDC) is a department at the University of Otago that works alongside both staff and students to support and enhance the idea of higher education in various aspects, of which technology is one. Information Technology Services (ITS) is another department at the university that provides support for technology use by staff and students. The two surveys completed by these two departments were chosen to represent the general picture of personal computers among the students at the University of Otago at the time this study was being undertaken. It was felt that EDUCAUSE reports offered the best representative view of student use of technology within the broader higher education sector. As the association for information technology in higher education, EDUCAUSE has been a leading research organisation whose mission is to transform higher education through the use of tecnology. Their reports have become the benchmark authority on the state and future of technology adoption in the higher education sector (EDUCAUSE, 2012). It is for this reason that data from the ECAR (EDUCAUSE Centre for Applied Research) student study was included. The secondary dataset allowed me to compare the role and use of personal computers among the undergraduate students as revealed through self-reports (Local and International Data) with the practice data (Computer Activity and Cohort Behavioural Data). There was a need, however, to be aware of the difficulties inherent in handling these types of datasets.

Applying an interpretive approach (Erickson, 1986; Rowlands, 2005; Vrasidas, 2001) - a qualitative research methodology with an idiographic focus which aims to make sense of a phenomenon within a specific context - meant taking into account the diversity that exists across individuals (in this case, the undergraduate student participants). This allowed for the interaction of embedded cultural background or information within the community (in this case the university) to be internalised in data analysis. The interpretive approach indicated that I, as the researcher, interacted with the participants during the data-gathering process (e.g., through open discussion sessions with participants) thus enabling both qualitative and quantitative data to be collected. While quantitative analyses were used to provide insights into participants of this study in order to examine their computer use in daily studying practice, qualitative analyses were used to provide general global understandings about the role of personal computers in higher education.

Themes then emerged naturally; occurring phenomena was captured (Computer Activity Data via logs and Cohort Behavioural Data via self-filming) in conjunction with subtle information generated from local and international datasets. The themes generated from the datasets were expected to inter-osculate with my concern about the discrepancy between self-reported and actual use of computer technology, my query about the preferred use of paper-based approaches, and my questions about students' processes of producing and consuming knowledge while studying.

Thesis Overview

This Introduction (Chapter 1) set up a general view of the study which examines the role/importance of personal computers to support learning in higher education. The chapter provided an initial preface to the issues raised in regard to this under-researched field based on the existing literature. In addition, the purpose of this study was explained, followed by a brief description of the design (interpretive approach) and method (actual practice data-gathering method) applied in this study.

In the following Research Design chapter (Chapter 2), I explain the research approach for this study which drew on the interpretive approach already mentioned above. My justification of who I am as a researcher, from a social constructivist's perspective, follows. The research structures and processes that are illustrated next are based on the four phases involved in the completion of this study: Preparation, Fieldwork, Analysis, and Write-up. These structures and processes are underpinned by Constructivist Grounded Theory. The chapter closes with a brief conclusion.

This is followed by the Methods chapter (Chapter 3) in which I describe the method used in creating the three datasets and how the findings were categorised from these datasets. The chapter then moves to a description of how themes emerged from these categories. I close with a comment concerning a possible investigation into relationship patterns between overall participant computer use, mapped against the participants' assignment schedules. The chapter closes with a brief remark.

I then draw the analytic focus down into the results generated from each of the datasets, and as a whole dataset, in the Findings chapter (Chapter 4). It is followed by a detailed analysis across the three themes that emerged from the findings. The chapter ends with the results from the overall participant computer use mapped against the participants' assignment schedules, followed by a short chapter summary.

In the next chapter (Chapter 5), I critically appraise the findings generated from each of the datasets as well as the three themes that emerged from the findings. A summary of the relationships between the conclusive findings and the three themes is included. The chapter finishes with a comment on the mapping of computer use against assignment schedules, followed by a short outline on what is coming up in the last chapter.

Chapter 6 presents a reflection on this study including a recap of the core elements of this study: the aims and the key findings, a rundown of the unavoidable limitations found in the study, and a series of recommendations. A statement on the relevance of this study, which is directed mainly to the tertiary population, academic staff and higher education institutions is then presented. The chapter is summed up with my postscript in the form of a critical autobiographic reflection.

And now the journey through my study begins with my research design in the next chapter (Chapter 2) ……

Chapter 2: Research Design

Introduction

In a social science study, the theoretical perspective of a researcher plays an important part in defining the research design (Abraham, 2008). This is particularly true in research that employs an interpretive approach, as in this study. For this reason, it is important for researchers to be transparent regarding their perspectives on reality (ontology) and knowledge (epistemology) as they relate to their research methods (methodology). This chapter illustrates my research approach followed by a synopsis of who I am as a researcher. The chapter closes with a description of the research structures and processes of this study based on four phases.

Research Approach

Social constructivism posits that all knowledge is contingent upon interactions between people and their world, and it assumes that what people take as real (objective knowledge and truth) is based upon their perspectives and experiences (Jackson & Sørensen, 2010). With this standpoint, a structured guideline, consisting of definitions of related concepts and existing theories was developed to guide my study. The guideline determined what I measured and the statistical relationships I looked for across the data in relation to the research. This study is located conceptually and methodologically in emerging fields of research practice and study; the methods used were informed by the concepts underpinning the development of constructed/co-constructed knowledge. The focus was on the role of computer technology in students' undergraduate studies.

A substantial part of this study was data-driven, encompassing on-going phases of data collection and analysis by using an interpretive approach (as mentioned in section 'Design and Method' in Chapter 1) (Erickson, 1986; Rowlands, 2005; Vrasidas, 2001). This approach emphasised active meaning-making, that is, the processes by which meanings were created and negotiated within the actions of participants, as well as how those meanings were uncovered and interpreted. The active meaning-making took account of accessing reality through social constructions, such as language and shared meanings, for investigating notions of "student-ness" in relation to computer technology use. The interpretive stance facilitated the understanding of the actions of participants, such as the ways they applied computer technology in their daily studying lives. Understanding was gained within the social contexts in which the actions were constructed. This understanding was continuously revised, as participants were seen as social agents, who constantly construct/co-construct their actions. The themes that emerged from the analysis of the datasets revealed different study patterns portrayed by the participants and provided a greater scope to address the main research question of this study. The recurring themes were commented on through a conceptual understanding negotiated by both participants and the researcher. Assertions about participants' actions and understandings were examined repeatedly to consider how these themes answered the research question. With such joint construction and co-construction of knowledge, a relational outcome was developed and an image of reality was generated.

Who I am as a Researcher

As a researcher, my ontological position greatly determines my approach to the practice of research. In relation to this study, my conviction is that social reality construction is fundamental to the manner in which I approach my research (Jackson & Sørensen, 2010). For example, I recognise concepts such as "study" and "learning" as coming about through social mediation. This view is aligned with the general ontological presupposition that constructivism is "independent of any foundational reality", where there is no existence of an 'objective' truth (Guba & Lincoln, 2001, p. 1). Any investigation therefore, is reliant on an appreciation of the mediating processes that hold the relationships of reality and truth together. Knowledge is the result of these relationally mediated co-constructing processes. Knowledge therefore is not objective and fixed, but forever changing. For Vygotsky, the relational aspects of everyday life play an important part in the process of constructing knowledge (Gordon, 1994; Huong, 2003). Ideas about reality and truth are socially formed based on one's understanding of shared perspectives, experiences and information (Guba & Lincoln, 2001).

My epistemological position determines that my interpretation of knowledge is through data. For me, everything is relative in this world and images of reality are shaped from a genesis of community (e.g., in this case, a community of researchers and student-participants). Relativity is mediated through mutual agreement on constructions of meanings in order to establish an agreeable outcome. Therefore, I emphasise an interactive role, which takes into account different constructions of the meanings from the data and allows them to be understood, discussed, and even critiqued by all contributing to, or participating in, the study. These constructions of meanings can provide insights into individuals' mental structures or mental constructs; patterns of thinking that are socially constructed, contextually generated and culturally influenced. I believe the constructions build upon what exist(s) and how these units interact with each other to constitute social reality (Blaikie, 2000), and thus develop into knowledge.

Therefore, I used an interpretive approach (as mentioned in the section above) to increase my understanding in unpacking the relational aspects of reality. The interpretive approach provides an insight into the meanings or purposes that are inherent in the way we behave, or into social phenomena, without promoting or undermining them. It is our values and behaviours that offer clues to understanding the conceptions of reality that we have. The way I go about this process of investigation is firstly to accept that everything around me has the possibility of acting as data (Glaser, 2002). Data, whether quantitative or qualitative, therefore, is anything that I can capture within the context of my study. It is conceived of as variable and transformable, depending on the perspectives of the interpreters.

Interpretation, viewed in this manner, enables me to grasp a wide range of meanings across a variety of social phenomena by utilising approaches that embrace the subjective meaning of each social action (Bryman, 2001). An action could be a result of internalised constructions. By this, I mean, as individuals, we internalise reality and share understandings that are constructed through social processes. One's ability is biologically limited but one's intellectual adaptation is culturally determined (McLeod, 2007). For example, in this study, using computer technology in undergraduate study is a tool of society, which is initially outside, or beyond a student. Therefore, knowing how to use computer technology is learnt through activity within a society. Sometimes, a student can even own this tool and modify it to suit his or her culture or context.

In summary, my perspectives of reality are determined by my social constructivist worldview. These perspectives are different from those of positivists who uphold the view that science defines the images of reality (Flowers, 2009). It also differs from constructivists who construct images of reality via a systematic process with validation of results, which are structured cognitively (Flowers, 2009). I, however, see the world as socially constructed by the myriad of social contexts, which include people's upbringing, beliefs, culture, education, experiences, and personal development. I hold the view that there is no fixed sense of truth as everything is situated in the subjective and context specific.

With the differences in views and impact presented in a study, I therefore find the need to understand, acknowledge, and articulate the researcher's perspectives of reality and knowledge in relation to the methodology. My position, in terms of ontology, epistemology and methodology regarding social constructivism, is significant to ensure the quality and transparency of my work. Explaining my perspectives as I have, supports my credibility and integrity as a researcher.

Research Structures and Processes

This section presents an overview of the processes and structures that shaped the study reported in this thesis. *Figure 2.1* shows these processes and structures across four phases: Preparation; Fieldwork; Analysis; and Write-up. The four phases of this study were implemented within the social constuctivist-interpretivist paradigm already described, and are explained below.

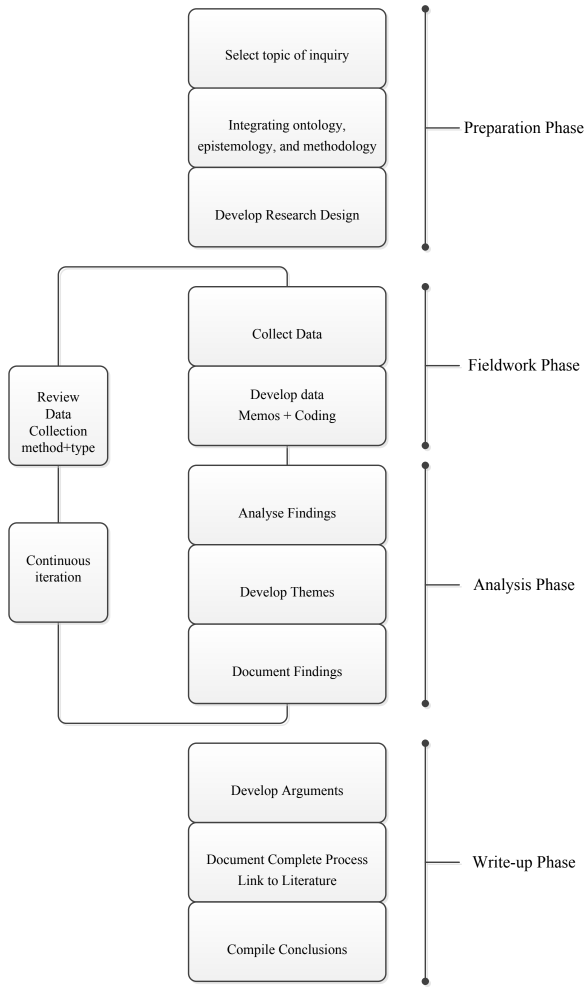


Figure 2.1: An overview of the four phases used

Preparation Phase

This phase encompassed activities which provided the groundwork for the study. Firstly, the aim of this study was determined: an investigation into the role/importance of personal computers to support learning in higher education. Then, guided by a social constructivist perspectives, Constructivist Grounded Theory (Charmaz, 2006) was employed to facilitate the research design of the study. Based on Grounded Theory, Constructivist Grounded Theory emerged from sociologists Barney G. Glaser and Anselm L. Strauss's collaborative ideas in their publication *The Discovery of Grounded Theory* (1967). They proposed a systematic, qualitative analysis that provided abstract and conceptual understandings of the study, as well as developing theories from research grounded in data. This method is flexible and can be adapted by qualitative researchers who have different theoretical and substantive interests to conduct a wide range of studies. Charmaz (2006) emphasised this flexibility and viewed Grounded Theory as a set of principles and practices. She focused on examining data, making the study action-centred, and interpreting the data. For her, no data or theory could be discovered, as grounded theories are constructed through our constant interactions with others. Such an approach is known as Constructivist Grounded Theory.

A Constructivist Grounded Theory approach was used, based on an emergent design (Cavallo, 2000), which aimed to capture the emergent phenomena that were important to understand, within the scope of this study. This study did not aim to capture a single reality or truth. Rather, it aimed to construct "images of reality" (Charmaz, 2000, p. 523), by including multiple perspectives. Grounded Theory was selected because it aligned with my theoretical paradigm and offered a set of principles and practices with flexible guidelines, which suited the focus of this study. The flexibility is based on temporal sequences, which are linked within a process and might lead to changes or surprises (e.g., unexpected outcomes) within the process due to the different involvement, interactions, and perspectives between the past and the present (Charmaz, 2006). In short, throughout the process of the study, there was raised awareness of the possibility of more than one analytic direction. The single events that occurred throughout the process, were viewed as possible contributing parts of a larger whole at the end of the process.

Fieldwork and Analysis Phases

The principal activities included in the Fieldwork Phase were data collection and data development. According to Bryant (2009), a researcher should not go into the research with a fixed hypothesis, but should evolve a research project with and through data. Everything can be treated as data within the notion of Constructivist Grounded theory; the data being collected with a view to constructing substantive theories 'grounded' within them. The more data the researcher has, the more grounded the theory is. Thus, the theoretical framework created from the data relates directly to the data. The iterative cycles of data collection in this study, allowed for, and anticipated, changes in strategies and procedures.

The datasets were designed and developed according to their individual situational as well as social contexts (as mentioned in section 'Design and Method' in Chapter 1). There were three datasets used in this study to investigate the role of personal computers in supporting undergraduate students' learning at the University of Otago, especially the learning they engaged in outside formal instructional contexts:

a) *Computer Activity Data* (Dataset-1): Students' computer logs showing application use by type and duration.

b) *Cohort Behavioural Data* (Dataset-2): Student-generated audio and video clips during personal study sessions involving the use of personal computers.

c) *Local and International Data* (Dataset-3):

- International: Recent ECAR Reports (2009-2012) from EDUCAUSE
- Local: Two Survey data from the University of Otago (Otago Online Survey 2009 and ITS Survey 2012)
- Institution/Government policy documents and literature concerning the role of computer technology within higher education in New Zealand.

While the next phase, the Analysis Phase, dealt primarily with analysis of the data, the nature of the Constructivist Grounded Theory approach meant that there was analysis of data occurring as the data were being gathered. As *Figure 2.1* indicates, there was a consequent overlap between the Fieldwork and the Analysis Phases: iterative processes of reviewing data collection method/type occurred alongside the emergence of findings and the development of themes wherein hypotheses emerged or unfolded from interactions between the data, the actions, and the perspectives of the researcher and the participants.

As a researcher, my active discovery played a significant role in constructing themes from analysing data. To begin this study, findings were collected and reflected on in order to generate core themes. The process of analysing the three datasets was achieved through reducing the raw data into concepts that were defined by particular categories. The application of Constructivist

Grounded Theory meant that that data development was achieved through themes, coding, writing memos and diagramming. Coding is the process of breaking down, separating, sorting, examining, comparing, conceptualising and categorising data. It labels every segment of the data and forms categories, which depict what each segment is about. With the development of categories, the relationships between categories were established followed by further development or refinement. Such interpretive work forms a Grounded Theory. In this process, memos were written as a record of analysis. Ideas which emerged from the datasets were constructed into figures or diagrams as visual presentations. Coding, writing memos and diagramming gradually became more detailed and sophisticated with the involvement of both the researcher and the participants. Further analysis resulted in the generation of themes from these combined findings which then grounded the "theory" or the final outcomes.

The careful and precise application of Constructivist Grounded Theory ensured that the ideas which emerged from this study were rigorous and verified. It was a process of reality construction that offered a comprehensive framework (including the analysis of the process), acknowledged macroscopic issues related to the phenomenon under investigation, and acted as a precursor for further study in limited research areas (Charmaz, 2006). Constructivist Grounded Theory emphasises close observation and analysis followed by the creation of an interpretive understanding and the generation of a concept abstracted from the datasets. Thus, the analysis in this research attended to what was being heard, seen and sensed and pursued potential analytic ideas about the study as a consequence.

Usually, analysis processes incorporate explicit guidelines as to where the research might proceed, but as already mentioned, I had to be alert to interesting data that might emerge at any part of the journey. I had to define the ideas that best fitted the research theme. If questions arose during the journey or if gaps appeared between categories, I had to answer the questions and fill in the gaps by collecting more data or by refining the categories. The data and the emerging theory were then examined to avoid duplication. In other words, Constructivist Grounded Theory enabled me to start the study by being open without knowing what to expect, but end with a constructed/co-constructed image of "truths" from the data as well as my interactions with(in) the world.

With three different datasets being gathered during the Fieldwork Phase, core findings emerged from the analysis of each dataset. From participants' self-filming audio and video clips (Dataset-2), qualitative and quantitative data were grounded through an auto videographic method (Butson & Thomson, 2011) followed by a case study (an idea to be explored in the next paragraph). As for participants' computer activities data (Dataset-1), descriptive analysis was grounded from their captured computer activities, followed by a case study. Furthermore, two ICT survey data sources - from the University of Otago and from relevant international studies (Dataset-3) also grounded the theory by providing other significant information and statements. With constant comparisons between the data categories, Constructivist Grounded Theory controlled the risk of introducing unidentified bias into the study, as my assumptions, knowledge, and ideas were forced to be treated like a dataset and applied in this comparative method. It "serves as a way to learn about the worlds we study and a method for developing theories to understand them". It is a "[construction] of reality" as "[we] are part of the world we study and the data we collect" (Charmaz, 2006, p. 10).

Because each participant was recognised as an independent source of evidence, a case study approach was adopted. A case study is both a process of inquiry about a case and the result of that inquiry (Stake, 2000). It is believed to be one of the preferred ways of doing research using Grounded Theory (Lehmann, 2001; Maznevski & Chudoba, 2000; Orlikowski, 1993; Urquhart, 2001), as it will enhance the construction of theory that is novel, testable and valid (Strauss & Corbin, 1990). Apart from the participants' ideas, the researcher's social constructivist viewpoint, as well as the information and the "degree of sophistication available" (Guba & Lincoln, 2001, p. 7) served as variable and transformable knowledge. Accepting this co-construction, data were placed into their relevant situational and social contexts, according to the emergent themes as interpreted by the researcher. As concluded by Campbell (2011), a theory is grounded in the research data when there is a constant iterative proposing and checking process within the scope of the study, such that the theory is not applied to the data, but the data generates the theory.

Write-up Phase

Theoretical analysis began at the start of the research journey (Preparation Phase) and ideas were explored when the analytical writing started. In this final phase, an inductive and iterative analytical approach was employed with the aim of drawing all findings together and making conclusions. The online technology experience survey and the survey conducted by the Higher Education Development Centre (HEDC) and Information Technology Service (ITS) respectively at University of Otago (source 1 of Dataset-3) were used as a general probe into technology use among students. These studies asked University of Otago students to comment on the level of engagement they had with technology. Both surveys involved first to third year courses from across various disciplines. The data was subjected to multiple readings and compared to the existing literature (e.g., EDUCAUSE studies in Dataset-3), as well as institutional and New Zealand Government policies. Such policies hold significance for tertiary learning and teaching in conjunction with the growing belief that eLearning is a natural and crucial learning pathway for students in making sense of the knowledge society. (These notions will be discussed in more detail in the section, 'Relevance of this study', in Chapter 6). The readings allowed the identification of themes within and across the Computer Activity Data (Dataset-1) and the Cohort Behavioural Data (Dataset-2) for each student and/or group of students. At the same time, relevant arguments from the readings, based on the generated themes, were examined, with a view to highlighting the important, fundamental influence of common assumptions about computer technology use among tertiary students.

In summary, Constructivist Grounded Theory provided a framework and process for gaining a better understanding of the social cultural world that was in line with my social constructivist worldview. This understanding assisted me, as the researcher, to appreciate how I, as well as how the phenomena I was investigating, fit into this world of the student and how personal computers were being used for learning outside formal teaching contexts. Constructivist Grounded Theory provided me with a set of principles, practices, structures and processes that reflected the study's purpose(s) and recognised the impact of the social community on the phenomena I was investigating.

Summary

This chapter has demonstrated how my study was designed using an interpretive approach within a social constructivist-interpretivist paradigm and how the processes of investigation were constructively grounded from, or on, my datasets. The next chapter (Chapter 3) will delineate the methods employed in the analysis of each of the three datasets and the detail how themes emerged from the findings of these datasets.

Chapter 3: Method

Introduction

This chapter describes and explains the methods employed in this study. Data collection and analysis of each dataset are discussed in detail, including its purpose for inclusion, the process of collection and the recruitment of participants. The first part of the chapter gives a brief overview of the core datasets on which the study was established and the subsequent themes that were explored. Following this overview is a more detailed description of each dataset and a more comprehensive explanation of the themes.

Datasets

Figure 3.1 below illustrates the three datasets created for this study. The two primary datasets, Datasets-1 and 2, were created from two separate cohort groups, while Dataset-3 was produced from the extraction of data from existing international (EDUCAUSE) and local (University of Otago) studies.

The *Computer Activity Data* (Dataset-1) represents computer usage data that was generated from the personal computers of 18 students in 2012 who self-reported as being skilled computer users. The *Cohort Behavioural Data* (Dataset-2) is a collection of video and audio clips created by a second cohort of four students in 2009 who also rated themselves as being skilled computer users. The third dataset (Dataset-3) is the *Local and International Data* on student computer use and behaviour extracted from publicly available local and international sources: the Otago Student Survey 2009 and Otago ITS Survey 2012 as well as the internationally acclaimed, research-based EDUCAUSE studies from 2009 to 2012.

Each dataset then contributes to a second level of investigation across three core themes:

- Computer-based Approach vs Paper-based Approach
- Production Activity vs Consumption Activity
- Self-reports of Practice vs Actual Practice

Figure 3.1 demonstrates the relations of the three datasets to the core themes.

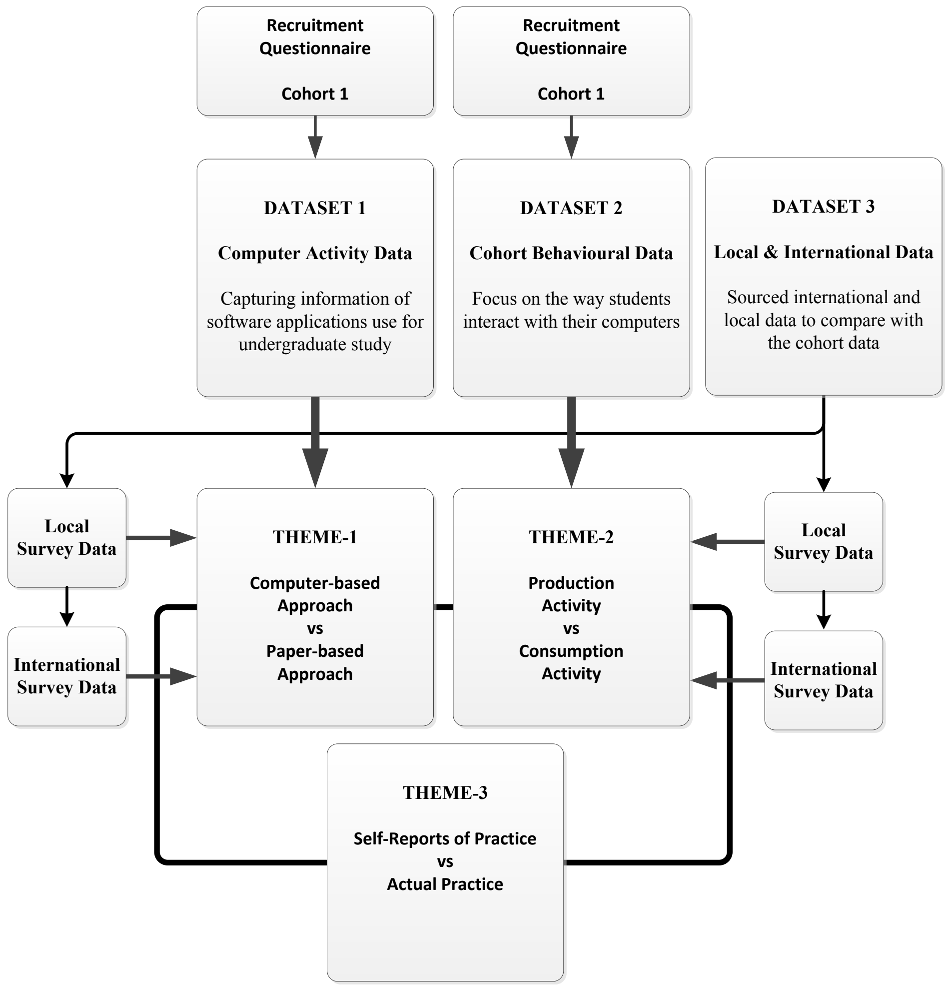


Figure 3.1: Relation of the datasets to the themes

Dataset-1: Computer Activity Data

This section outlines the detailed process of how Dataset-1 (Computer Activity Data) was captured and analysed. As the data involved participants, the process started off with recruitment, followed by the application of the data-collection tool, and ended with the captured computer activities and analysis. This naturally-occurring data, gathered as a result of students using their computers, was seen as an accurate method of revealing application types used and their computer technology engagement when studying over the first six weeks of the fieldwork period (Fieldwork Phase – see *Figure 2.1*). The focus was on the context(s), the extent to which software applications and web services were used to support undergraduate academic practice with personal computers - at what times, and for how long. Through this computer activity data, I expected to elicit students' actual technology practices, as opposed to their reported ones (see *Figure 3.1*).

Participants and Recruitment

As a residential assistant employed at Toroa College, University of Otago, I had the privilege of being a member of the private residential college Facebook site. I sent a description and invitation (see Appendix 1) via the Facebook message service about my project to 40 third-year students whom I randomly selected from the membership list.

Thirty students who replied and showed their interest were invited to undertake a short questionnaire (see Appendix 2) to gain some understanding of their perceived use of, and abilities with, computer technology. The questions were

1. Is access to a computer really important for your university study?

2. Which of the following best describes you?
   a. I love technologies and am among the first to experiment with as well as use them before most people I know.
   b. I usually use new technologies when most people I know do and sometimes I will be one of the last people I know to use them.
   c. I am sceptical of new technologies and use them only when I have to.

3. Please indicate the ratio (within 10) of how much you use computers in your studies compared to other aspects of your life.

4. How do you rate your ability to use computers?

5. What is your skill level for the following?

- using the university library website
- spread sheets
- presentation software
- graphics software
- computer maintenance
- internet information searching
- evaluating the reliability and credibility of online sources
- using digital information from various access

Question one sorted the participants' views on the importance of computer access for their university study. Question two asked how proficient participants were in the use of technology in their daily lives. These two questions were necessary to indicate the importance of personal computer use in participants' undergraduate lives. Question three invited the participants to self-rate on the extent of computer usage between study and non-study. This question was important to compare the students' self-reported practice as opposed to their actual practice, which was gathered through the extracted computer activity logs. Question four requested a more general rating of participants' overall perception of their computer skills. Question five required the participants to rate their abilities in different aspects of computer usage. These last two questions determined the participants' computer savvy-ness. In addition, the results of these two questions were used for final selection of participants for this dataset in this study.

Of the 30 who replied, 25 self-reported as average or expert computer users to question four. 18 (male-9 and female-9) with the highest scores (average or expert in at least four specific computer usages in question five) were recruited. The first instruction (see Appendix 3) was given to the selected participants through their individual private message inbox on their Facebook accounts. At the same time, another private message was sent to the unselected participants to thank them for their expression of interest (see Appendix 4). All 18 participants' questionnaire replies were summarised and the data was assembled in tables (see Appendix 5). Any remark provided by any participant was noted down for analysis reference. The questionnaire replies were kept as a preliminary dataset to compare participants' self-reports and their actual use of personal computers in academic practice.

Computer Activity Data

The Computer Activity Data was a core dataset. These data were gathered using a free software programme, ManicTime, which is known as "Personal time management software for logging and tracking work hours" (Mininday, 2009). ManicTime resides in the background of the computer reducing its intrusion on users' normal computer use. The data was not reliant on the students keeping records and thus it would yield more authentic information than could be gained from asking students about their computer usage.

ManicTime was downloaded onto each participant's computer and configured to record the programmes or websites used, as well as documents accessed, at what dates/times and for how long, over the first six weeks in semester one. All the participants were invited to attend a briefing session where the software was explained and training was given on software functions; this included the ability to turn it on/off and delete any record. All those who were invited, attended the briefing session. The computer activities captured the programmes and web services that students were using on a regular basis. The information was calculated "on the fly" and available for viewing by the student by clicking on an icon on the task bar. The software used an attractive and informative interface as shown in *Figures 3.2*, *3.3*, and *3.4* below.

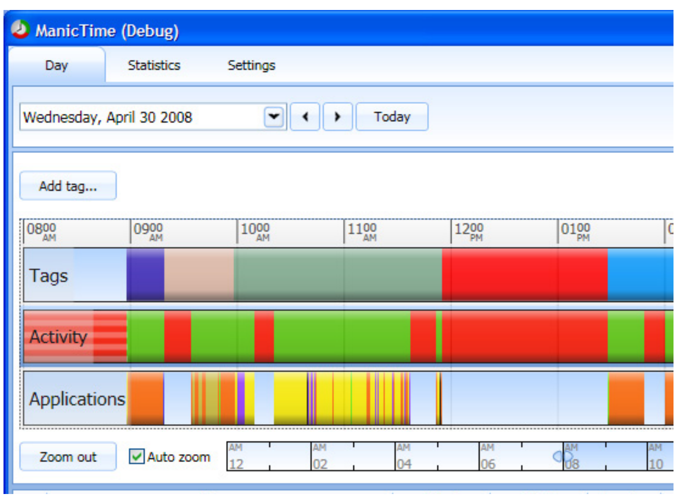
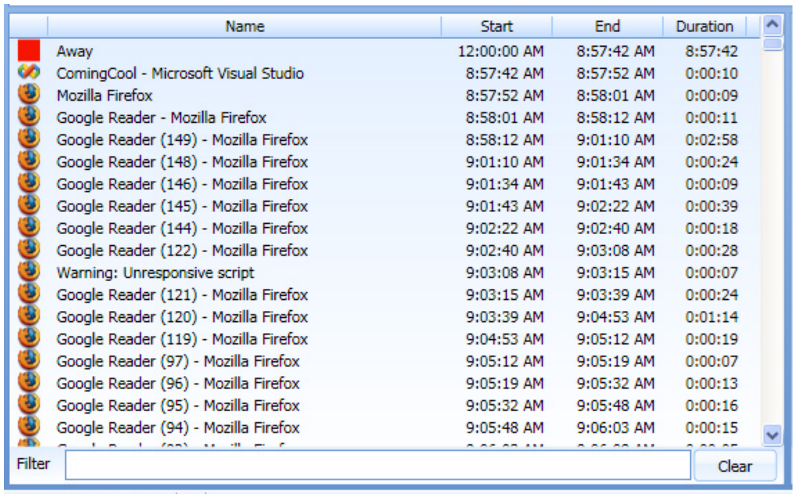


Figure 3.2: Computer activities are tracked based on the time of the day (Mininday, 2009)



Name	Start	End	Duration
Away	12:00:00 AM	8:57:42 AM	8:57:42
ComingCool - Microsoft Visual Studio	8:57:42 AM	8:57:52 AM	0:00:10
Mozilla Firefox	8:57:52 AM	8:58:01 AM	0:00:09
Google Reader - Mozilla Firefox	8:58:01 AM	8:58:12 AM	0:00:11
Google Reader (149) - Mozilla Firefox	8:58:12 AM	9:01:10 AM	0:02:58
Google Reader (148) - Mozilla Firefox	9:01:10 AM	9:01:34 AM	0:00:24
Google Reader (146) - Mozilla Firefox	9:01:34 AM	9:01:43 AM	0:00:09
Google Reader (145) - Mozilla Firefox	9:01:43 AM	9:02:22 AM	0:00:39
Google Reader (144) - Mozilla Firefox	9:02:22 AM	9:02:40 AM	0:00:18
Google Reader (122) - Mozilla Firefox	9:02:40 AM	9:03:08 AM	0:00:28
Warning: Unresponsive script	9:03:08 AM	9:03:15 AM	0:00:07
Google Reader (121) - Mozilla Firefox	9:03:15 AM	9:03:39 AM	0:00:24
Google Reader (120) - Mozilla Firefox	9:03:39 AM	9:04:53 AM	0:01:14
Google Reader (119) - Mozilla Firefox	9:04:53 AM	9:05:12 AM	0:00:19
Google Reader (97) - Mozilla Firefox	9:05:12 AM	9:05:19 AM	0:00:07
Google Reader (96) - Mozilla Firefox	9:05:19 AM	9:05:32 AM	0:00:13
Google Reader (95) - Mozilla Firefox	9:05:32 AM	9:05:48 AM	0:00:16
Google Reader (94) - Mozilla Firefox	9:05:48 AM	9:06:03 AM	0:00:15

Figure 3.3: The starting and the ending time of each computer activity is recorded (Mininday, 2009)

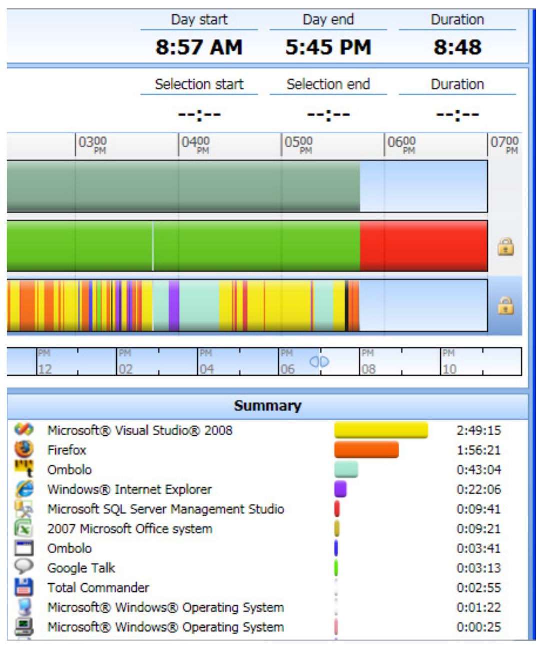


Figure 3.4: A summary of each computer activity is calculated each day (Mininday, 2009)

ManicTime is a detailed computer activity tracking application. At the click of an icon situated in the task bar, live data is presented in both tabular and graphical forms. These displays include the top applications used, top documents accessed, and computer usage within a certain duration (see *Figure 3.5*).

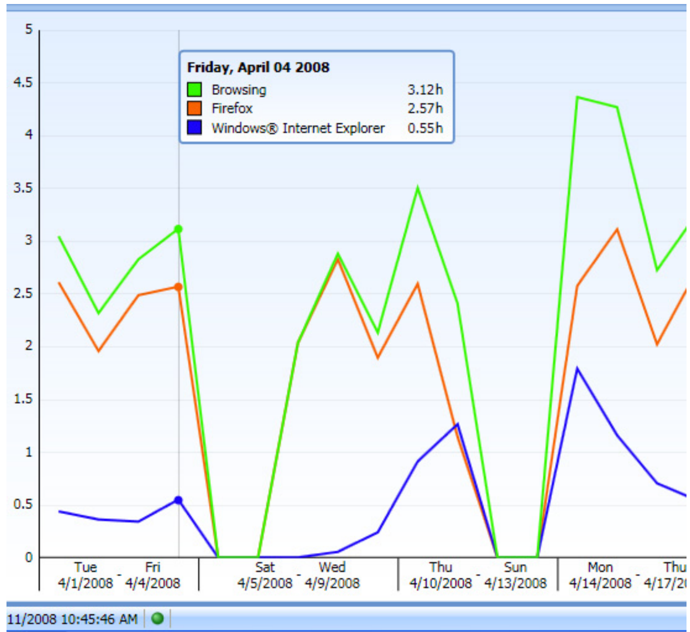


Figure 3.5: Computer usages by duration (Mininday, 2009)

The core benefit of using ManicTime for this study was its function as a personal, time-tracking tool, thus providing monitoring at a rudimentary level. Other software programmes reviewed for the study, while more comprehensive in their data capture, were defined as surveillance packages. These types of programmes are often covert in nature, recording every keyboard activity, such as typing passwords and online banking information. ManicTime, on the other hand, is overt in that users have access to the software from the task bar and the ability to delete any of the records. The data captured is less sensitive, in that ManicTime only tracks the software programmes that are being used (such as Microsoft Office or Brower Applications), the websites visited through capturing the Uniform Resource Locators (URLs) and the documents that are accessed (for example “Assignment_1.doc”). At the same time, it records the duration of these activities.

Computer Activity Data Analysis

At the end of the first six weeks of semester one, an individual meeting was scheduled with each of the 18 participants to extract their computer activity dataset. By clicking on the “Statistics” tab on the ManicTime interface, all the figures and tables (Day, Duration, Top Applications, Top

Documents, Top Computer Usage and Custom) generated from 27th February 2012 to 8th April 2012 were exported to a USB stick. An example of the figures (Custom) is shown as below.

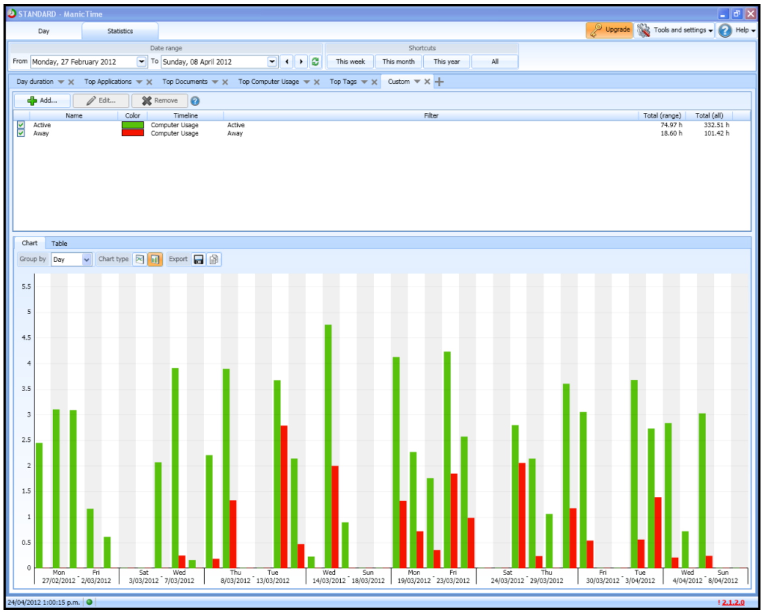


Figure 3.6: Weekly computer use – active vs inactive mode

Under the tab “Tools and Settings”, the back-up data in SDF (a database file) format was also saved onto a USB stick so that the participants’ daily computer usages could be retrieved in detail. The extracted computer activity data was then exported to Microsoft Excel for calculation and generation of tables and figures according to the categories. Categories were generated based on the computer activities captured. The summary of the categories is shown in *Figure 3.7*.

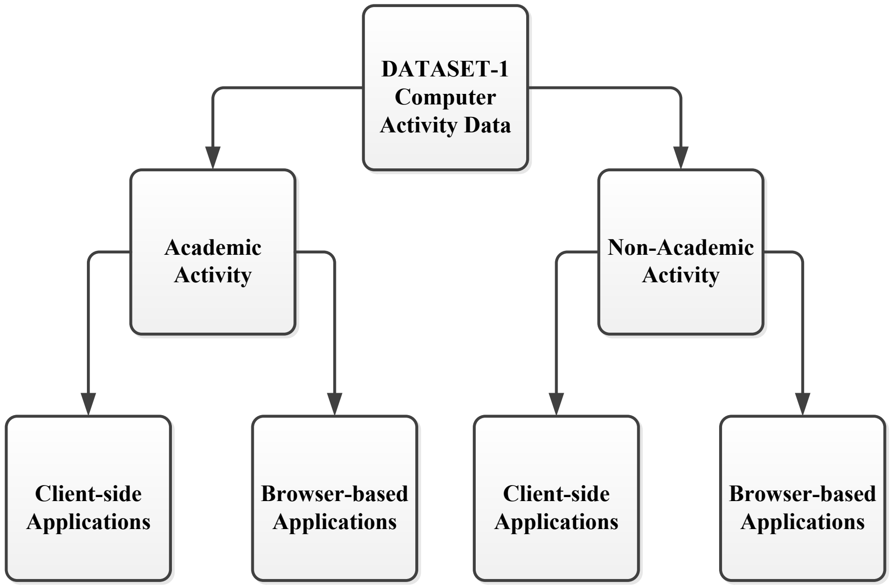


Figure 3.7: Generation of categories from the computer activities (Dataset-1)

As shown in *Figure 3.7*, the analysis focused on the top three software applications and web services used. The filtered dataset was divided into two categories titled Academic Activity and Non-Academic Activity. Academic Activity refers to software, documents or web services that were related to the participants' academic study. Non-Academic Activity includes all other uses, such as banking, entertainment sites, Facebook groups, etc. The distribution of the categories was not difficult given that all the URLs and file names accessed were recorded in the computer activities list.

The Academic Activity and Non-Academic Activity categories were then divided into Client-side Applications (e.g., Microsoft Office) and Browser-based Applications. Client-side Applications refers to all the built-in application programmes on personal computers used for different purposes. Browser-based Applications include website services (e.g., Blackboard) and website pages (e.g., Wikipedia).

In summary, this dataset traced the students' actual use of personal computers (software applications, web-based services/pages and documents) for their daily undergraduate academic practice as documented by the software programme, ManicTime.

Dataset-2: Cohort Behavioural Data

This section describes how the Cohort Behavioural Data (four participants' video and audio clips) were collected and analysed. As with dataset-1, the Cohort Behavioural Data involved participants who self-reported as being computer savvy. The process started with the recruitment followed by the generation of behavioural traits and analysis through coding with data analysis software (NVivo). With appropriate ethical approval[1], this dataset consisted of over 12 hours of video and audio files, captured by four third-year students, of their personal study sessions in 2009. The focus was on the context(s): to what extent did the participants integrate and interact with computer technology in their daily undergraduate study habits. Through this Cohort Behavioural Data, how computer technology plays a role in undergraduate students' personal studying time was examined (see *Figure 3.1*).

Participants and Recruitment

The process of recruitment involved strolling around the campus, approaching students, and inquiring if students: (1) were in their third year of study; (2) believed they were reasonably computer savvy; and (3) would be interested in being involved in a study. Those who answered yes (n=40) to all three questions were then briefed about the study as well as their roles in the study (see Appendix 6) and asked if they were still interested. Forty students agreed to be involved in the study and provided their names and contact details (see Appendix 7). The second inquiry was used to evaluate each participant's degree of computer literacy by inviting them to rate their ability in using their computer and the web as: expert user, competent user, novice user, or non-user.

A follow-up email (see Appendix 8) was sent to the 40 respondents after the invitation. Five declined to continue. Of the remaining 35, thirty-three reported they were competent users and two that they were expert users. An email confirming their interest and inclusion in the final selection process was sent to these respondents (see Appendix 9). From this group, four students were selected based on a balance of ability, gender and department distributions (there are four main departments at the University of Otago: Commerce, Health Science, Humanities and

[1] Consent was given by particpants to use film clips for research purpose

Sciences). An email confirming their selection and outlining initial instructions was sent (see Appendix 10). A courtesy email was sent to the unselected participants (see Appendix 11).

Table 3.1 below, displays the questionnaire responses from the initial group of 35 and the final selected cohort according to ability, gender, and the University department through which they were studying.

Table 3.1:
Categorisation and selection of responses

	Humanities						Commerce						Science			Health Science					Total
	Music/Theatre	**Law**	**Anthropology**	**Languages**	**History**	**Others**	**Marketing**	**Economics**	**Management**	**Tourism**	**Accounting**	**Info Science**	**Computer Sc**	**Zoology**	**Psychology**	**Medicine**	**Physiotherapy**	**Pharmacy**	**Neuroscience**	**Others**	
F	4	2	3	1	0	0	1	2	2	0	0	0	0	1	2	0	1	1	1	1	**22**
M	3	1	0	0	1	1	1	1	0	1	1	1	1	0	0	1	0	0	0	0	**13**
Total	7	3	3	1	1	1	2	3	2	1	1	1	1	1	2	1	1	1	1	1	**35**
	16						**10**						**4**			**5**					**35**
Selected		**M**			**M**										**F**	**F**					**4**

Cohort Behavioural Data

Auto-videography (Butson & Thomson, 2011) was chosen as a central method of data collection for this dataset. It aligned well with the research design by recognising the participants' power and uniqueness as sources of evidence, as well as engaging them in the inquiry (see section 'Research Structures and Processes' in Chapter 2). It enabled the introduction of first-person observational perspectives to the collection and analysis of the video data. Apart from giving the student participants the camera (Belk & Kozinets, 2005), it aimed to distance the researcher in order to go some way towards realising the goal of eliciting actual behaviours.

The four participants were provided with recording devices and given a briefing on how to create records of their authentic study practices. Beyond the brief, very little direction was given to the participants and they were free to record what they wished and to do what they wished (edit/delete/re-record etc.) with their recordings. In this way, the participants were encouraged to be natural, candid, spontaneous and self-directed in their behaviours.

The Cohort Behavioural Data was a core dataset. The self-filmed clips were recorded during the participants' personal study sessions. The filming highlighted the importance and the use of personal computers in their study, particularly in relation to the academic activities which they undertook outside the formal instructional contexts of lectures, laboratories, tutorials and field trips (Butson & Thomson, 2011). These self-filmed clips were sent for professional transcribing. All four films and transcripts were imported to an analysis software programme (NVivo) and saved as individual documents.

Cohort Behavioural Analysis

1. Generating themes through coding

Generally, an interactive relationship between the four participants and me, as the researcher, informed the data analysis. Specifically, the strategies of Constructivist Grounded Theory (Charmaz, 2006), described in the four phases of the study in Chapter 2 and shown in *Figure 2.1*, were used to carry out the film coding analysis. The basic concepts of coding were derived from a Constructivist Grounded Theory perspective, which involve the use of qualitative analysis software (NVivo) that facilitated a systematic, iterative approach. Interpretation (i.e., questions concerning what is going on, what the participants actually do, and what is in fact the motivation behind the scene) was applied to analyse this dataset.

As NVivo could not handle large video/audio files or certain video/audio file formats, each participant's film clip had to be split into smaller, compressed versions and converted to a usable format. Categories were created by coding the data sources to produce a clear weight-value for each. This reduced the contribution of approachability for the lowest scoring category in comparison with the highest scoring category. In line with the Constructivist Grounded Theory approach I was using, the coding processes started with open coding: distributing data into discrete parts and examining the data for similarities and differences - followed by grouping them according to categories. Each formed category had to be checked for accuracy, and any inconsistencies had to be revised. For example, I had to associate each category regularly with my arguments/assertions to determine whether my developing interpretation of the data was sufficiently supported by the coded references.

Also, because Constructivist Grounded Theory was designed to avoid the false assumption that the frequency of coded categories would imply their importance to the study, every category, no matter its frequency or its interesting points, had to be linked back to my research question. NVivo's coding stripes played an important part in this respect, enabling me to compare the categories with all the coded parts displayed in the node browser. This allowed me to label the categories and check the degree of their appropriateness in relation to the research question. During the development of categories, following the process of Constructivist Grounded Theory, detailed notes/memos were made about category names. Memos/notes consisted of summaries and propositional statements about the developing categories. Clarification of the categories occurred through this iterative process of viewing and reviewing while comparing and contrasting ideas around the research questions. This process was undertaken collaboratively with the individual participant's opinions or their own self-directed scripts while filming.

Having developed the categories from the film clips, I created tabs showing a comparison of ideas based on the research question. There were six categories in total:

1. Awareness vs Adaptation of Computer Technology,
2. Computer vs Non Computer Usages,
3. Consuming vs Producing Knowledge,
4. Natural Occurring Behaviours,
5. Traditional vs Modern Study Methods, and
6. With vs Without Production.

The number of references coded to each category varied from five (node 'Consuming VS Producing Knowledge') to 29 (node 'Traditional VS Modern Study Methods'). There were some categories that consisted of only a small number of references and I assumed they would be combined with other node(s) eventually. For example, I expected to combine the category 'Consuming VS Producing Knowledge' with the category 'Computer VS Non Computer Usages' as they overlapped in most of the references.

On completion of the first phase of coding from all four film clips, I restructured my categories. Through studying data, comparing them and writing memos, I refined ideas that I believed were the best fit for the data as a series of tentative analytic categories. When inevitable questions arose and gaps in my categories appeared, I sought data to answer these questions and possibly fill the gaps (Charmaz, 2006). The categories were re-organised into three key ones: (a) the use of computer software for on or off tasks; (b) the process of production and consumption of knowledge with or without technology; and (c) the students' on and off tasks with or without computer technology involvement. From the initial six categories, I had successfully merged the overlapped categories into three condensed categories in order to accommodate my study. With the newly structured categories, I again referred to each sub-category for further analysis. The numbers of references coded for each sub-category varied.

In short, qualitative data was captured, and qualitative as well as quantitative data analyses were conducted following a Constructivist Grounded Theory process. Different data types were analysed independently through NVivo, by watching the filming repeatedly and reading the transcripts closely to identify the common themes arising from the participants in conjunction with the research question.

2. Calculation

The coding process was followed by a series of calculations to generate descriptive results from the quantitative data. For each created sub-category, I captured all the coded time lines and moved them to Microsoft Excel for calculation. For example, for the sub-category "Producing Knowledge without Technology", I listed all the timelines coded for each participant, as shown in *Figure 3.8*.

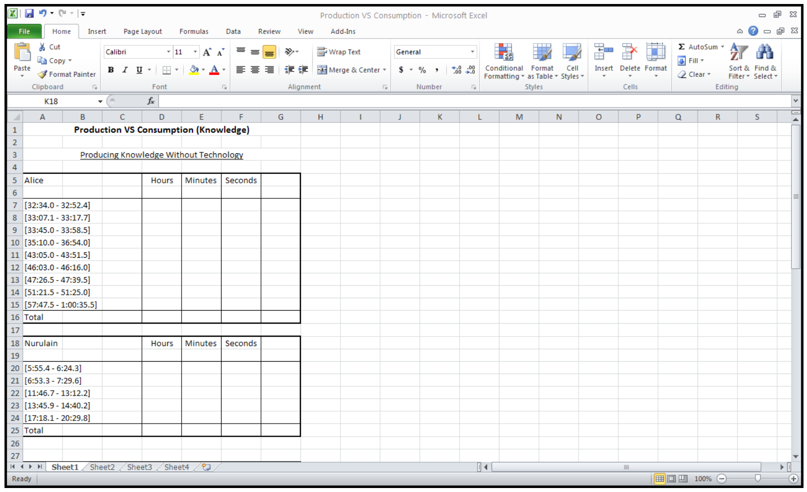


Figure 3.8: Timelines for each participant under "Producing Knowledge without Technology"

I repeated the same procedure for all the sub-categories. In other words, I calculated the total time for each participant under a sub-category from the durations obtained in three different units: hours, minutes, and seconds. Later, I created a table, Table 3.2, to calculate the total length of each participant's video clips.

Table 3.2

Calculation of duration for each participant

Name	**Duration for all video clips**	**Total time**	**Total seconds**
Participant 1			
Participant 2			
Participant 3			
Participant 4			

With the total time converted into the smallest unit of time (seconds) it allowed me to proceed to further calculations, including obtaining the percentage for each sub-category and the percentage for each participant's duration of a certain sub-category. The percentages then enabled me to insert tables and figures for a clear visual comparison among the categories and among the participants. Each of the three categories was presented on the spreadsheet as shown in *Figures 3.9*, *3.10* and *3.11* below.

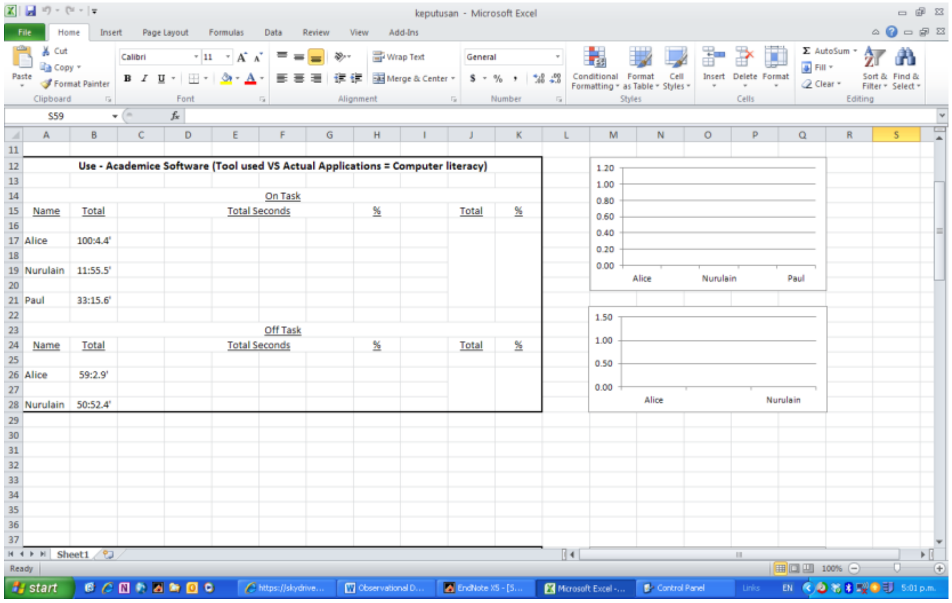


Figure 3.9: Use of academic software for on or off tasks

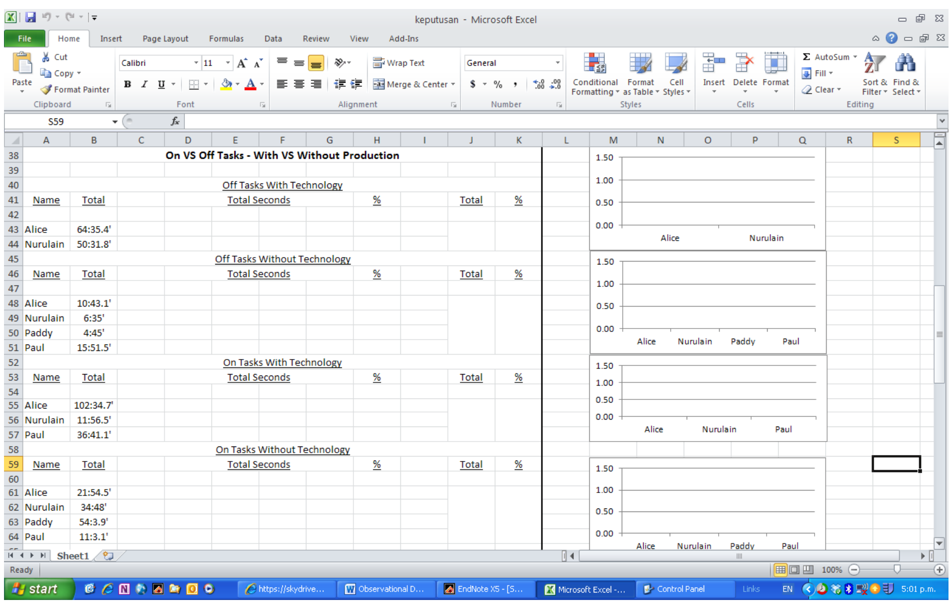


Figure 3.10: The students' on and off tasks with or without technology

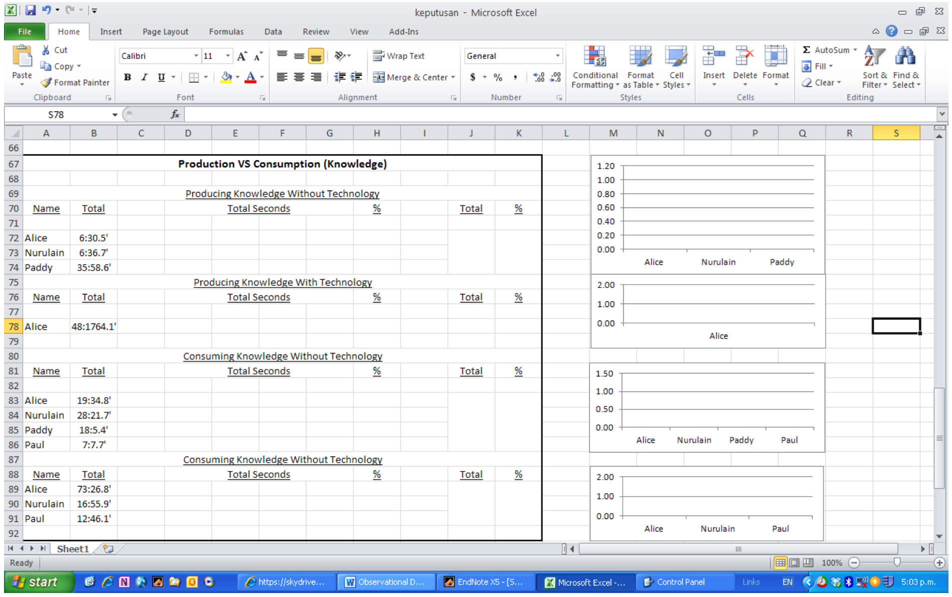


Figure 3.11: Production or consumption of knowledge with or without technology

3. Re-generation of Categories

In alignment with dataset-1, I combined “Use of Academic Software for On or Off Tasks” (see *Figure 3.9*) and “The Students’ On and Off Tasks with or without Technology” (see *Figure 3.10*) into a trait, namely “First Behavioural Trait: Academic vs Non-academic work”. Within this trait, On Tasks are classified as Academic Work and Off Tasks are regarded as Non-academic work. Apart from categorising Academic Work and Non-academic Work based on software involved, it was also examined from a wider angle: Academic vs Non-academic Work with or Without Technology involvement. Academic Work with Technology involves all studying styles that included the presence of technology on the spot, such as listening to music while writing notes, whereas Non-academic Work with Technology involves no study but the any kind of technological use, such as watching movie clips. On the other hand, Academic Work without Technology includes all study patterns without technology, such as reading out loud from the textbooks, while Non-academic Work without Technology is simply no studying and no technology involvement, such as chatting to the flatmates.

The second category, “Production or Consumption of Knowledge with or without Technology”, was renamed as “Second Behavioural Trait: The process of production and consumption of knowledge”. It was divided into four: Producing Knowledge with Technology; Producing

Knowledge without Technology; Consuming Knowledge with Technology; and Consuming Knowledge without Technology. Producing Knowledge indicates the process of applying what was learnt, such as developing slides for presentation, whereas Consuming Knowledge refers to the process of receiving information, such as finding an answer to a question. Both processes can be achieved with or without the involvement of computer technology. For example, developing slides for presentation on Microsoft Power Point involved computer technology, but not if the slides were developed through drawings on paper; finding an answer to a question on Google involved computer technology, but not if a student referred to textbooks or written notes.

In summary, the analysis of this dataset culminated in an abstract theoretical understanding of the studied experience (Charmaz, 2006) among undergraduate students in a digital environment. From the calculations (quantitative results) generated, I generated text-based results (qualitative results).

Dataset-3: Local and International Data

This section describes the detailed process of how local and international studies were incorporated in this study. Referring to the section 'Design and Method' in Chapter 1, data from a number of locally administered surveys on ICT at the University of Otago and internationally conducted by EDUCAUSE were seen to be relevant to the current study.

The Information Technology Service (ITS) and Higher Education Development Centre (HEDC) at the University of Otago had both commissioned Information Technology related surveys. These surveys were used as a core data source to gain a picture of the current student and institutional capability regarding ICT provision. A systematic search for recent EDUCAUSE studies involving personal computer use among undergraduates was undertaken. The results were analysed and reviewed using a Grounded Theory approach. Applicable findings were extracted. The criteria for inclusion of studies were linked to data that had a close alignment to personal use of computer technology to support academic study. This included various aspects associated with hardware, software and user behaviour.

Through this local and international dataset, I expected to discover the extent to which computer technology plays a role among undergraduate students and how it is used by them in both local and international contexts (see *Figure 3.1*).

Source 1: Online Survey (2009)

As mentioned in the section 'Design and Method' in Chapter 1, an online technology experience survey was created in 2009 by HEDC to seek students' views and use of technology in tertiary studies at the University of Otago. The survey identified students' current technological practices and needs. The responses were beneficial in planning for, and integrating technology into, learning and teaching. The survey consisted of 18 questions and appeared in seven pages on the web (see Appendix 12). Options were given for all the questions except the first question (the students' name) and comment space was provided for eight opinion questions (Questions 9, 10, 11, 13, 14, 15, 16 and 17).

On page one, the survey was introduced, and, as well as an explanation of its purpose, required the students to fill in their name and the type of network they used (e.g., private network, university network, etc.). Page two defined the terms used in the survey. There were four questions on page three, related to: students' views on the importance of computer access for their studies; their adoption of technology in their daily life; their self-rating of computer usage in their studies and for other aspects of their lives; and their rating of their ability in using technology. Next, the students were asked to rate their abilities in different aspects of computer usage. Then, on pages five and six, there were four questions investigating the students' software programme and website use. The four questions included: whether they used any software programme/website for studies; their choice of software programme(s)/website(s); their purposes for using their chosen software programme(s)/website(s); and their motivation for using the mentioned software programme(s)/website(s). Finally, on the last page, there were three questions examining the students' application of new technologies in their studies, how they used these technologies and their opinion about whether lecturers should also use them.

Results – Analysis

After three weeks, the questionnaire was closed. Eight relevant questions were used in the dataset for the current study, namely, questions 3, 4, 6, 7, 8, 10, 12 and 13. These included: the importance of using technology as part of learning at university (Q3); the student's adoption of technology (Q4); the student's ability to use technology (Q6); the student's skill level for specific use of technology (Q7); the student's use of software programmes and websites in academic work (Q8 and Q12); the purposes of using software programmes in academic work (Q10); as well as the website(s) used in academic work (Q13).

Source 2: ITS Survey at the University of Otago (2012)

As raised in the section 'Design and Method' in Chapter 1, ITS at the University of Otago conducted an online survey using web-based software through students' webmail at the beginning of semester one in 2012. The survey was to ascertain students' technology usage and their perception of technology in their studies. 13 questions with options were included in the survey. The questions focussed on students' laptop, tablet, mobile device, and/or desktop ownership; main area and status of study; usage of wireless and/or wired Ethernet at campus; laptop and/or tablet operating system; utility of their laptop; and usage of internet on their mobile device (if applicable). Through the analysis of the results, provided by ITS, an understanding of the setting(s) in which students learn and use technology to support their learning at tertiary level was gained.

Results – Analysis

The results of the survey were reviewed and only relevant data was extracted for this study, namely, students' access to the internet at their residence, student internet connection type, as well as students' laptop, desktop and tablet ownership.

Combined Results-Analysis

The findings from both local sources were then combined and categorised using the traits generated from the Dataset-2 analysis, that is, around Academic vs Non-Academic Work and The Process of Production and Consumption of Knowledge.

Source 3: EDUCAUSE literature (2009 - 2012)

As touched upon in the section 'Design and Method' in Chapter 1, ECAR (EDUCAUSE Centre for Applied Research) studies were included in this international dataset. The ECAR study data offers a framework for understanding the state of higher education IT as it pertains to students' present and evolving technology perspectives (Dahlstrom, 2011). With random matches of keywords, a list of related EDUCAUSE journal articles was found. In order to minimise the search results, the list was filtered for the years between 2009 and 2012.

Results - Analysis

Among the articles listed, the aspect(s) of investigations and the method(s) used were examined to determine if they were appropriate to be applied as reference data for the findings and data analysis of the current study. Based on these criteria, five most recent EDUCAUSE journal articles were chosen and used as a comparison to my two main cohort datasets (Datasets-1 and 2). The results from these research projects were retrieved based on their suitability to this study.

Combined Results-Analysis

The findings from all five international studies were combined and categorised based on the similar traits generated through the analysis of Dataset-2, which were Academic vs Non-Academic Work and The Process of Production and Consumption of Knowledge.

Summary of Results-Analysis

The combined findings for both local and international studies were summarised in a table format for comparison under the same categories as they existed in the individual datasets, which were Academic vs Non-Academic Work and The Process of Production and Consumption of Knowledge.

In summary, this dataset served to generate relevant findings and/or results from both local and international studies, so that an understanding of the role/importance of personal computer for today's undergraduate students could be acquired.

Generation of Themes for the Study

Dataset-1 generated results which included the top three software applications and web services used by the participants, a comparison between the use of client-side software and browser-based services, and the categorisation of computer usages as either academic or non-academic. Dataset-2 generated two behavioural traits, namely Academic vs Non-academic Work and The process of production and consumption of knowledge. Similar to Dataset-2, Dataset-3 generated two categories: Academic vs Non-academic Work and The Process of Production and Consumption of Knowledge.

The combination of categories across each dataset then contributed to a second level generation of three core themes for the whole study (see *Figure 3.1*). These three themes are now described.

1. Computer-based Approach vs Paper-based Approach

This theme focuses on the notion of studying patterns among the students. The two generated behavioural traits from Dataset-2 were the main contributors to this theme (see section 'Re-generation of Categories' under Dataset-2: Cohort Behavioural Data in this chapter). Both traits consisted of two major sub-traits, which were either with, or without, the involvement of computer technology. This theme was the result of Academic Work with Technology in the first behavioural trait, and Production and Consumption of Knowledge with Technology in the second behavioural trait, being combined as the use of a Computer-based Approach. On the other hand, Academic Work without Technology in the first behavioural trait, and Production and Consumption of Knowledge without Technology in the second behavioural trait, made up the use of a Paper-based Approach. The list of top three software applications and web services used from Dataset-1 (see section 'Computer Activity Data' under Dataset-1: Computer Activity Data in this chapter) provided extra, unseen evidence on how students use a Computer-based Approach (e.g., academic-related software programmes and browser-based services) in their daily study habits. In addition, Dataset-3, which gave a general report on the students' use of computer technology in both local and international contexts (see section 'Summary of Results-Analysis' under Dataset-3: Local and International Data in this chapter), further enriched the theme of the students' use of computer technology in comparison with a Paper-based Approach.

2. Production Activity vs Consumption Activity

This theme focuses on the notion of "student-ness" in undergraduate study. The second behavioural trait in Dataset-2 (see section 'Re-generation of Categories' under Dataset-2: Cohort Behaivoural Data in this chapter), which generated the processes of Production and Consumption of Knowledge in both contexts, with and without the involvement of computer technology, was the key channel of this theme. Dataset-3, which generated a similar but a narrower comparison: The Process of Production and Consumption of Knowledge (see section 'Summary of Results-Analysis' under Dataset-3: Local and International Data in this chapter), provided applicable reports as a benchmark for comparison. In addition, the list of client-side software programmes and browser-based services generated from the computer activities in Dataset-1 (see *Figure 3.*7) served as an indicator of what the student participants used to produce and/or consume knowledge.

3. Self-reports of Practice vs Actual Practice

This theme focuses on the notion of the gap between self-report and actual practice as a method choice when it comes to determining computer technology use among students (see *Figure 3.*1). It was primarily driven by Dataset-1, which generated the comparison between Academic and Non-Academic use of personal computers from the categorisation of computer activities captured (see *Figure 3.*7). The first behavioural trait in Dataset-2 (see section 'Re-generation of Categories' under Dataset-2: Cohort Behavioural Data in this chapter) generated a similar comparison but with a wider scope in projecting the difference between participants' self-report and actual practice for Academic and Non-academic Work with Technology, in terms of computer literacy. In addition, the extracted findings gathered in Dataset-3 (see section 'Summary of Results-Analysis' under Dataset-3: Local and International Data in this chapter), which provided reports on students' use/views of Academic and Non-academic Work, enhanced the exploration of this theme.

Interesting Mapping Exercise

The use of Constructivist Grounded Theory, as mentioned in Chapter 2, allows flexibility in a research journey. It also permits changes or surprises within the process that might lead in more than one analytic direction. The potential for an interesting mapping exercise emerged from the iterative reworking of the Computer Activity Data (Dataset-1). Computer activity data, including both Academic and Non-Academic Work, were plotted across a timeline that included the dates of each participant's course demands, such as internal assessments, presentations, assignments and essays. The computer activity use was calculated as a daily portion of time and plotted across six-weekly intervals. Figures were generated for all the participants who had course demands within the six weeks' participation (n=14). A table was then created to show the alignment between computer use and the course demands.

Summary

This chapter outlined in detail the methods employed in the analysis of each of the datasets and the generation of themes from the data of these datasets. This was followed by a brief description of the 'computer use time against course assignment' mapping exercise. The following chapter (Chapter 4) will continue with the reports of findings from each dataset and the analysis across the generated themes, as well as the results from the interesting mapping exercise.

Chapter 4: Findings

Introduction

This chapter presents the results of the analysis of each of the three datasets: Computer Activity Data (Dataset-1), Cohort Behavioural Data (Dataset-2), and Local and International EDUCAUSE Data (Dataset-3). As described in Chapter 3, Dataset-1 refers to data that were captured from students' personal computers about the applications they used, the websites they visited via browsers and the documents they accessed from their system. Dataset-2 highlighted how students actually used or interacted with their computers, particularly the manner in which they used software programmes and web services. Finally, survey data that included relevant local and international data sourced from existing reports produced by EDUCAUSE and the University of Otago (Dataset-3) were used to compare findings about the role/importance of personal computers to support learning in higher education with the findings from this study.

The findings from each dataset are presented, as are the results of further analysis across three core themes:

1. The use of computer technology in comparison with paper-based approaches, namely "*Computer-based Approach vs Paper-based Approach*"
2. The processes of production and consumption of knowledge in conjunction with computer technology use, namely "*Production Activity vs Consumption Activity*",
3. Students' self-report and actual use of computer technology in their study, namely "*Self-Reports of Practice vs Actual Practice*"

The following sections outline the findings from each of the three thematic analyses. The chapter concludes with a comparison finding that I undertook as a point of interest.

Dataset-1: Computer Activity Data

The findings from the analysis of Dataset-1 reveal the extent to which students at the University of Otago used their personal computers (e.g., software programmes and websites) to support their undergraduate academic practice in their daily study habits. As described in detail in section

‘Dataset-1: Computer Activity Dataset’ in Chapter 3, 30 third-year students were invited to complete a questionnaire to assess their degree of computer literacy for selection. Of these, the students with the top highest scores were selected for the study (n=18). Software was used to extract computer usage data from these participants’ laptops over the duration of the study period (6 weeks =1008 hours). This data included the top three software applications and top three web services used. The usage was then categorised as client-side software programmes or browser-based services followed by academic or non-academic (see *Figure 3.7*).

Participant Selection Data

The participants were selected based on self-reports of their degree of computer literacy. This was measured using the responses to the five questions relating to computer use and perceived aptitude with computer technology in the questionnaire (see Appendix 4). Of the 25 students who rated their computer use/aptitude as average to expert, 18 with the top highest scores were selected to undertake the study.

In question one, students were asked to state whether they agreed, were neutral or disagreed with the claim ‘Access to a computer for university study is important’; all but one of the participants selected the ‘Agree’ option. The one participant who did not make a selection chose instead to make a comment: “A computer is important when you have poor teachers. You will have to teach yourself to learn.”

The second question aimed at ascertaining the students’ overall confidence and interest in adopting new technologies. Of the 18 students, only five regarded themselves as early adopters, with the majority (n=10) stating they saw themselves more as followers than as early adopters when it came to using new technologies. The remaining three, while comfortable with technology, considered they were sceptical when it came to new technologies.

Question three explored how the students used their personal computers for both academic (study) and non-academic use (other aspects of life). Nine of the 18 felt they had a balanced approach to computer use for academic and non-academic purposes with the other nine stating they were more likely to use their personal computer for academic than non-academic purposes (see Table 4.1).

Table 4.1

Student self-perception measure of their academic and non-academic computer use (Q3)

Participants	Percentage (%)	
	Academic Use	**Non Academic Use**
1	60	40
2	60	40
3	70	30
4	50	50
5	50	50
6	50	50
7	50	50
8	50	50
9	50	50
10	40	60
11	40	60
12	40	60
13	40	60
14	40	60
15	40	60
16	40	60
15	40	60
16	40	60
17	30	70
18	20	80

Question four asked students to self-rate their ability in using computers. All 18 reported their ability as average to expert (see Appendix 13). As for their ability in using specific computer applications (question five), all 18 students rated themselves as average to expert users against a list of common software programmes and web services (see Appendix 13).

Computer Activity Data

As mentioned above, the computer activities list was divided into client-side applications (e.g., Microsoft Word or Window Media Player) and browser-based services (e.g., Blackboard or Facebook). At the level of application use, the computer activities revealed the most popular application was the browser, with browser-based use considerably higher than client-side software programmes (average = 96.59%). The top three browser-based services were Facebook and YouTube which accounted for about 52.74% of students' overall computer usage, with Google (average = 2.92%) the next on the list. As for client-side applications, Microsoft Office was ranked the highest (average = 7.18%) followed by the file management application, Windows Explorer (average = 4.92%), and Adobe/Foxit Reader (average = 3.48%). Table 4.2 below shows the total use of client-side software and browser-based services retrieved from every participant's computer activity data.

Table 4.2:

Student use of client-side software and browser-based services

Participants	Percentage (%)	
	Client-side Software	**Browser-based Services**
1	13.42	86.58
2	98.86	1.14
3	12.25	87.75
4	19.05	80.95
5	17.53	82.47
6	12.05	87.95
7	14.21	85.79
8	13.93	86.07
9	3.87	96.13
10	26.25	73.75
11	24.70	75.30
12	21.00	79.00
13	14.31	85.69
14	27.95	72.05
15	47.15	52.85
16	44.72	55.28
17	17.65	82.35
18	22.03	77.97

The computer activities were then divided into two main categories: Academic and Non-Academic Work (this includes both client-side software and browser-based services). Table 4.3 below shows the actual practice of how participants used computers in their studies compared with how they used them in other aspects of their life.

Table 4.3:

Computer activities for comparison of academic vs non-academic use

Participants	Percentage (%)	
	Academic	**Non-academic**
1	10	90
2	90	10
3	10	90
4	10	90
5	20	80
6	10	90
7	10	90
8	10	90
9	10	90
10	10	90
11	20	80
12	10	90
13	10	90
14	10	90
15	10	90
16	10	90
17	10	90
18	10	90

The problem of using self-reports to express practice in regard to computer use is highlighted by the discrepancy between the self-perception questionnaire data (Table 4.1) and computer activity data (Table 4.3). Reflecting on the limitation of self-reports, as discussed in section 'Design and Method' in Chapter 1, misalignment was found between student perceptions of practice (Table 4.1) and their actual practice (Table 4.3). From the questionnaire data, students perceived that they either struck a balance in the use of computer technology between study and other aspects of life or had a higher computer technology usage for study. The actual practice (computer activities), however, revealed the opposite.

In summary, the Dataset-1 (Computer Activity Data) revealed:

1. the difference in usage between the top-ranked client-side software programmes (Microsoft Office 7.18% and Window Explorer 4.92%) and browser-based services (YouTube and Facebook 52.74%) (see section 'Computer Activity Data' above).
2. the high percentage of browser-based services use among undergraduate students (average of 96.59% among 18 participants) (see Table 4.2).
3. the high non-academic use of personal computers in undergraduate students' actual practice compared with their academic use (average of five times more on non-academic use) (see Table 4.3).

Dataset-2: Cohort Behavioural Data

The results of the analysis of Dataset-2 highlight how four students used their personal computers to support their study. As depicted in detail in section 'Dataset-2: Cohort Behavioural Data' in Chapter 3, 35 third-year students who rated themselves as proficient computer users were invited to complete a survey to measure their degree of computer literacy. The four third-year students selected to participate further then filmed their private study sessions at home. The 12 hours of filming created by the four participants were coded by activity under the following terms: First Behavioural Trait: Academic vs Non-academic work and Second Behavioural Trait: The process of production and consumption of knowledge.

Participant Selection Data

Similar to the selection process described for Dataset-1, the participants were selected based on their degree of computer literacy. However, in this instance the selection occurred in a more straightforward way. Computer literacy was measured through responses to the question about their perceived skill with computer technology only (see Appendix 6). Of the 35 students who rated their computer skill as average-to-expert, four with the strongest interest in further participation in the study, and who provided a representative balance of ability, gender and department distribution, were selected to undertake the study.

First Behavioural Trait: Academic vs Non-academic work

This behavioural trait was split into two parts: Academic and Non-academic Work. Academic Work refers to any usage on participants' laptop or computer for study purposes, such as typing an essay using Microsoft Word or reading an article using Adobe Reader. Non-academic Work, on the other hand, includes any laptop or computer usage for non-study purposes, such as browsing through posts/photographs on a Facebook page or adjusting the volume of music on Window Media Player. The data is presented for each participant, indicated by 1, 2, 3 or 4, in Tables 4.4 and 4.5, below.

Table 4.4:

Academic work of each participant

Participant	Academic Work
Participant 1	63.77%
Participant 2	17.93%
Participant 3	0.00%
Participant 4	51.77%

Table 4.4 shows that participant 1 was the only participant who involved significant laptop use (e.g., Internet Browser and Microsoft Word). Participant 2 only used the laptop (e.g., Adobe Reader and Internet Browser) partially. Participant 3 did not use the laptop for study at all but would do so when undertaking assignment work. The data indicated that participant 4 used an even mix of paper-based approaches (i.e., paper and pen) and computer-based approaches (i.e., Microsoft Word and Internet Browser) in study.

Table 4.5:

Non-academic work for each participant

Participant	Non-academic Work
Participant 1	36.23%
Participant 2	82.07%
Participant 3	0.00%
Participant 4	48.23%

Table 4.5 reveals that only three participants used their personal computers for Non-academic Work. Participant 1 used the laptop for routine activity, such as email correspondence and listening to music (i.e., Gmail and Window Media Player), whereas participant 2 used the laptop predominantly for entertainment and socialising. For example, participant 2's Microsoft Instant Messenger was on the entire time and the Facebook page was always on the computer screen for constant updates. Participant 4 used the laptop to browse information (e.g., Google). Participant 3 did not carry out other tasks on the laptop for study purposes.

As explained in the section 'Re-generation of Categories' under Dataset-2: Cohort Behavioural Data in Chapter 3, behavioural traits of Academic and Non-academic Work were further dissected into four subsets: Academic Work with Technology; Academic Work without Technology; Non-academic Work with Technology; and Non-academic Work without Technology. Academic Work with Technology comprises all studying approaches that involve the presence of technology; this would include behaviours such as listening to music when reading a slide on Microsoft Power Point. Non-academic Work with Technology refers to any non-studying activity captured within the study area that involves any kind of technological use, such as texting and playing online games. On the other hand, Academic Work without Technology includes all studying patterns without technology, such as highlighting while reading written notes; whereas Non-academic Work without Technology is simply any other behaviour captured within the studying area being filmed, such as drinking a glass of water. Tables 4.6 to 4.9 present Academic and Non-academic Work with or without Technology for each participant.

Table 4.6:

Academic work with technology for each participant

Participant	Academic Work with Technology
Participant 1	65.37%
Participant 2	19.30%
Participant 3	0.00%
Participant 4	57.10%

Table 4.6 indicates that only participants 1 and 4 engaged with computer technology in their study. Participant 1 checked study progress, such as the completion of tasks, on the Outlook Calendar and participant 4 switched between Microsoft Word and an internet browser to complete the assignment. Participant 2 used computer technology only for viewing lecture slides or diagrams on the computer. When reading, participant 2 used the textbook. Participant 3 was the only participant who did not involve any technology in studying.

Table 4.7:

Academic work without technology for each participant

Participant	Academic Work without Technology
Participant 1	13.96%
Participant 2	56.25%
Participant 3	91.83%
Participant 4	17.20%

Table 4.7 presents Academic Work without Technology. Participants 1 and 4, with the lowest percentages, wrote or highlighted notes on papers occasionally. Participant 2 did most of the readings on paper with a pen and a highlighter in hand. Participant 3 used paper-based

approaches to study, although the laptop was on one side, as shown in the film clip during the studying time.

Table 4.8:

Non-academic work with technology for each participant

Participant	Non-academic Work with Technology
Participant 1	34.63%
Participant 2	80.70%
Participant 3	0.00%
Participant 4	42.90%

Table 4.8 displays the Non-academic Work with Technology data. Participants 1, 2 and 4 carried out various tasks with computer technology during their studying periods. They carried out similar off-task activities, such as listening to music, adjusting the music software programme and exploring internet websites while studying. Participant 2, with the highest percentage usage, in particular relied on technology for socialising; to stay connected with others. As the participant admitted, Facebook is "the book" that was always needed and therefore was always on the computer screen. Also, the Microsoft Instant Messenger was switched on permanently. Although participant 3 did not study with technology (see Table 4.6), the participant did not carry out any non-academic work with technology either.

Table 4.9:

Non-academic work without technology for each participant

Participant	Non-academic Work without Technology
Participant 1	6.83%
Participant 2	43.75%
Participant 3	8.17%
Participant 4	82.80%

All four participants did other activities (Non-academic Work without Technology) while they were studying, as shown by the percentage usage score in Table 4.9. The most common activities were leaving the desk and going away for a while. Some of them played with their pet or talked to flatmates during the studying period. These activities were not considered as studying and nor did they involve any computer technology.

The findings from this behavioural trait are summarised in Tables 4.10 and 4.11, below.

Table 4.10:

A summary of each participant's academic and non-academic work

Participant	Academic Work	Non-Academic Work
Participant 1	63.77%	36.23%
Participant 2	17.93%	82.07%
Participant 3	0.00%	0.00%
Participant 4	51.77%	48.23%
Total average	**33.37%**	**41.63%**

Table 4.11:

A summary of each participant's academic and non-academic work with/without technology involvement

Participant	Academic Work		Non-Academic Work	
	with technology	without technology	with technology	without technology
Participant 1	65.37%	13.96%	34.63%	6.83%
Participant 2	19.30%	56.25%	80.70%	43.75%
Participant 3	0.00%	91.83%	0.00%	8.17%
Participant 4	57.10%	17.20%	42.90%	82.80%
Total average	**35.44%**	**44.81%**	**39.56%**	**35.39%**

In short, the first behavioural trait showed that, for computer activity across all participants, there was a higher percentage of Non-academic Work with the involvement of technology (39.56% as opposed to 35.39% - see Table 4.11), but a lower percentage of Academic Work when there was involvement of technology (35.44% as opposed to 44.81% - see Table 4.11).

Second Behavioural Trait: The process of production and consumption of knowledge

This trait consists of four divisions: Producing Knowledge with or without Technology and Consuming Knowledge with or without Technology. In the process of studying, a student will either produce knowledge (e.g., constructing an argument while writing an essay) or consume knowledge (e.g., retrieving information from the web). Whichever it is, there can be involvement of computer technology or not as shown in the examples in Table 4.12.

Table 4.12:

An example for each division of the behavioural trait

Division	Example
Producing Knowledge with Technology	Writing an essay in Microsoft Word
Producing Knowledge without Technology	Mind-mapping notes on papers
Consuming Knowledge with Technology	Googling information on the web
Consuming Knowledge without Technology	Finding an answer from a textbook

Tables 4.13 to 4.16 present the second behavioural trait data for each of the divisions listed in Table 4.12. Each participant is indicated by 1, 2, 3 or 4.

Table 4.13:

Producing knowledge with technology for each participant

Participant	Producing Knowledge with Technology
Participant 1	49.32%
Participant 2	0.00%
Participant 3	0.00%
Participant 4	44.66%

As shown in Table 4.13, only participants 1 and 4 produced knowledge with computer technology when studying. Both of them used the same software applications to do so, namely, Microsoft Word and an internet browser application. While participant 1 used an internet browser to look for articles and other references to write the essay, participant 4 used it to search materials to construct arguments for the assignment. Participant 1 produced more knowledge using computer technology than the others. Participant 4 made significant use of computer technology in daily study as well, and was more of a knowledge producer than a consumer. Participant 2 used technology while studying, but no production of knowledge was evident (e.g., the production activity was on paper rather than on the computer screen). Participant 3 did not switch on the laptop when studying, so there was no production of knowledge with technology at all in this particular case.

Table 4.14:

Producing knowledge without technology for each participant

Participant	Producing Knowledge without Technology
Participant 1	4.15%
Participant 2	10.69%
Participant 3	61.11%
Participant 4	88.91%

Table 4.14 exhibits the results for Producing Knowledge without Technology. Participant 1 produced knowledge on paper only occasionally during the studying period. The participant printed out the calendar, trying to work out how to use Outlook Calendar (e.g., "I printed out a calendar and I just wrote due dates on it and highlighted them and I've been crossing off each month so we're in August at the moment"). Participant 2 showed a similar studying pattern. The participant was a blogger but usually applied paper-based approaches in study (i.e., taking notes and writing). Participants 3 and 4 also produced knowledge on paper (e.g., note-taking for studying and completing assignments respectively) most of the time. Participant 3 was the only participant who did not involve computer technology in the study. The participant produced knowledge more than s/he consumed knowledge, although paper-based approaches were applied. With the highest percentage of Producing Knowledge without Technology (88.91%), participant 4 used a lot of paper-based approaches, such as drafting essays on paper.

Table 4.15:

Consuming knowledge with technology for each participant

Participant	Consuming Knowledge with Technology
Participant 1	46.80%
Participant 2	27.37%
Participant 3	0.00%
Participant 4	19.87%

Table 4.15 demonstrates each participant's data for Consuming Knowledge with Technology. Participant 1 consumed knowledge with computer technology (e.g., searching journals on databases or past year exam papers from the university library site) more than the others. With the lowest percentages, participants 2 and 4 indicated little consumption of knowledge with technology. Participant 2 used computer technology in the study only occasionally for consumption purposes, especially when the diagrams related to the notes on paper were needed. The participant referred back to the lecture slides on the university Blackboard site. Participant 4, however, tried to search materials for the assignment on Google. Participant 3 did not involve computer technology in the study, so there was no consumption activity recorded.

Table 4.16:

Consuming knowledge without technology for each participant

Participant	Consuming Knowledge without Technology
Participant 1	12.48%
Participant 2	45.84%
Participant 3	30.73%
Participant 4	11.09%

Table 4.16 illustrates that all four participants consumed knowledge without the involvement of computer technology (e.g., the use of paper-based approaches). Participants 1 and 4 referred to their handwritten notes from time-to-time when trying to complete their course work. Participant 2 ranked the highest in this category. This participant was doing revision from textbooks and making notes on paper. Participant 2 relied extensively on paper-based approaches and was more a consumer than a producer of knowledge. Although participant 3 relied purely on paper-based approaches for study, the concentration was not as high as participant 2 and thus the percentage of knowledge consumption was not as high.

The findings from this behavioural trait are summarised in Tables 4.17 and 4.18 below.

Table 4.17:
A summary of each participant's production and consumption of knowledge

Participant	Production	Consumption
Participant 1	26.74%	59.28%
Participant 2	5.35%	73.21%
Participant 3	61.11%	15.37%
Participant 4	30.56%	15.48%
Total Average	**30.94%**	**40.84%**

Table 4.18:

A summary of each participant's production and consumption of knowledge with/without technology involvement

Participant	Production		Consumption	
	with Technology	without Technology	with Technology	without Technology
Participant 1	49.32%	4.15%	46.80%	12.48%
Participant 2	00.00%	10.69%	27.37%	45.84%
Participant 3	00.00%	61.11%	00.00%	30.73%
Participant 4	44.66%	88.91%	19.87%	11.09%
Total Average	**23.50%**	**41.22%**	**23.51%**	**25.04%**

In short, the second behavioural trait showed a higher percentage in both processes of production (41.22% as opposed to 23.50% - see Table 4.48) and consumption (25.04% as opposed to 23.51% - see Table 4.18) of knowledge when the students were studying without the involvement of technology.

In summary, the Dataset-2 (Cohort Behavioural Data) analysis reveals:

1. the high non-academic use of personal computers in undergraduate students' actual studying practice (see Table 4.11).
2. that consumption activity is more active compared with production activity in students' general daily studying habits (see Table 4.17).
3. that the production and consumption of knowledge is more active when there is no involvement of technology (see Table 4.18). In other words, paper-based approaches are preferred by students while studying.

Dataset-3: Local and International Data

This dataset displays the extent to which computer technology plays a role in undergraduate academic practice and how it is used by students in both local and international contexts, based on self-report data. As outlined in detail in section 'Dataset-3: Local and International Data' in Chapter 3, Dataset-3 comprises two local studies at the University of Otago (Online Survey 2009 and ITS Survey 2012) and five international studies conducted by EDUCAUSE (2009-2012). The results from the two local studies and the five international studies (both individual and combined data) are summarised as Academic vs Non-academic in Table 4.19 and as The process of production and consumption of knowledge in Table 4.20.

Dataset-3 - Local Survey Data, Source 1

The Otago Online Survey was carried out by HEDC at the University of Otago in 2009 and it consisted of 18 questions. Only data relevant to this study was extracted and used for analysis.

Question 3: Using technology is a really important part of my learning at university

All the participants who answered this question agreed that technology plays an important role in their university learning.

Question 4: The best way to describe myself in regard to technology use

Fifty-one percent of the participants who answered this question regarded themselves as followers rather than adopters (34%) when it comes to new technologies. Only two thought they were sceptical of new technologies.

Question 6: Rate of ability to use technology

Eighty-nine percent of the participants who answered this question regarded themselves as average to expert technology users. Only 4% thought they were not very skilled.

Question 7: Rate of skill level for common use of technologies

An average of 39.78% of the participants regarded themselves as fairly skilled in all the technological aspects listed, except for the specific use of graphics software, such as Photoshop and Flash.

Question 8: Use of software programmes for academic work

Ninety-eight percent of the responses showed that software programme(s) were used by students for their academic work.

Question 10: Purposes of using software programmes

As the majority of the software programme users were using Microsoft Office, the top-ranked tasks they undertook were processing words (94%), composing essays and/or assignments (91%), working with data (85%), doing presentations (83%) and making diagrams (74%).

Question 12: Use of websites for academic work

All the participants who answered this question agreed that they used websites for academic work.

Question 13: Websites used for academic work

The responses revealed that the majority used Blackboard (97%), library databases (89%), Google (85%), the library online catalogue (85%) and Wikipedia (82%) for their academic work. No one used Unitube but there were many other sites listed as academic-use websites.

In short, students said that technology plays an important role in their higher education study. Nevertheless, most of them also claimed that they were followers in using technology. Almost all of them considered themselves at least fairly skilled users in common applications. The most popular software application for studies was Microsoft Office, as it assisted the students to process words and compose essays and/or assignments. All respondents said that they were website users when it came to study and the top three ranked sites for this aspect were Blackboard, the Library and Google.

Dataset-3 - Local Survey Data, Source 2

The ITS Survey carried out in 2012, consisted of 15 questions. The data was extracted from the full data set according to its relevance to this study for analysis. A summary of that data is now presented.

Students' access to the Internet at their residence: There was a dramatic increase in the percentage of students' accessing the internet off-campus from 2002 to 2005 and from 2008 to 2009. In 2011, 97.60% of the students had access to the internet from their place of residence.

Student Internet Connection Type: It is clear that broadband has been replacing dial up since 2007. The data showed that 99% of the students have broadband access in 2012.

Student Laptop, Desktop, and/or Tablet ownership: The ownership of laptops increased every year until 2011 when there was also an increase in tablet ownership. On the other hand, desktop ownership has been decreasing since 2010. In 2012, 96% of the students own a laptop.

In short, almost every student owns a laptop and has a broadband internet connection at their residence.

Combined Results-Analysis: Dataset-3 - Local Survey Data, Source 1 and Source 2

The findings from the two local sources are summarised in Table 4.19 below.

Table 4.19:

A summary of two local sources for academic and non-academic work

Sources	Academic	Non-academic
Source 1	• agree technology plays an important role in university learning • majority are at least fairly skilled users in common applications • software programme(s) and websites are used for academic work	
Source 2	• high personal computer ownership	

Table 4.20:

A summary of two local sources for the aspect: The process of production and consumption of knowledge

Source	Production	Consumption
Source 1		• majority use Blackboard (97%), library databases (89%), Google (85%), library online catalogue (85%), and Wikipedia (82%) for academic work
Source 2	• Microsoft Office is the top-ranked software programme used for processing words (94%) and composing essays and/or assignments (91%)	• broadband internet access from residence

In summary, the local (self-reported) survey data revealed:

1. a recognition of the necessity of computer technology in undergraduate student life (i.e., high personal computer ownership and internet access from residence; majority are at least fairly skilful in using computer technology) (see Table 4.19).
2. the trend of using client-side software programmes (e.g., Microsoft Office) for production of knowledge and using browser-based services (e.g., Blackboard and Google) for consumption of knowledge (see Table 4.20).

Dataset-3 - International Survey Data

Five international studies undertaken between 2009 and 2012 were chosen from EDUCAUSE literature, based on their relevance to this study. Only related data were extracted from each of these five studies and summarised as in Tables 4.21 to 4.25 below. Each table presents a summary of the selected study, including its title, author, research aims, research methods and key findings.

Table 4.21:

The ECAR Study of Undergraduate Students and Information Technology, 2009

Author(s)	Shannon D. Smith, Gail Salaway and Judith Borreson Caruso
Research aim	To examine undergraduate students' experience in using Internet-capable handheld devices as their appearance could have a significant impact in higher education
Method(s)	Literature review, web-based quantitative survey, student focus groups, student comments, and a comparison of longitudinal data from 2006 to 2009 surveys
Finding(s)	- Library website and video sites are the top IT use and internet use. - Students are using technologies but not necessarily for academic reasons. - All the respondents self-reported as internet-savvy users especially in searching internet and using presentation software, spread sheets, course and learning management systems, or college/university library websites. - 70.4% of respondents think IT use in course has positive impacts and about half of the respondents agree that IT improves their learning or prepares them for work.

Table 4.22:

The ECAR Study of Undergraduate Students and Information Technology, 2010

Author(s)	Shannon D. Smith and Judith Borreson Caruso
Research aim	To take a closer look at cloud based (specifically, web-based) applications and resources based on students' assessments of their own technical skills and their opinions on the use and effectiveness of IT
Method(s)	Literature and survey review; web-based quantitative survey; student focus groups; student comments; a comparison of longitudinal data from 2007 to 2010 surveys
Finding(s)	1. Students' view on their own technology adoption and information literacy - 49% of respondents identified themselves as mainstream adopters and 81% of respondents considered themselves expert or very skilled in searching Internet

	2. Student ownership and use of technology - 89% own either a laptop or a netbook - More than 94% used their institution's library website for school, work, or recreation, 90% of respondents used presentation software and course or learning management systems, and more than 85% used spread sheets - 42% contributed to video sites, 40% updated wikis, and 36% were blog users 3. Social Networking - The percentage of students who have used SNS increased for all age groups above 18 e.g. Facebook users contributed over 96% - Reasons for social networking: Stay in touch with friends (96%), share photos, music, videos, or other work (72%) 4. Technology use for academic purposes - 36.2% used web-based word processer, spread sheet, presentation, and form applications (53% used it to collaborate in academic work) - 33.1% used Wikis (30.7% collaborated on the Wiki for academic work) - 29.4% accessed SNS (49.4% applied SNS in academic work) - 70% of respondents agreed that IT makes doing course activities more convenient and about half of respondents agreed that IT use improves learning - Half of respondents agreed that they were adequately prepared to use IT as needed in their course when they entered college/university and slightly fewer than half agreed that the IT they had used in their courses will have adequately prepared them for workplace - 55-60% of respondents preferred a moderate amount of technology use in course

Table 4.23:

ECAR National Study of Students and Information Technology in Higher Education, 2011

Author(s)	Eden Dahlstrom, Peter Grunwald, Tom de Boor, Martha Vockley
Research aim	1. Assess students' technology ownership and use 2. Explore how effectively instructors and institutions are using technology 3. Understand students' technology skill level 4. Gauge students' technology perceptions, attitudes, and preferences
Method(s)	3,000 students at 1,179 colleges and universities provided a nationally representative sample of students
Finding(s)	1. Students rely on more traditional devices 2. Students recognise major academic benefits of technology - 85% of laptop owners used them for academic purposes (96% of the respondents used word processors, 88% used college/university's library website, 85% used presentation software, and 83% used spread sheets) - 82% recognised technology as information producer and 80% agreed that IT makes it easier to track academic progress - Technology as communication tool for school or personal purposes: 99% are email users, 93% preferred text message, 90% used Facebook, and 85% accessed web-based videos and Wikis respectively - Website preference for academic benefits: Google 36% followed by Wikipedia 11% - Technology skill level: 85% of the respondents were skilful in word processing, 73% were skilful in accessing college/university's library website, 68% were skilful at using course or learning management system and presentation software respectively

Table 4.24:

Connecting Student Data from ECAR and CDS, 2011

Author(s)	Eden Dahlstrom
Research aim	To investigate student technology access and ownership from both student and CIO perspectives in order to consider to what extent and how students' viewpoints are involved in governance of IT issues and dive deeper into student sentiment about technology in higher education
Method(s)	Integrate selected data from the 2010 Core Data Service (CDS) survey results with selected results of the ECAR National Study of Students and Information Technology in Higher Education, 2011 (ECAR Student Study)
Finding(s)	98% undergraduate students reported owning a computer (laptop or desktop) with 87% of them owning a laptop 84% of respondents agreed that technology is worth the investment when used well and 75% think technology is an essential part of the college experience

Table 4.25:

Case Study 21, 2012

Author(s)	Brad Wheeler and Nik Osborne
Research aim	To study the use of e-texts and other digital-learning materials
Method(s)	Two-year pilot project: - 2009: an initial assessment at Indiana University (IU) on twenty high-enrolment courses (738 respondents out of 1037 students) to gather quantitative information about the cost of textbooks for students - Early eText Pilot Study (system logs for 1726 students) - 2011: pilot study at IU with agreements and a model
Finding(s)	About 60% of the respondents preferred e-texts to print but 55% said they read fewer of the e-texts than they would have from a printed text

Combined Results-Analysis: Dataset-3 - International Survey Data

The findings from the five international studies are summarised in Tables 4.26 and 4.27 below.

Table 4.26:

A summary of five international studies for academic and non-academic work

Source	Academic	Non-academic
2009	• IT use in course has positive impacts • IT improves learning or prepares for work	• video sites are the top IT use • technologies are not necessarily for academic purposes
2010	• high ownership of laptop or netbook • IT makes doing course activities more convenient and improves learning • 50% are adequately prepared to use IT • 55-60% prefer a moderate amount of technology use in course	• 42% contributed to video sites • Facebook use over 96% to stay in touch with friends
2011 a	• students rely on more traditional devices • high laptop ownership (89%) • agree IT makes easier academic progress	• technology as information tool: 99% email users and 90% Facebook users
2011 b	• high laptop ownership (87%) • 84% think technology is worth the investment and it is essential for college experience	
2012	• 55% prefer reading more from printed text	

Table 4.27:

A summary of five international studies for the aspect: The process of production and consumption of knowledge

Source	Production	Consumption
2009	• savvy in using presentation software, spread sheets, course and learning management systems, or college/university library websites	• library website is the top internet use • savvy in searching internet
2010	• 90% use presentation software • 36.2% use web-based word processor, spread sheet, presentation, and form applications to collaborate on academic work	• expert or very skilled in searching Internet • 94% use library website and 90% use course or learning management systems
2011 a	• high use of word processors (96%) and 85% are skilful in word • 85% use presentation software and 83% use spread sheets	• high use of library website (88%) and 73% are skilful in it • 82% recognised technology as information producer • website preference: Google 36% and Wikipedia 11%

In summary, the international (self-reported) survey data reveals:

1. a general agreement on the importance and benefits of computer technology in undergraduate study in conjunction with high ownership of personal computers (see Table 4.26).
2. the fact that students are adequately skilled to use common client-site software programmes (i.e., word processor, presentation software, and spread sheets) and browser-based services (i.e., library website and course and learning management systems) for academic work (see Table 4.27).
3. the trend towards recognising technology as an information producer (e.g., searching internet) and for non-academic use (e.g., email, Facebook and video sites) (see Table 4.27).

4. the preference of students for paper-based approaches (i.e., reliance on traditional devices, preference for reading from printed text and preference for a moderate amount of technology use in their course) (see Table 4.26).

Dataset-3: Summary of Results-Analysis

The findings from local (Sources 1 and 2) and international data are summarised in Tables 4.28 and 4.29 below.

Table 4.28:

A summary of dataset-3 for academic and non-academic work

Sources	Academic	Non-academic
Local	• agree technology plays an important role in university learning • majority are at least fairly skilled users in common applications • software programme(s) and websites are used for academic work • high personal computer ownership	
International	• IT use in course has positive impacts: improves learning or prepares for work, makes doing course activities more convenient, makes easier academic progress • high ownership of laptop or netbook • 50% are adequately prepared to use IT • 55-60% prefer a moderate amount of technology use in course • students rely on more traditional devices • 84% think technology is worth the investment and it is essential for college experience	• video sites are the top IT use • technologies are not necessarily for academic purposes • technology as information tool: 99% email users and 90%-96% Facebook users (96% - stay in touch with friends)

	• 55% prefer reading more from printed text	

Table 4.29:

A summary of dataset-3 for the aspect: The process of production and consumption of knowledge

Sources	Production	Consumption
Local	• Microsoft Office is the top ranked software programme used for processing words (94%) and composing essays and/or assignments (91%)	• majority use Blackboard (97%), library databases (89%), Google (85%), library online catalogue (85%) and Wikipedia (82%) for academic work • broadband internet access from residence
International	• savvy in using presentation software (85-90%), spread sheets (83%), course and learning management systems, or college/university library websites • high use of word processors (96%) and 85% are skilful in word • 36.2% use web-based word processor, spread sheet, presentation and form applications to collaborate for academic work	• library website is the top internet use (73% are skilful in it) followed by course or learning management systems • savvy in searching internet • 82% recognised technology as information producer • website preference: Google 36% and Wikipedia 11%

To conclude, the local and international studies based on self-reported data reveal:

1. the significant role of the personal computer in undergraduate study and the recognition of its role in academic work (e.g., high ownership of personal computers) (see Table 4.28).
2. that students are skilful in using common client-site software programmes (i.e., Microsoft Office) for production of knowledge and browser-based services (i.e., internet searching) for consumption of knowledge (see Table 4.29).

3. that students favour paper-based approaches (e.g., prefer printed texts) and using computer technology for non-academic work (e.g., Facebook) in their daily studying lives (see Table 4.28).

Analysis of Themes

As outlined in the above discussion, Dataset-1 (Computer Activity Data) provided detailed information on students' accessing of software applications, websites and documents throughout their first six weeks of semester one in 2012, while Dataset-2 (Cohort Behavioural Data) illustrated the ways in which students interacted with computer technology during their private studying time in 2009. In addition, Dataset-3 (Local and International Data) served as a prompt by providing relevant evidence on the role and importance of personal computers in undergraduate study, based on both local and international contexts. The grounded categories/traits that emerged from the analysis of each dataset inter-defined and inter-wove with one another and evolved into the three generated themes described below.

Theme-1 compares students' use of computer-based and paper-based approaches as they study. This theme serves to highlight the extent to which students were using computer-based and/or paper-based practices to support their undergraduate learning.

Theme-2 focuses on the processes of production and consumption of knowledge in students' daily study practice in conjunction with the use of computer technology. This theme draws attention to whether undergraduate study is more directed to producing or consuming knowledge, especially when it is outside the formal instructional context. In conjunction, the theme highlights processes related to the role of personal computers in undergraduate study today.

Lastly, theme-3 explores the gap between students' self-reports (report of computer usage in the questionnaire) and their actual use of computer technology (computer activity logs) as part of their undergraduate study, as well their degree of computer literacy in daily academic practice. Apart from uncovering students' non-academic use of computers, this theme emphasises the extent to which students use personal computers to support academic study and whether that use aligns with their academic use in terms of extent and capability.

Theme-1: Computer-based Approach vs Paper-based Approach

Findings from the analysis of Dataset-1 showed the low and limited use of academic software in students' daily study over the first six weeks of semester one. Microsoft Office, which was ranked the highest, only records a usage of 7.18% on average (as mentioned in the section 'Computer Activity Data' under Dataset-1: Computer Activity Data in this chapter). This is consistent with what emerged from Dataset-2 which recorded minimum computer technology use but high use of paper-based approaches for participant 2 and no use of computer technology for participant 3 (see Table 4.11). According to participant 3:

> I find like I have a specific method when I'm taking notes which wouldn't work so much if I was trying to type it out like I sort of draw lots of arrows with connections between what's being said and I couldn't do that with typing.

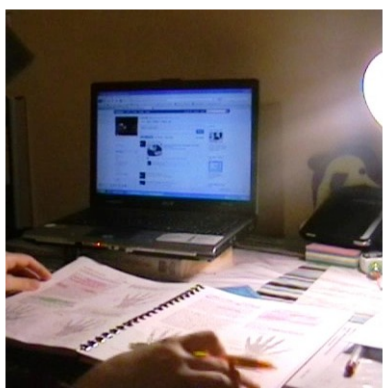


Figure 4.1: Relationship between the area dedicated for paper-based resources and the position of laptop in the studying area[2]

As shown in *Figure 4.1* above, participant 2 applied paper-based approaches (read from text books and made notes with pens) when studying. Her laptop was sitting to one side with a

[2] Consent was granted by participants for the use of the film files for research purpose

Facebook page on the screen. Her study area was dominated by paper-based resources including diary, papers, books, sticky posts and other stationery.

Even though participants 1 and 4 in dataset-2 used computer technology in their studies, there was a mixture of computer technology usage and paper-based approaches (see Table 4.11). Their main application usage was Microsoft Word, but they treated it as a typewriter rather than a text producer. Both of them typed out the assignments based on pre-written drafts on paper. Participant 2 commented that she would type the assignment, print it out, edit it on paper, and retype everything if there were a lot of changes to be made. As for participant 3, he said he only used Blackboard and email when he was studying and only for administrative tasks. He would check Blackboard to see if there was any new lecture material or if there were any notices regarding classes being cancelled or changed. He felt obliged to reply to email received. The only actual academic software he used for studying was as part of the compulsory activity required by the course: a database tutorial through Lexus, which he considered to be a "good" research tool for his studies. Other than that, he had no involvement with computer technology when he was studying.

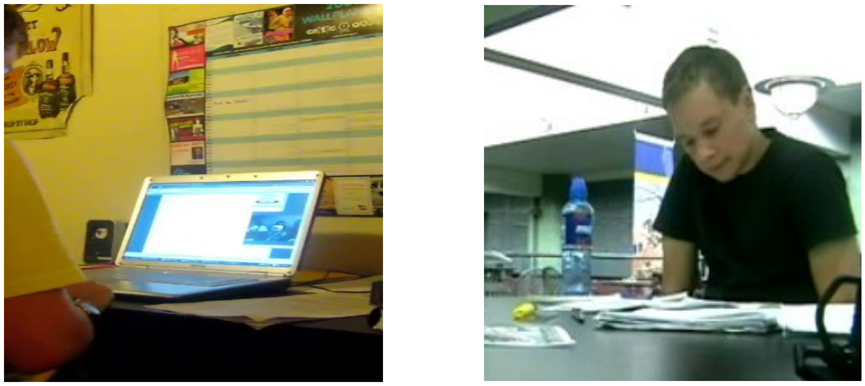
Surprisingly, the self-reported findings from three of the international studies in Dataset-3 also suggested that

- 55-60% of the students prefer a moderate amount of technology use in their courses;
- the majority of the students rely on more traditional devices;
- the majority thinks that technologies are not necessary for academic work; and
- 55% of the students prefer reading from printed, paper-based text.

These results align with the findings generated from the two main cohort datasets (Datasets-1 and 2) in this study.

Theme-2: Production Activity vs Consumption Activity

In Dataset-2, the filming revealed that there was an overall high rate of consumption activity during the students' studying sessions, regardless of whether there was involvement of technology (see Table 4.17). As shown in *Figure 4.2* below, participant 4 (on the left) searched information on Google in order to complete his assignment, whereas participant 3 (on the right) retrieved knowledge from paper-based sources.



Figures 4.2: The process of consuming knowledge with and without technology[3]

Compared with consumption activity, the production activity for academic work was very limited, as shown in the filmed clips. This is consistent with what was interpreted from the list of computer activities in Dataset-1. The list revealed that Microsoft Office was the most widely used client-side software programme for the students' production activity (average of 7% - as mentioned in the section 'Computer Activity Data' under Dataset-1: Computer Activity Data in this chapter).

In this case, findings from Dataset-3 differed from the findings of Datasets-1 and 2. The filtered findings from both the local and international studies indicated students' self-reported computer use as below.

For client-side software programmes,

- Microsoft Office is the top-ranked software programme used for word processing (94%) and composing essays and/or assignments (91%);
- the majority of the students are savvy in using presentation software (85-90%) and spreadsheets (83%); and
- there is a high use of word processors (96%).

[3] Consent was granted by participants for the use of the film files for research purpose

For browser-based services,

- the majority use Blackboard (97%), library databases (89%), Google (85%), library online catalogues (85%) and Wikipedia (82%) for academic work;
- the majority website preferences are: Google (36%) and Wikipedia (11%); and
- 82% of the students recognised technology as an information producer.

In contrast with the findings of the analysis of Datasets-1 and 2, these results imply that students actively use computer technology in their academic practices for either production or consumption purposes.

Theme-3: Self-Reports of Practice vs Actual Practice

Figures 4.3(a) and *4.3(b)*, below, show the comparison between students' reports (Question 3 in the questionnaire) and actual practice (computer activities) of their computer use for academic and non-academic use from Dataset-1. In Dataset-1, half of the students reported that they either struck a balance of computer technology use between academic and other aspects of life (non-academic use), or that they tended more towards academic use (see also Table 4.2). However, in their actual practice, the computer activity data showed that 17 out of 18 of the students used computer technology 80%-90% more in other aspects of life (non-academic use) than in academic work (see also Table 4.3).

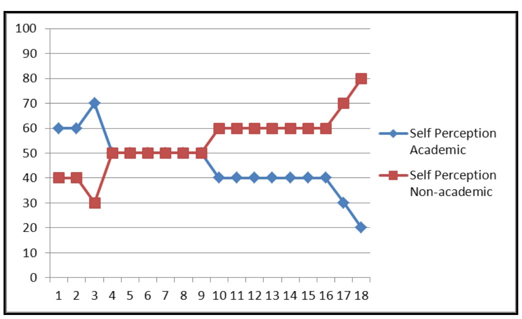


Figure 4.3(a): Self-perception

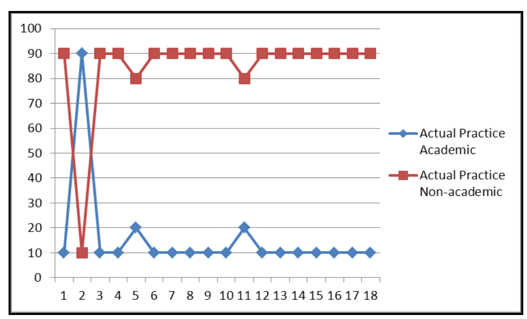
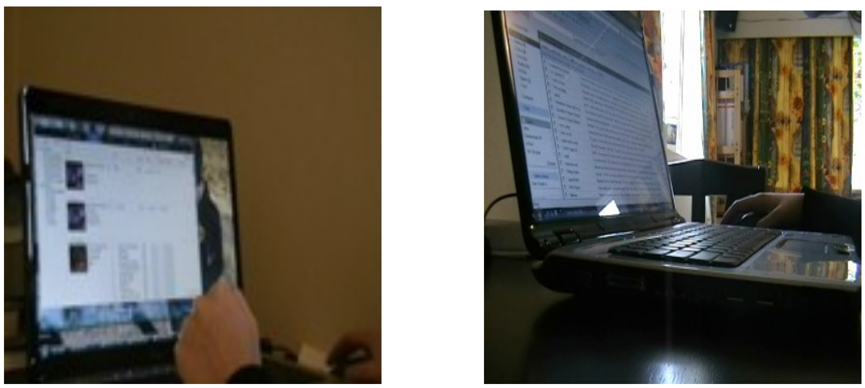


Figure 4.3(b): Actual practice

The findings show a considerable disparity between what students think they are doing (*Figure 4.3a*) and what they are actually doing when it comes to computer usage (*Figure 4.3b*). While most of them reported that their use of computers was predominately for academic purposes (the red line in *Figure 4.3a*), the computer activity data of actual use revealed the reverse (the red line in *Figure 4.3b*). This is supported by Dataset-2, which showed how low the Academic Work rate was concerning students' actual practice (see Table 4.4). Academic Work with Technology recorded only 35.44% on average among the students (see Table 4.11). Non-academic Work with Technology seems to be more popular among the students (see Table 4.8). As shown in *Figure 4.4* below, participant 1 played around with music/songs on Window Media Player (as in the illustration on the left) and checked her email on the Gmail website (as in the illustration on the right) more frequently than doing her academic work during her studying sessions.



Figures 4.4: Non-academic work with technology[4]

In terms of computer literacy, the findings from Datasets-1 and 2 indicated that all the participants reported themselves as computer savvy (see the section 'Participant Selection Data' in Datasets-1 and 2 in this chapter). Nevertheless, the narrow range of computer activities established in Dataset-1 suggested limited computer skills, especially where aspects of academic use was concerned. As mentioned in the section 'Computer Activity Data' under Dataset-1: Computer Activity Data in this chapter, the top three software applications used for academic purposes were Microsoft Office (7.18% on average), Window Explorer (4.92% on average), and Adobe/Foxit Reader (3.48% on average). It is interesting to note that usage of all three was under 10% and did not require high computer skill. The outcomes of the analysis of Dataset-2 (auto videographical filming; see Tables 4.11 and 4.18) demonstrated a similar phenomenon, where all participants showed limited skill in computer usage for academic purposes.

[4] Consent was granted by participants for the use of the film files for research purpose

An example of the limited skill in using software applications is provided in *Figure 4.5*.

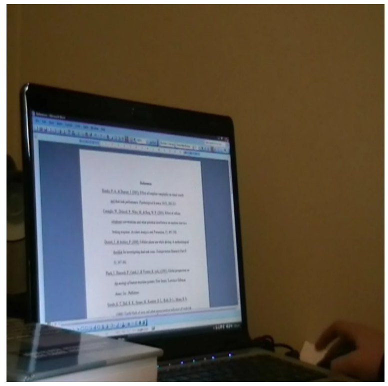


Figure 4.5: Typing references one-by-one on Microsoft Word[5]

Figure 4.5 above shows participant 1, who is using Microsoft Word, typed references for an assignment one by one, instead of using a software programme such as Endnote. She said, "I'm just doing my psychology assignment … first of all I'm going to compile a list of references just using Microsoft Word ……" As she proceeded, she repeatedly deleted what she had typed as she made errors, and the productivity rate was quite low. She commented about her expectations of the process before she started typing, "This is probably going to take me ages". In the process, she said, "This is really time consuming"; "This is boring"; "God that is so annoying"; and "I've done this so many times I've just memorised reference lists". The film showed that she took more than one hour to finish one page of references.

The low computer literacy shown in the typing of the references example appeared in the administrative aspects of the participants' academic use of computer technology as well. As shown in the *Figure 4.6*, below, participant 1 had to print out a calendar in order to complete a schedule using Microsoft Outlook.

[5] Consent was granted by participants for the use of the film files for research purpose

Figure 4.6: Matching printed calendar with Outlook calendar[6]

At the same time, although Dataset-3 was self-report data, it aligned with Datasets-1 and 2 in showing the disparity between the students' self-reports as computer savvy and/or computer users in academic work and their perceived actual use of computer technology for study. The relevant findings are stated below.

Self-reports as computer savvy and/or computer users in academic work:

- the majority perceive themselves as being at least fairly skilled users in common applications;
- there is a high personal computer ownership and broadband internet access from their places of residence among undergraduate students; and
- 50% are adequately prepared to use IT before entering university.

Self-perceived use of computer technology for study showed that:

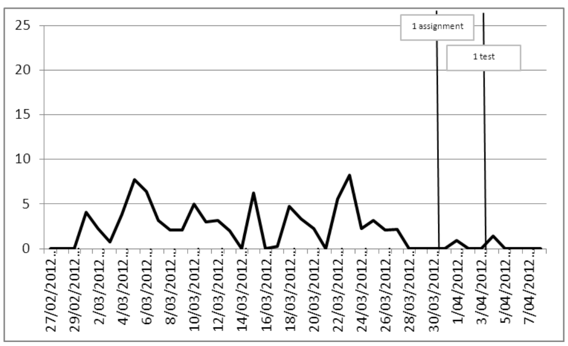
- technology is treated as an information tool: 99% email users and 90%-96% Facebook users (96% - stay in touch with friends); and
- video sites are the top IT use before any other client-side or browser-based academic software programmes.

The students' self-perceived non-academic use contradicts the students' perceived actual use (either client-side software programmes or browser-based services) for their study although it aligns with the findings generated from Datasets-1 and 2 of this study.

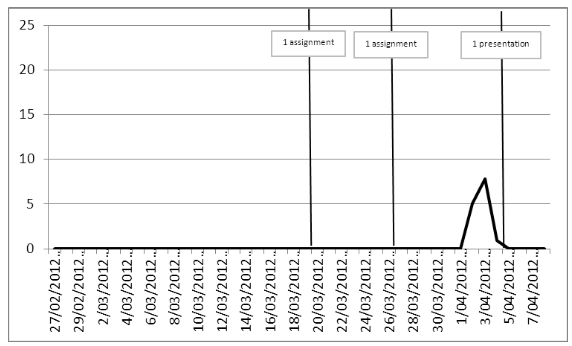
[6] Consent was granted by participants for the use of the film files for research purpose

Interesting Mapping Exercise

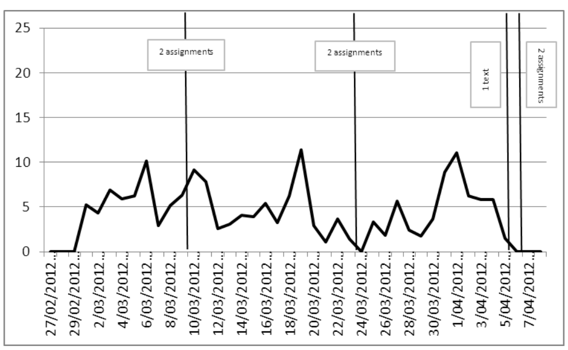
As declared in the section 'Interesting Mapping Exercise' in Chapter 3, an unexpected finding emerged from the analysis of Dataset-1. Using the computer activity data (Dataset-1) collected from 18 participants' personal computers, the total overall daily computer use (this included both Academic and Non-Academic Use) was matched over time with their academic course use (e.g., schedule of course assignments). 14 of the participants engaged in both Academic and Non-academic activity, while four did not have any academic course demand over the participation period. *Figure 4.7*, below, shows the match between each student's course period by week with the various course demands throughout the first six weeks of semester one.



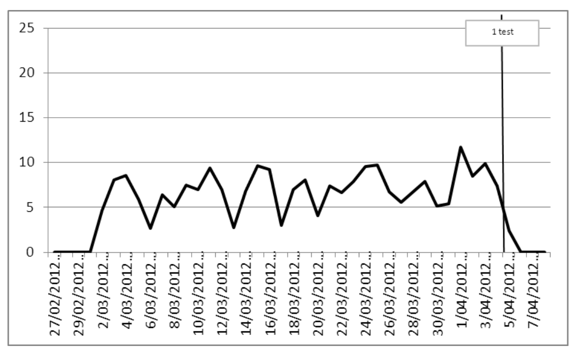
Participant-1



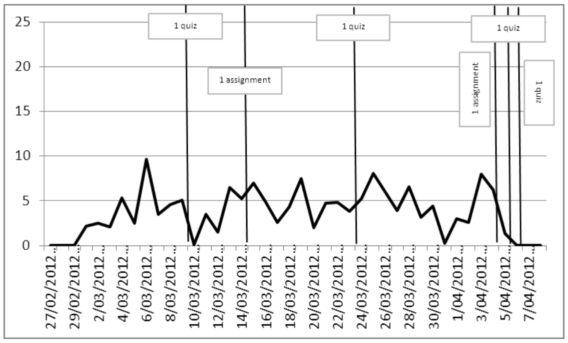
Participant -2



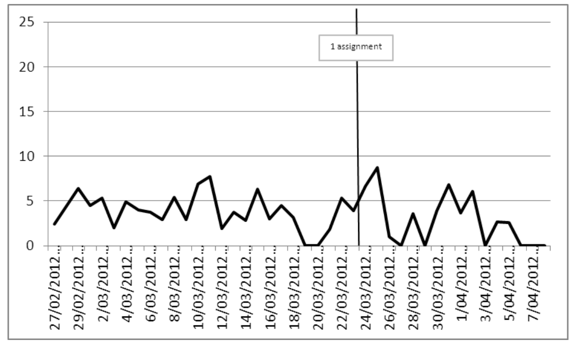
Participant -4



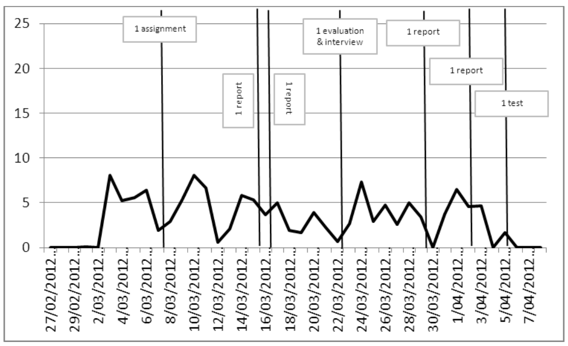
Participant -5



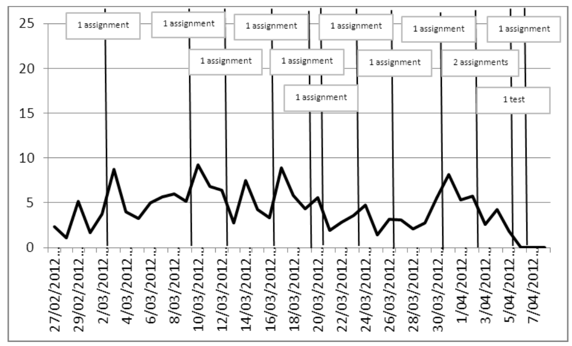
Participant -6



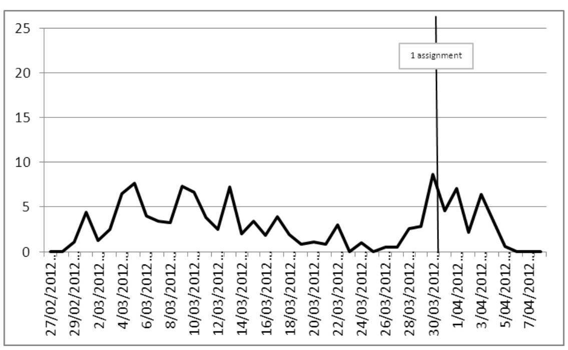
Participant -7



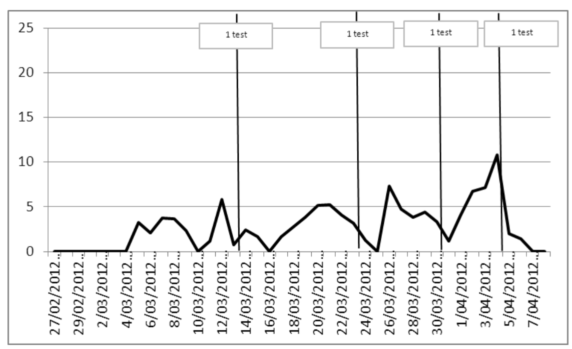
Participant -8



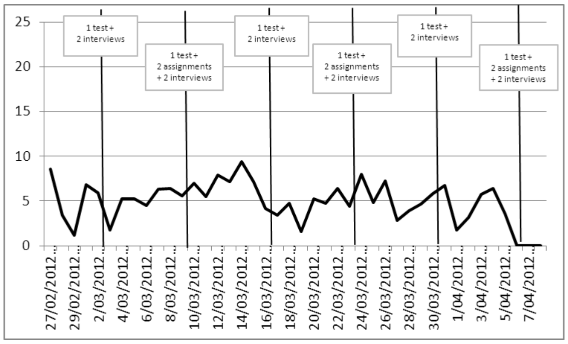
Participant -10



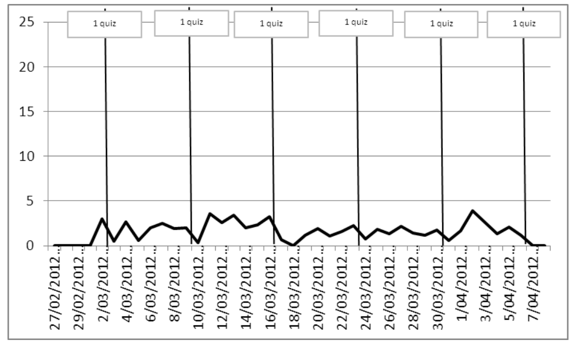
Participant -11



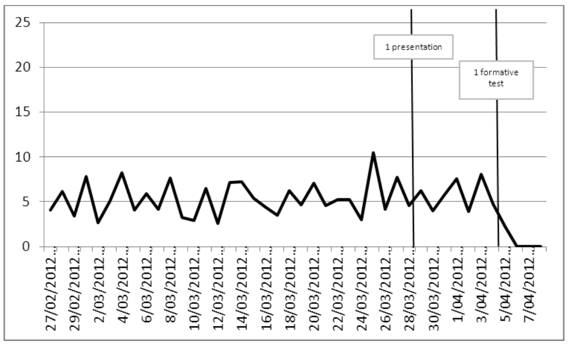
Participant -12



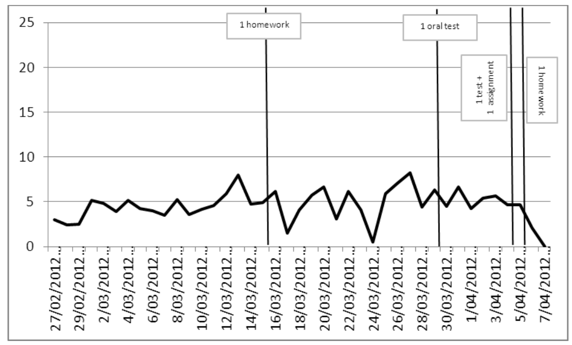
Participant -14



Participant -15



Participant -17



Participant -18

Figures 4.7: The actual practice of the participants over the first six weeks of semester one

While there appears to be the odd match between computer use and study task(s) date in some of the graphs, the degree of misalignment is substantial, as shown in Table 4.30 below.

Table 4.30:

Computer activity alignment with course demands

Participant	No of alignments	Non-alignment
1	2	1
2	3	0
3	0	0
4	4	1
5	1	0
6	6	2
7	1	1
8	7	4
9	0	0
10	12	7
11	1	0
12	4	1
13	0	0
14	6	3
15	6	0
16	0	0
17	2	1
18	4	0

As shown in Table 4.30, the alignment rate is low. In the case of five participants (participants 2, 5, 11, 15, and 18), there is no alignment at all. Participants 4, 6 and 12 had less than 50% alignment between their computer usage and academic schedule. Only participant 7 achieved alignment.

Conclusive Findings

With the contraposition between two main cohort datasets (Datasets-1 and 2) and the supported data derived from both local and international studies (Dataset-3), as well as the comparison of interesting mapping between computer activities and study period, a summary of the findings is listed below based on the three main themes and the mapping exercise.

1. *Computer-based vs Paper-based Approaches:* Students preferred to work in a paper-based manner where possible. The routine behaviour of transferring digital to print was more prevalant than had been expected.

2. *Production Activity vs Consumption Activity*: Students produce and consume more knowledge when studying without the involvement of technology, which means paper-based approaches are favoured.

3. *Self-Reports of Practice vs Actual Practice:* Students' use of computer technology and computer literacy in their academic activities is actually less and more limited, than they self-reported.

4. *Computer Activities vs Study Period*: Students' computer use presents a low alignment with their academic course demands (e.g., assignment due dates) but the use shows a sudden increase just after the academic course demand key dates rather than prior to them. The pre-assignment spikes of computer activity are likely to be recreational use, where the computer is used as a form of procrastination in students' academic practices.

5. *Dataset-3 vs Datasets-1 and 2*: Apart from the theme "Computer-based vs Paper-based Approaches" where similar findings were found in all three datasets, the findings from Dataset-3 were different to the findings of the analysis of Datasets-1 and 2. For the theme "Production Activity vs Consumption Activity", the findings from Dataset-3 show that students actively use computer technology in their academic practices for either production or consumption purposes, which was opposite from findings of Datasets-1 and 2. As for the theme "Self-Reports of Practice vs Actual Practice", the findings in Dataset-3 present a conflicting result. The students' self-perceived, non-academic use contradicts the students' perceived actual use (either client-side software programmes or browser-based services) for their study, although it aligns with the findings generated from Datasets-1 and 2 of this study.

Summary

This chapter displayed the findings from each dataset in detail and provided a comprehensive analysis across the three themes generated from the findings as well as the results developed from the interesting mapping exercise. It concluded with the key findings of this study. The discussion chapter (Chapter 5) follows.

Chapter 5: Discussion

Introduction

As computer technologies become increasingly sophisticated and ubiquitous, understanding the extent to which students integrate these technologies into their study practice is essential (Butson & Thomson, 2011). Nevertheless, there has been little research to date that explores students' first-hand experiences of using new technologies to support their academic practice (Sharpe et al., 2005). The primary endeavour in regard to this investigation was to situate the data collection as close as possible to students' daily studying practices with their personal computer. Three datasets (Computer Activity Data, Cohort Behavioural Data, as well as Local and International Data) were created in this study. The core findings from each of these datasets then contributed to the development of the three main themes, namely Computer-based vs Paper-based Approaches, Production vs Consumption Activity and Self-Reports vs Actual Practice. This chapter discusses the findings from each of the datasets followed by a discussion of the three themes that emerged from the data. I close with a conclusion.

Datasets

The Computer Activity Data (Dataset-1), the data automatically generated on the students' laptop as a result of their daily use, showed a significant difference between the students' use of client-side software applications (low use) and browser-based services (high use) – see Table 4.2. This would suggest that undergraduates are less reliant on the various software applications installed on their laptops than they are on the browser to access the World Wide Web.

This data also showed that daily, non-academic use of their personal computers was significantly higher compared with their academic use (see Table 4.3). Given the high level of belief and confidence expressed by the participants regarding the importance of computer technology in higher education (see Appendix 5), I would have expected them to be avid users of both client-side software and web-based services for academic use. Instead, the data showed that a dominant use of personal computers by these undergraduate students is for socialising (social networks, such as, Facebook, and email), personal web services (Trade Me and online banking) and entertainment (YouTube, music and movies). The low level use of academic-related software/web services compared with non-academic use sends a clear message that for these 'computer savvy' third year students, personal computers were not as crucial to their academic study as I had expected or as current research has argued (Dataset-3, Local and International Data).

This may not be surprising given the finding that students preferred a non-digital or paper-based approach when studying. The dominance and reliance on paper-based approaches, as revealed in the film clips (Dataset-2, Cohort Behavioural Data), certainly raises questions about assumptions often made about students' level of computer literacy in higher education (Dataset-3, Local and International Data). Similar to the participants in Dataset-1, Computer Activity Data, the student cohort involved in the behavioural data recognised themselves as being 'computer savvies' as well as reliant on computer technology to advance their studies. An analysis of both Computer Activity and Cohort Behavioural Data, however, revealed that the participants exhibited only rudimentary awareness and skills concerning the capabilities of their computers to enhance their academic work (e.g., file management, bibliographies, planning, word-processing, databases, and analytical packages). The video data showed that the participants were very inexperienced users of these technologies in their academic pursuits. For example, one participant had no idea how to reference (Dataset-2, Cohort Behavioural Data). Talking aloud, that participant stated, "I'm going to try and find someone [Google and University Library Site] that can tell me how to reference an edited book from a conference so that shouldn't be hard." In terms of using the university website, the comment was made, "I don't often look for books in this catalogue [university library catalogue] so I'm a bit bad at it". At the same time, another participant disclosed that they found the learning management system (Blackboard) difficult to use and only accessed it whenever they missed classes. These experiences reveal an aspect of student awareness/limitations regarding academic-orientated technologies use that I did not expect.

While the findings showed that computer technology has a dominant place within students' daily lives outside their studies, they did not show that these practices have found their way into academia (Cowan, 2011). Claims such as 'I love IT, IT is my life, my laptop is my life, without IT I would be a very unhappy person, IT allows us to do so many things, and those of us who are natural at it would not be the same without it' (Smith & Caruso, 2010) could have led us to the assumption that students' computer literacy in academic practice is high. However, the video and audio data captured in this study (Dataset-2, Cohort Behavioural Data), while supporting these claims concerning non-academic use, do not support this view in relation to academic use.

The findings also showed that the students used their personal computers to source information (consumption activity) more for non-academic purposes than academic ones. Even more remarkable was that these students appeared to use their personal computers to create material (production activity) more in non-academic than academic contexts. For example, regarding the academic use of personal computers in terms of information searching (consumption) and writing (production), participant 1 in Dataset-2, Cohort Behavioural Data would spend much of her time constructing a handwritten draft of her assignment (paper-based production) before using her computer in the style of a typewriter (no on screen manipulation of text), all the while "Googling" information "on the fly" (computer-based consumption). Participant 2 undertook the entire note-taking process on paper (paper-based production), while occasionally viewing lecture slides on the computer screen (computer-based consumption). Participant 4 also took notes on paper (paper-based production) before typing the information into the computer. Participant 3 did not use his laptop at all for studying, although it was always present on his desk and switched on. When asked about this, the student replied that he could not see any benefit that his laptop could offer for studying. To conclude, the students' behavioural data suggested that computer technology for this cohort was not as significant as I anticipated and was more an adjunct than a necessity. It seems that students depended heavily on paper-based systems for drafting, planning, and information management (production activities for academic work) even though they had their personal computers on the desks at all times, generally for playing music and/or monitoring Facebook (production activities for non-academic work). Clearly the students in this study were using their personal computer more for non-academic work than for academic work.

This finding is somewhat perplexing given that much of the literature regarding students' use of personal computers highlights the prominence of these devices for academic use with a number of these studies claiming that personal computers now play a significant role in supporting undergraduate study (Aspden & Thorpe, 2009; Dahlstrom, 2011; Guidry & BrckaLorenz, 2010;

Smith & Caruso, 2010). So why did the findings of this study differ significantly from previous studies? The main difference was the focus on actual practice in this study. Most studies on student use of computers in higher education rely on perception data, often gathered via surveys and questionnaires. The perception data gathered from students in the current study - questionnaire data in Dataset-1 (Computer Activity Data) and survey data in Dataset-2 (Cohort Behavioural Data) - were similar to the findings presented in the literature. However, the data gathered on actual practice (Dataset-1 - computer activity logs and Dataset-2 - students' behaviour) showed something very different.

I also found that very few of these perception-based studies distinguish between academic and non-academic use, creating a confusing picture given the difference I found between the two. In addition, many of the contemporary studies did not consider the relevance of paper-based approaches in students' academic practice; possibly because most institutions now deliver resources in digital formats (i.e., Microsoft Word and portable document formats). I, too, made this assumption, until I became aware that all of the participants in this study downloaded and printed relevant resources. I can only speculate that students' preference for printed material could be due to their lack of awareness of mark-up facilities, storage, and retrieval capabilities that digital formats offer. In fact, as previously noted, the students in this study were completely unaware of the academic-related software applications on their computers, such as bibliography programmes (e.g., Endnote, Outlook, and OneNote), analysis packages (e.g., SPSS, NVivo, and MATLAB), and the applications' relevance to academic practice (e.g., spreadsheets, graphics software, and computer maintenance).

The difference between the students' beliefs about their personal computer use and their actual computer use highlights that self-report data or post-event recollections should not be relied on to represent actual practice. Studies employing perception data might have led to the assumption that the extent of computer use to support higher education study is high. However, the naturally-occurring data collected in this study revealed that computer use for academic purposes was very low.

The Three Themes

Theme-1: Computer-based Approach vs Paper-based Approach

All the participants in Computer Activity and Cohort Behavioural Data (Datasets-1 and 2) agreed that computer technology plays an important role in their undergraduate academic practice. This supports the findings from the Local and International Data (Dataset-3). This is not surprising given the rapid increase in the ownership of personal computers over the past five years (Aspden & Thorpe, 2009; Dahlstrom, 2011; Guidry & BrckaLorenz, 2010; Smith & Caruso, 2010). It seems reasonable then to assume that students are likely to employ computer technologies to support their studies. However, the findings in this study (especially Dataset-2, Cohort Behavioural Data) showed that students preferred paper-based approaches to computer-based approaches in their daily study routines. This highlights a difference between how they perceive computer technology, as opposed to how they use it.

It is interesting to speculate whether students' preference for paper-based approaches is the result of their unease with the technology or whether it is due to a dependence on paper-based approaches inherent in higher education. Participant 1 in Dataset-2, Cohort Behavioural Data, commented that she used paper-based approaches in her study because the university lecturers provided her with paper-based hand-outs. Participant 4 also mentioned that he became confused with the diverse expectations of lecturers regarding the role/use of the Content Management System (Blackboard). In the same vein, a few EDUCAUSE studies showed that fewer than half of the students involved in those studies think that the teaching staff at the college/university have adequate IT skills or use IT effectively to support learning (Aspden & Thorpe, 2009; Dahlstrom, 2011; Smith & Caruso, 2010). Could there be a link between students' low use of computer technology in academic work and higher education's dependence on paper-based approaches?

It seems reasonable to assume that the way in which an institution embraces and implements technology is going to have a bearing on the way in which students will engage with technology in their higher education learning. The social network phenomenon is an example of this. One EDUCAUSE study indicated that students expect lecturers to use technology and use it well (Guidry & BrckaLorenz, 2010). A local Otago study also found that lecturers play an important role in motivating the use of computer technology for academic purposes (source 1 in Dataset-3). Clearly, academic staff use of computer technology in their teaching practices has an impact on the extent to which students will adopt computer technology to support their study. Although students are comfortable with technology and see it as integral to higher education (Dahlstrom, 2011), they expect that teaching staff will model the academic use of technology (Smith & Caruso, 2010).

It is easy to consider that the widespread ownership of personal computers by students in higher education is due to the importance of these devices in supporting their undergraduate studies. However, the findings in this study revealed that, for the group of students involved, their primary use of these devices was for non-academic purposes. This is best exemplified by a staff member's recent comment to me, implying that students need, and generally have, two devices for academic study: a personal computer and a printer, of which the printer is the most important. The computer is simply a device that is used to access documents that the student then prints out and stores in a ring binder. All of the participants in this study indicated their preference for, and dependence on, paper-based approaches to support their study practice and incidentally all used ring binders to store and categorise their resources. I am not suggesting that the use of ring-binders is inappropriate, but simply pointing out that personal computers in this process only seem to be a device that connects digital resources to a printer and this printed material is then placed within a binder.

Theme-2: Production Activity vs Consumption Activity

The findings generated from Dataset-2, Cohort Behavioural Data suggest that students' use of their personal computer for production and consumption purposes is higher in the non-academic context than the academic. While their production activity for academic use was generally limited to Microsoft Word and their consumption activity was narrowed to browser-based searching, they were active producers in non-academic contexts, such as social networks, online banking, purchasing and selling sites. The use of the web, outside academia, as the first port of call for information (news, health, television, movies, information on pubs, air tickets, etc.) is not surprising and it is easy to underestimate the extent to which the web has entered our daily lives. Given those resources, such as PowerPoint slides, articles, and assignment guidelines are supplied, I was expecting a higher academic production instead of the higher non-academic production.

The unexpected part is that the students' proficiency is higher in production activity for non-academic work. After only one briefing, the participants mastered the software (Dataset-1, Computer Activity Data), for example, performing functions such as deleting the captured computer activity or switching the software application on and off at their convenience if necessary (production activity for participation). This ability was also shown in the filming of clips (Dataset-2, Cohort Behavioural Data). Participant 1 worked out the shuffle function on Windows Media Player within five minutes, from the starting comment, "Where was I? There's probably an easier way of doing this, but I'm not very good at doing this." to "That's better. I think you just need to drag things into the play list*"* (production activity for entertainment). In another scene, she worked out how to use the calendaring functions in Microsoft Outlook in 8.5 minutes; her starting comment being*, "*I'm just trying to figure out how to use Microsoft Office Outlook" to "Wohoo! It worked" (production activity for management). If it is accepted that students will learn what they need to learn at their own pace (Douglas, Tawnya, & Randy, 2012), then why does this pace seem so slow for academic use? Perhaps the extent of need or requirement within higher education to utilise computer technology should be examined.

Datasets-1 and 2, as well as two EDUCAUSE studies from Dataset-3 also disclosed that students spend more time online for communication purposes. Facebook rated over 96% in 2010 and 90% in 2011 (Dahlstrom, 2011; Smith & Caruso, 2010) and an average of 53% in this study (dataset-1). The main use of the personal computer by the participants of this study was for communication (Twitter, Facebook, email, messenger, Skype etc.). However, the focus on documents and information, while present, was relatively low. This raises an interesting question regarding higher education: if computers are primarily used for communication, what is their role within higher education?

Theme-3: Self-Reports of Practice vs Actual Practice

Much of the literature on the place of computer technology in supporting learning in higher education is based on perception data. The main aim of this study was to explore the validity of this approach by examining whether there is a difference between students' perceptions and actual practice in relation to their computer use and their computer literacy. The results from Dataset-1, Computer Activity Data (Table 4.1 and Table 4.3) suggest that there is a considerable difference. While the literature claims that students "expect to use technology in academia to give them access to resources and progress reports, make them more efficient as students, facilitate connecting with others, and make learning more relevant and engaging" (Dahlstrom, 2011, p. 3), the naturally-occurring practice data in this study (Datasets-1 and 2, Computer Activity and Cohort Behavioural Data) did not support such claims. This highlights a clear difference in outcomes from these distinct approaches and questions the current dependence on perception data to reveal authentic, situated practice.

I am not the first to question the current reliance on perception data. One study examined participants' daily Twitter posts in order to gain insightful information on students' blended university, home and social lives (Aspden & Thorpe, 2009). As spontaneous and concise update(s) were presented on the posts to the community (researchers and participants) anytime and anywhere, such openness exceeded the initial research expectations and allowed better or more flexible analysis. Similarly in this study, the data was captured as it occurred and did not rely on students' perceived or remembered practice. Apart from revealing "important co-joined, tacit behaviours and personality that are present in all our experiences" (Butson & Thomson, 2011, p. 7) as an undergraduate student, the practice data collected builds a new view of computer technology use among students, especially pertaining to their study. For example, participant 1 in Dataset-2, Cohort Behavioural Data said, "I find that having music on makes me work slower but I can do more. Don't know why." In addition, participant 2 in the same dataset used explicit technological devices, for example, the dictionary on her cell phone, rather than the e-dictionary, when her laptop was placed just in front of her. The students' academic practice captured in this study expressed the "sense of being there" (Butson & Thomson, 2011, p. 7). These shared experiences are not as honest or convincing when presented in their self-report data.

In summary

Datasets-1 and 2 (Computer Activity and Cohort Behavioural Data) in this study captured third year undergraduate students' practice of using their personal computers in their independent study sessions. From the findings generated from these two datasets, it is clear that the students' autonomous learning behaviours with their personal computer are actually different from common assumptions and views often reported in the literature. While Dataset-1 (computer activity logs) determined what was actually used (e.g., software programmes and/or websites) to support students' daily academic practices, Dataset-2 (self-filming clips) showed us

> what students "defined as 'study' (what they selected to record), what they defined as a study period (the duration of the recordings), what they were thinking about as they studied (verbal interactions with the camera) and what they defined as the study space (capture angle). (Butson & Thomson, 2011, p. 3)

The findings show a surprising difference between students' engagement in consumption over production activity, as well as their high interaction with paper-based over computer-based approaches. It is also worth noting that the approach of capturing actual practice within authentic and situated contexts offers us new insights not found in perception data gathered through questionnaires and surveys.

Final Measure

Aligning with the sections 'Interesting Mapping Exercise' in Chapter 3 and Chapter 4, the data gathered (Dataset-1, Computer Activity Data) allowed for a final, overall measure that, while problematic, was worthwhile undertaking. By using Dataset-1, Computer Activity Data, an investigation was carried out to discern if there was a relationship between students' overall computer use and their academic course demands (e.g., the schedule of course assignments or tests). The students' (n = 14) total overall daily computer use (including both academic and non-academic use) was matched against their course schedule throughout their participation period in semester one (six weeks in total). Timeline graphs were created of their daily computer use. Vertical lines were added across the timeline to indicate assignment dates. Surprisingly, I did not find a relationship between the daily computer use and the students' course assignment schedule.

While I am aware that plotting computer use across the course assignment schedule might be problematic as it was based on my presuppositions, it offered the opportunity to at least explore the extent of alignment between overall computer usage as captured by the computer activity logs with the students' academic demands, more precisely their assignment schedule. If students were going to use personal computers for studying purposes, I was sure that there would be an increase of use around assignment deadlines. Firstly, it is worth stating that I presupposed that students engaged in more study during the week prior to an assignment or task due date. Secondly, the computer activity logs that I used included both academic and non-academic use. All in all, I would have expected a greater alignment between computer use and assignments if personal computers were a significant component of academic study. The lack of an obvious alignment supports the finding from the computer logs and the video data that the use of personal computers to support study for the participants involved in this study was low.

Lastly, I think it is worth mentioning that a similar preliminary study of computer activity undertaken by Butson and Sim, in early 2012, of five third-year undergraduate students who undertook a single, full-time paper over a summer school course at the University of Otago showed a similar pattern of results as the Computer Activity Data in this study (see Appendix 14).

Thesis Thus Far

This chapter has put forward an inclusive discussion based on the key findings that emerged from the datasets in this study as well as the themes grounded from the key findings. I will end my thesis (Chapter 6) by looking back on the journey of this study and by looking forward to assess its impact.

Chapter 6: Reflecting on this Study

Introduction

This final chapter will summarise the study, outlining its aims, the key findings, suggestions for further research, limitations found in the datasets of this study and the relevance of this study in the higher education context as well as in the broader research field. The chapter concludes with a postscript on my critical autobiography reflection.

The Core of the Study: Aims and Findings

This study aimed to investigate the part that personal computers play in the study practice of undergraduate students at the University of Otago. In addition, it offers important insights into the benefits—in understanding actual practice—of using data-capturing techniques aimed at gathering naturally-occurring data as opposed to more traditional perception data approaches. While the findings are specific to the cohort groups involved and are therefore not generalisable, the results do offer new understandings and insight into the use of computers to support undergraduate study.

From this study, students were found to be active computer technology users and highly computer literate in non-academic use. Their academic use, in terms of practice and literacy, however, was low and limited. In other words, the nature of students' personal computer use in their study was primarily for consumption activity (e.g., sourcing information) rather than for production activity (e.g., creating documents). Students were also found to favour paper-based approaches when studying (especially for production activity) and to favour computer technology for non-academic work in their daily practice.

Recommendations

It is hoped that this study will promote a deeper conversation about the role of technology in higher education and the use students currently make of personal computers/devices to support their study. Perhaps more research on larger and more diverse groups of students could be considered. Additionally, authentic and situated behavioural data should be employed in researching technology use. The difference found between perception and practice data signals the need for a substantial shift in the way we understand and gather data in this emerging field.

Limitations

Dataset-1, Computer Activity Data, and Dataset-2, Cohort Behavioural, were collected from third year participants only. At the same time, Dataset-3, Local and International Data, while sourced from a particular set of studies which were considered representative of the practice for the local and international student community, could be seen as representing a narrow perspective.

Also, it must be acknowledged that the presence of a camera did affect participants' behaviour. Although the participants were distanced physically from the locus of control, it is believed that the participants' awareness of the camera lens remained (Butson & Thomson, 2011). The participants' processes of video and audio creation often involved them speaking at the camera to researchers or viewers, saying out loud what they were doing as they were adjusting the video cameras from time to time. Even if the participants did not directly address the researchers or inform the researchers, it was not uncommon to witness some level of performance (Butson & Thomson, 2011). Similarly, some participants viewing the computer activity data that was being captured were surprised (e.g., duration of time on Facebook) and did state they were going to change their behaviour as a result. The ability to turn the software application, ManicTime, on or off, as well as the ability to delete the computer activities captured according to the participants' needs, might have caused the loss of some data without researcher knowledge.

For example, the Dataset-1, Computer Activity Data participants disclosed that they became aware of their excessive non-academic use from regularly checking the software ManicTime, installed on their personal computer. Such behaviour awareness was not expected at the beginning of the study. The awareness, however, did not appear to change behaviour dramatically, but it did provide a degree of self-awareness regarding their computer usage, which could be helpful for their future academic practice. Similarly, the participants for the Dataset-2, Cohort Behavioural Data chose not to edit their filming and they submitted their film clips as captured. Indeed, it was hoped that both groups of participants would do this. The unconscious or semi-conscious performance in both Computer Activity (Dataset-1) and Cohort Behavioural Data (Dataset-2) included instances of “conspicuous self-presentation” (Belk & Kozinets, 2005, p. 5). This self-presentation was regarded as clearly modelling forms of a popular culture such as reality and confessional television.

Relevance of this Study

Drawing on actual practice data, this study was an initial attempt to understand the role of personal computers and their usage in the academic practice of undergraduate students. It aimed to provide insights into the context(s) in which undergraduate students integrate technology into their learning, and the ways they use technology to support and develop autonomous learning. In this context, students’ eLearning experience, attitudes, and strategies were explored from the three datasets.

This study applied methods which focused on the benefits of capturing naturally occurring behaviour. The data generated by this study will be accessible to local, national, or even international groups and will help inform the growing literature on undergraduate students’ authentic learning experiences with computer technology. The findings are relevant to the broader tertiary population in that they will help to engenger awareness among the students about their actual studying practice behaviour with computer technology and provide an opportunity for academic staff to understand to what extent personal computers play a role in students’ study. Further, the study adds another voice or aspect to the growing interest in the role and impact that computer devices are playing in education.

In addition, this study is of significance for tertiary learning and teaching in New Zealand. The Tertiary Education Commission (TEC) promotes eLearning as playing a vital role in strengthening New Zealand’s tertiary education system and helping it to better meet the needs of learners (Ministry of Education, 2004). The TEC’s position is that eLearning is a key enabler of an education system that is not only more fluid, but also more responsive to the needs of learners, education providers and society as a whole. Such a position is part of a growing belief in New Zealand that eLearning is part of the natural and crucial learning pathway for students in the knowledge society (NZ’s tertiary eLearning portal, 2008). This study, therefore, is pivotal in the sense of constructing and/or co-constructing a theory, or at least a set of ideas, centred upon this belief.

Postscript: Critical Autobiography Reflection

Including a critical autobiography reflection in my study is actually a challenge for me. First, it is a somewhat uncomfortable way of making me visible through academic writing. Second, I struggle with how, and how much, I should embed myself in my writing. Nevertheless, I suppose this reflection is a significant learning path in my future research field.

I would regard autobiographical reflection as a core element of my future research direction. As suggested by Nelson (1994), research perspectives can be transformed if they are woven into the fabric of self-identity, having a sustained impact on both the research practice and life of the researcher. My journey as a researcher is woven through this study. I have moved from a naïve state to an understanding and deeper recognition of the complexities in the practice of research. I am confident that this work has begun the formation of my research identity. I am acutely aware that my life experiences are part of who I am as a researcher, but also worry about the degree to which this impacts on my analysis. In this early stage of grappling with the objective and subjective elements of researcher bias/engagement, I was vigilant in adhering to the data derived through the systematic research process and analysis.

As a social constructivist, it was natural for me to adopt Constructivist Grounded Theory. While capturing and analysing the data, I often found myself indulging as a participant: I have been an undergraduate, and I am a keen user of computer technology. On reflection, this approach was very useful. I encouraged myself to think from the perspectives of the participants, situating myself in their space, rather than placing myself apart or outside their experience.

In closing, I have come to realise that, now I have completed this work and begun thinking about the next phase of my life as an academic/researcher, there is a need to reflect and consider what has contributed to the shaping of who I am now, as a result of this study and the expectations I had placed on myself.

Appendix 1: Invitation through a Facebook private message

Dear XX,

How are you? I understand that you will be a third year student at University of Otago and you are studying in Semester One 2012.

For your information, I am doing a Masters Research Project and I would like to invite you to participate in my project. This project aims to investigate how undergraduate students at the University of Otago use technology, in their personal time and with their personal computers, to support and develop autonomous learning.

Should you agree to take part in this project, I will invite you to complete a quick simple questionnaire and the 18 most computer literate participants will be selected for the project. If you are one of the 18 selected participants, I will install a software programme (ManicTime) on to your laptop which will record the programmes used, at what times, and for how long over the first six weeks of semester one period. This natural occurring data will be used to reveal your computer technology integration into your learning over the first six weeks of semester one period. You will have full control of the software (ability to turn on/off and delete records). The software presents an attractive interface that shows you how you are using your computer. I believe you will find the information being recorded interesting and very helpful. At the completion of the course I will meet with you to take a copy of your computer activity as well as to discuss (informally) the data collected and its relationship to your approach to study. Food and drink will be provided. You will receive a $10 University Book Shop voucher on completion of the project as a token of appreciation.

Please be aware that you may decide not to take part in the project without any disadvantage to yourself of any kind. It would be greatly appreciated if you could let me know if you are interested as part of this project before the semester starts on 27th February 2012.

Thank you.

Yours sincerely,
Kwong Nui Sim

Appendix 2: First instruction to the selected participants

Dear XX,

You have been selected to participate in my Masters Research Project on how undergraduate students at the University of Otago use technology, in their personal time and with their personal computers, to support and develop autonomous learning.

As discussed when you initially indicated your willingness to participate, being part of the project:

- you will have a software program, ManicTime installed onto your computer;
- you should have your computer with you at ALL your studying time;
- you will be invited to a face-to-face interview (if necessary) at the end of first six weeks of semester one (food and drink will be supplied);
- you will receive a $10 University Book Shop voucher on completion of the project.

I would like to meet all participants individually. Please reply to this message indicating which times you are normally available during the week to meet with me.

Please feel free to contact me if would like further information about the project.

Thank you.

Yours sincerely,
Kwong Nui Sim

Appendix 3: A private message to the unselected participants

Dear XX,

Thank you for expressing an interest in participating in my Masters Research Project on how undergraduate students at the University of Otago use technology, in their personal time and with their personal computers, to support and develop autonomous learning.

There was a high response to my recruitment. I have selected participants from those who responded based on the questionnaire which determines your degree of computer literacy as well as your computer views, skills and usages.

Thank you once again for your willingness to participate in the project. Have a great Semester One.

Yours sincerely,
Kwong Nui Sim

Appendix 4: Questionnaire to determine your degree of computer views, skills and usages

Purpose

This survey is conducted to determine your degree of computer literacy as well as your computer views, skills and usages. The 18 most computer literate participants will be selected for the project of investigating the role personal computers play in supporting undergraduate study at the University of Otago over the first six weeks of semester one period. The focus will be on the context(s) in which you integrate technology into your study and the applications and web services you use to support your academic practice. This project is a Masters Research Project.

Definitions of terms

The term 'computer' and 'technology' refers to anything you use your computer for. This includes World Wide Websites and web applications, such as Blackboard, Moodle, library systems, Facebook and Twitter, and computer-based programs like MS Office, Endnote, and SPSS and networking programs like messenger, Google talk etc.

Whenever the term 'university' is used in this survey, it refers to the University of Otago.

Instructions

Please circle only ONE answer that you think it is the most suitable and appropriate to the question asked below unless otherwise stated in the question. ALL five questions are compulsory.

Participants' Experience

1. Access to a computer is really important for my university study.

a. Agree

b. Neutral

c. Disagree

2. Which of the following best describes you?

a. I love new technologies and am among the first to experiment with as well as use them before most people I know.

b. I usually use new technologies when most people I know do and sometimes I will be one of the last people I know to use them.

c. I am sceptical of new technologies and use them only when I have to.

3. Please indicate the ratio (within 10) of how much you use computers in your studies compared to other aspects of your life. For example, write 5:5 when you use technologies equally for studies and other things.

Studies ( )

Other aspects ( )

4. How do you rate your ability to use computers?

a. Expert and skilful

b. Fairly

c. No at all skilled

5. What is your skill level for the following? Please use the spaces to add others.

	Expert and Skilful	Fairly	Not at all skilled
Using the university library website			
Spread sheets (E.g. Excel)			
Presentation software (E.g. PowerPoint)			
Graphics software (E.g. Photoshop)			
Computer maintenance (E.g. Security)			
Internet information searching (E.g. Google)			
Evaluating the reliability and credibility of online sources (E.g. Wikipedia)			
Using digital information from various access (E.g. Blackboard)			

Appendix 5: A summary of questionnaire replies

Question 1

All 17 agree except a participant didn't choose any of the option as he said "A computer is important when you have poor teachers. You will have to teach yourself to learn."

Question 2

5 choose A with one says "but new technologies are expensive".

10 choose B

3 choose C

Question 3

6 : 4 = 2

7 : 3 = 1

5 : 5 = 6

4 : 6 = 7

3 : 7 = 1

2 : 8 = 1

Question 4

16 choose FAIRLY and 2 choose EXPERT and SKILLFUL

Question 5

	Expert and Skilful	Fairly	Not at all skilled
Using the university library website	6	11	1
Spread sheets (E.g. Excel)	2	12	4
Presentation software (E.g. PowerPoint)	5	12	1
Graphics software (E.g. Photoshop)		8	10
Computer maintenance (E.g. Security)	1	7	10
Internet information searching (E.g. Google)	11	7	
Evaluating the reliability and credibility of online sources (E.g. Wikipedia)	8	10	
Using digital information from various access (E.g. Blackboard)	7	11	

Appendix 6: Recruitment preamble

Have you got a few minutes to answer a couple of questions?
If yes ……

Are you a third year student?
If yes ……

I am looking for third year students to take part in a research project about students' personal use of computers to support their learning. As part of the project:
- participants will be invited to keep video/audio-diaries about their use of computer technologies to support their learning;
- participants will be asked to participate in face-to-face meetings/interviews/focus groups if necessary (food and drink will be supplied);
- participants will be asked if they are willing to be observed as they go about their academic activities.

Would you be interested in taking part?
If yes ……

Could I take your details and one of the researchers will be in touch with you?
If yes …… Please fill the slip

Appendix 7: On the spot recruitment

Name:	Gender: M / F
How would you rate your ability to use computer and internet technology?	Expert user Competent user Novice user Non-user
What department(s) is/are you studying in and what subject are you majoring in?	
Email address:	

Appendix 8: An email of invitation

Dear XX,

On Tuesday 17th March, you expressed an interest in participating in my research project on students' personal use of computer technologies to support their learning.

As discussed when you were initially approached, as part of the project:

- participants will be invited to keep video/audio-diaries about their use of computer and internet technologies to support their learning;
- participants will be asked to participate in four face-to-face meetings/ interviews/focus groups if necessary (food and drink will be supplied);
- participants will be asked if they are willing to be observed as they go about their academic activities.

If you are still interested and would like further information or would like to participate in the project, please reply to this email and indicate what time would be suitable for meeting with the researchers.

Thanks,
Kwong Nui Sim

Appendix 9: An email of thank you and confirmation of interest

Dear XX:

Thank you for expressing an interest in participating in my research project on students' personal use of computer technologies to support their study.

As discussed when you were initially approached, as part of the project:

- participants will be invited to keep video/audio-diaries about their use of computer and internet technologies to support their learning;
- participants will be asked to participate in four face-to-face meetings/ interviews/focus groups if necessary (food and drink will be supplied);
- participants will be asked if they are willing to be observed as they go about their academic activities.

If you are still interested and would like to participate in the project, please reply to this email to confirm your willingness to participate.

I am keen for all participants to meet initially in one group. Therefore, it would be greatly appreciated if you could also let me know what times you are available next week to meet with me and other project participants to introduce you to the project.

Please don't hesitate to contact me if would like further information about the project.

Thanks,
Kwong Nui Sim

Appendix 10: The first instruction to the selected participants

Dear XX:

You have been selected to participate in my research project on students' personal use of computer technologies to support their study.

As discussed when you initially indicated your willingness to participate, as part of the project:
- participants will be invited to keep video/audio-diaries about their use of computer and internet technologies to support their learning;
- participants will be asked to participate in four face-to-face meetings / interviews/focus groups if necessary (food and drink will be supplied);
- participants will be asked if they are willing to be observed as they go about their academic activities.

I would like all participants to meet initially in one group. With the availability provided by you and other participants, please meet me and other project participants on 15th April at room G01 in the central library.

Please feel free to contact me if you would like further information about the project.

Thanks,
Kwong Nui Sim

Appendix 11: A courtesy email

Dear XX:

Thank you for expressing an interest in participating in my research project on students' personal use of computer technology to support their learning.

There was a high response to my recruitment. I have selected participants from those who responded based on their self-reported computer competency, their interests in participants, and the balance of gender as well as departments distribution.

Thank you once again for your willingness to participate in the project.

Regards,
Kwong Nui Sim

Appendix 12: Otago online survey

Survey-T1

Page 1

Technology Experience Survey

We are interested in your views and use of technology in university studies. This is important for us to be able to identify current technological practices and needs. This information will be used in planning for, and integrating technology into learning and teaching.

All survey responses will be processed in confidence by the Higher Education Development Centre (HEDC).

Thank you for your participation.

Regards,

Russell Butson, Lecturer
HEDC

1. Please enter your name:*

2. Which network are you involved with...*
   – Please Select –

Survey-T1

Page 2

Definitions of terms commonly used in this survey

The term '**technology**' refers to a range of information and communication technologies that can be used to support learning and teaching. This includes learning management systems (such as Blackboard and Moodle), library systems, the World Wide Web, web applications (such as facebook and twitter)and software packages (such as MS Office, Endnote, SPSS).

Whenever the term '**university**' is used in this survey it refers to the University of Otago.

Survey-T1

Page 3

3. Using technology is a really important part of my learning at university
   - Strongly Agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

4. Which of the following best describes you?
   - I love new technologies and am among the first to experiment with and use them
   - I like new technologies and use them before most people I know
   - I usually use new technologies when most people I know do
   - I am one of the last people I know to use new technologies
   - I am skeptical of new technologies and use them only when I have to

5. Please indicate the ratio of how much you use technology in your studies compared to other aspects of your life. For example, 50-50 when you use technologies equally for studies and other things or 70-30 when you use more technology in your studies than in other aspects of your life.

   Studies

   Other Aspects

6. How do you rate your ability to use technology?
   - Expert
   - Very skilled
   - Fairly skilled
   - Not very skilled
   - Not at all skilled

Survey-T1

Page 4

7. What is your skill level for the following?

	Not at all skilled	Not very skilled	Fairly skilled	Very skilled	Expert
Using the university library website	○	○	○	○	○
Spreadsheets (Excel, etc.)	○	○	○	○	○
Presentation software (PowerPoint, etc.)	○	○	○	○	○
Graphics software (Photoshop, Flash, etc.)	○	○	○	○	○
Computer maintenance (software updates, security, etc.)	○	○	○	○	○
Using the internet to effectively and efficiently search for information	○	○	○	○	○
Evaluating the reliability and credibility of online sources of information	○	○	○	○	○
Understanding the ethical/legal issues surrounding the access and use of digital information	○	○	○	○	○

Survey-T1

Page 5

Software programme use

8. Do you use software programmes for your academic work
   - ○ Yes
   - ○ No

If you answered no, please go to the next page

9. Which of the following software programmes do you use for your academic work (please check as many as apply)?
   - ☐ MS Word
   - ☐ Endnote
   - ☐ Excel
   - ☐ Powerpoint
   - ☐ Outlook Express
   - ☐ Visio
   - ☐ SPSS
   - ☐ Other, please specify

10. Which of the following purposes do you use these programmes for (please check as many as apply)?
    - ☐ Word-processing
    - ☐ Presentations
    - ☐ Working with data
    - ☐ Making diagrams
    - ☐ Storing information
    - ☐ Note-taking
    - ☐ Compiling reference libraries
    - ☐ Composing essays and/or assignments
    - ☐ Communicating with instructors about my course work
    - ☐ Communicating with other students about my course work
    - ☐ Planning my study
    - ☐ Other, please specify

11. What motivates you to use these programmes for your academic work (please check all that apply)?
    - ☐ My lecturer encourages me to use them

- [ ] Quality of presentation
- [ ] They allow me to edit and change my work
- [ ] To save time
- [ ] These programmes are the ones installed on my computer
- [ ] Other, please specify

Survey-T1

Page 6

Website use

12. Do you use websites for your academic work?
    - ○ Yes
    - ○ No

If you answered no, please go to next page

13. Which of the following websites do you use for your academic work (please check all that apply)?
    - [ ] Youtube
    - [ ] Unitube
    - [ ] Library Online Catalogue
    - [ ] Library databases
    - [ ] Google
    - [ ] Google Scholar
    - [ ] Wikipedia
    - [ ] Blackboard
    - [ ] Moodle
    - [ ] Other, please specify

14. Which of the following purposes do you use these websites for (please check all that apply)?
    - [ ] To gather information
    - [ ] To gather resources (e.g. podcasts, course notes)
    - [ ] To communicate with faculty
    - [ ] To communicate with other students about my course work
    - [ ] To share resources with other students
    - [ ] Planning my study
    - [ ] Other, please specify

15. What motivates you to use these websites (please check all that apply)?
    - [ ] My lecturers encourage me to
    - [ ] To save time
    - [ ] These websites provide an easy way to find information
    - [ ] These websites provide a wide range of information
    - [ ] Other, please specify

Survey-T1

Page 7

16. Which of the following 'new' technologies do you use to support your academic work (please check all that apply)?
    - [ ] Micro-blogging (e.g. Twitter)
    - [ ] Social networking (e.g. facebook, bebo, my space)
    - [ ] Blog/weblog (e.g. blogger)
    - [ ] Wikis
    - [ ] Online applications (e.g. google apps, email, google docs)
    - [ ] Unitube
    - [ ] Youtube
    - [ ] Discussion forums/news groups
    - [ ] Live text-based chat (e.g. MSN, Yahoo!, Gtalk)

☐ Live audio chat (e.g. Skype)

☐ Social bookmarking (e.g. del.icio.us, citeUlike, connotea, Endnote Web)

☐ I-phone

☐ Mobile phone

☐ Podcasts

☐ Photo image sharing (e.g. flickr)

☐ I don't use any 'new' technologies to support my academic work

☐ Other, please specify

17. How do you use them (please check all that apply)?

☐ To communicate with other students about my course work

☐ To communicate with faculty about my course work

☐ To access resources (e.g. videos from Youtube) to use in my course work

☐ To share resources with other students

☐ Other, please specify

18. Do you think your lecturers should use any of these 'new' technologies in their teaching practice?

○ Yes

○ No

Appendix 13: The replies for question 4 and 5 in the questionnaire

4. How do you rate your ability to use computers?

a. Expert and skilful

b. Fairly

c. No at all skilled

All (16) choose FAIRLY except 2 choose EXPERT and SKILLFUL

5. What is your skill level for the following? Please use the spaces to add others.

	Expert and Skilful	Fairly	Not at all skilled
Using the university library website	(6)	(11)	(1)
Spread sheets (E.g. Excel)	(2)	(12)	(4)
Presentation software (E.g. PowerPoint)	(5)	(12)	(1)
Graphics software (E.g. Photoshop)		(8)	(10)
Computer maintenance (E.g. Security)	(1)	(7)	(10)
Internet information searching (E.g. Google)	(11)	(7)	
Evaluating the reliability and credibility of online sources (E.g. Wikipedia)	(8)	(10)	
Using digital information from various access (E.g. Blackboard)	(7)	(11)	

Appendix 14: A pilot computer activity study done in summer school period 2012

Table 1:

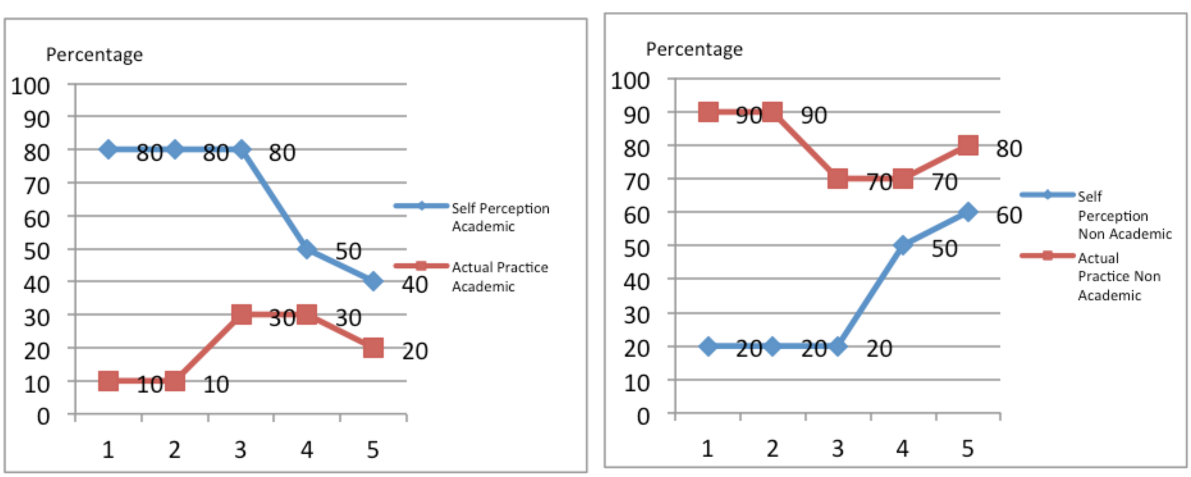
Student perception comparison of academic vs non-academic use

Comparison / Participants	Percentage (%)	
	Academic Use	Non Academic Use
1	80	20
2	80	20
3	80	20
4	50	50
5	40	60

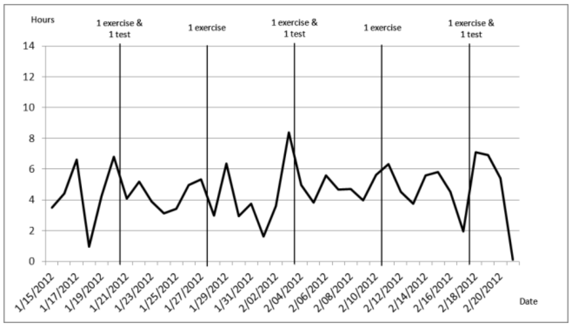
Table 2:

Computer logs comparison of academic vs non-academic use

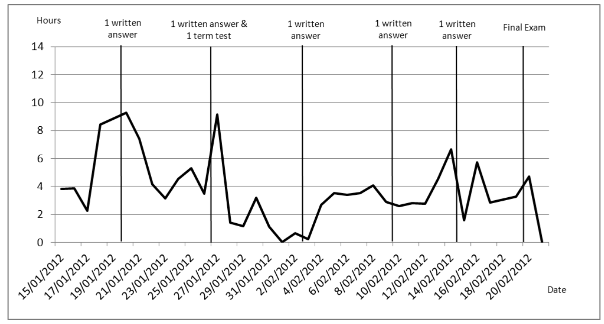
Comparison / Participants	Percentage (%)	
	Academic Use	Non Academic Use
1	10	90
2	10	90
3	30	70
4	30	70
5	20	80



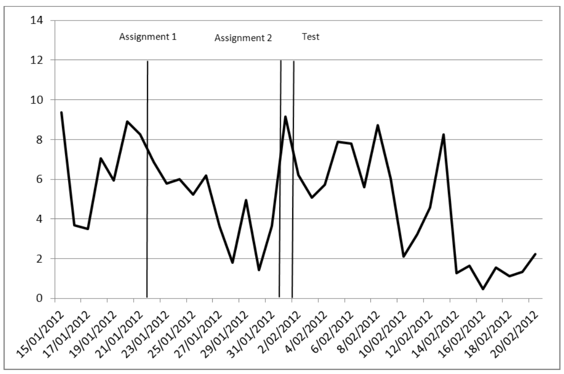
Figures 1: Self perception vs actual practice of academic use and non-academic use



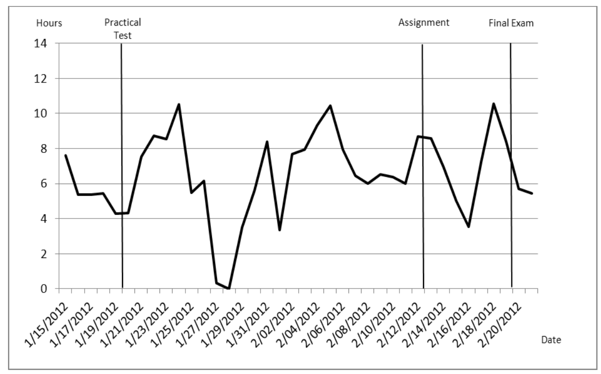
Student-1



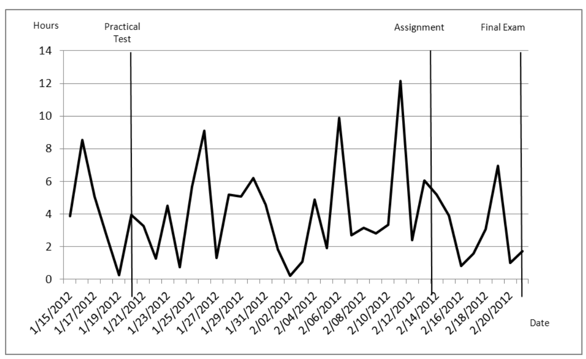
Student-2



Student-3



Student-4



Student-5

Figures 2: The actual practice of the participants over the summer school period

Table 3:

Computer activity alignment with assignments over the summer school period

	No of alignments	Non-alignment
Student 1	2	3
Student 2	2	4
Student 3	2	1
Student 4	3	0
Student 5	3	0

References

Abraham, M. R. (2008). Importance of a theoretical framework for research. In D. M. Bunce & R. e. S. Cole (Eds.), *Nuts and bolts of chemical education research* (Vol. 976, pp. 47 - 66). Washington, DC: American Chemical Society : Distributed by Oxford University Press.

Anderson, C. (2008). The end of theory: The data deluge makes the scientific method obsolete. Retrieved July 2012, 2012, from http://www.wired.com/science/discoveries/magazine/16-07/pb_theory

Aspden, E. J., & Thorpe, L. (2009). "Where do you learn?": Tweeting to inform learning space development. Retrieved June, 2012, from http://www.educause.edu/ero/article/where-do-you-learn-tweeting-inform-learning-space-development

Aviles, K., Philips, B., Rosenblatt, T., & Vargas, J. (2005). If higher education listened to me. [Review]. *Educause*, 7.

Belk, R. W., & Kozinets, R. V. (2005). Videography in marketing and consumer research. [Technical paper]. *Qualitative Market Research, 8*(2), 128-141. doi: 10.1108/13522750510592418

Blaikie, N. (2000). *Designing social research : the logic of anticipation*: Cambridge, UK : Polity Press.

Bryant, T. (Producer). (2009, 15th September). Research Training 2 day Workshop - Grounded Theory Method Prof Tony Bryant. [Youtube] Retrieved from http://www.youtube.com/watch?v=fmWKf5L0mfA

Bryman, A. (2001). *Social research methods*: Oxford: Oxford University Press.

Butson, R., & Thomson, C. (2011). Reflections on the use of autovideography in an undergraduate education context. *Journal of Research Practice, 7*(2), 1-10.

Campbell, J. (Producer). (2011, 4th January). 38. Introduction to methods of qualitative research grounded theory. Retrieved from http://www.youtube.com/watch?v=kOLBtUiSCwY

Cavallo, D. (2000). Emergent design and learning environments: Building on indigenous knowledge. *IBM Systems Journal, 39*(3 & 4), 768-781.

Charmaz, K. (2000). *Grounded theory. Objectivist and constructivist methods*. Thousand Oaks, CA: Sage.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks, CA: SAGE

Charter Colleges and Universities Participating in the National Higher Education ICT Initiative. (2003). Succeeding in the 21st Century. Retrieved July 2012, 2012, from http://www.ets.org/Media/Tests/Information_and_Communication_Technology_Literacy/ICTwhitepaperfinal.pdf

Concannon, F., Flynn, A., & Campbell, M. (2005). What campus-based students think about the quality and benefits of e-learning. *British Journal of Educational Technology, 36*(3), 501-512.

Conole, G., de Laat, M., Dillon, T., & Darby, J. (2008). 'Disruptive technologies', 'pedagogical innovation': What's new? Findings from an in-depth study of students' use and perception of technology. *Computers & Education, 50*, 511-524. doi: 10.1016/j.compedu.2007.09.009

Creanor, L., Trinder, K., Gowan, D., & Howells, C. (2006). LEX: The learner experience of e-learning - final project report (pp. 1-44). JISC e-pedagogy understanding my learner programme. Glasgow: Glasgow Calendonian University.

Dahlstrom, E. (2011). Connecting student data from ECAR and CDS. [Research Bulletin]. *Educause*, 1-7.

Dahlstrom, E., Grunwald, P., de Boor, T., & Vockley, M. (2011). ECAR National study of students and information technology in higher education (pp. 1-54). Boulder, CO: EDUCAUSE Center for Applied Research: Educause.

Dobbins, K. W. (2005). Getting ready for the net generation learner. [Review]. *Educause*, 9.

Douglas, J., Tawnya, M., & Randy, G. (2012). Student perceptions of course management system tools. [Research Bulletin]. *Educause*, 1-11.

Edmunds, R., Thorpe, M., & Conole, G. (2012). Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach. *British Journal of Educational Technology, 43*(1), 71-84. doi: 10.1111/j.1467-8535.2010.01142.x

EDUCAUSE. (2012). About the Core Data Service. Retrieved July, 2012, from http://www.educause.edu/research-and-publications/research/core-data-service/about-core-data-service

Erickson, F. (1986). Qualitative methods in research on teaching. In W. Merlin C. (Ed.), *Handbook of research on teaching* (3rd ed., pp. 1037). New York : Macmillan

Flowers, P. (2009). Research philosophies – Importance and relevance. [MSc by Research]. *Leading Learning and Change*(1), 5.

Glaser, B. G. (2002). Constructivist grounded theory? *Forum: Qualitative Social Research Sozialforschung, 3*(3), 1-14.

Goodfellow, R. (2011). Literacy, literacies, and the digital in higher education. *Teaching in Higher Education, 16*(1), 131-144. doi: 10.1080/13562517.2011.544125

Goodyear, P., & Ellis, R. A. (2008). University students' approaches to learning: rethinking the place of technology. *Distance Education, 29*(2), 141-152. doi: 10.1080/01587910802154947

Gordon, W. (1994). *Learning and teaching "Science Concepts": Vygotsky's ideas revisited*. Paper presented at the Vygotsky and the Human Sciences Conference (September 1994), Moscow.

Green, A., S. , Rafaeli, E., Bolger, N., Shrout, P., E. , & Reis, H., T. (2006). Paper or plastic? Data equivalence in paper and electronic diaries. *Psychological Methods, 11*(1), 87-105. Retrieved from http://docsfiles.com/pdf_paper_or_plastic_data_equivalence_in_paper_and_electronic_diaries.html doi:10.1037/1082-989X.11.1.87

Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park, Ca: Sage.

Guba, E. G., & Lincoln, Y. S. (2001). Guidelines and checklist for constructivist (a.k.a. fourth generation) evaluation. *Evaluation Checklists Project*, 1-15.

Guidry, K., & BrckaLorenz, A. (2010). A comparison of student and faculty academic technology use across disciplines. Retrieved from http://www.educause.edu/ero/article/comparison-student-and-faculty-academic-technology-use-across-disciplines

Huong, L. P. H. (2003). The mediational role of language teachers in sociocultural theory. *Bureau of Educational and Cultural Affairs, 41*(3). Retrieved from http://eca.state.gov/forum/vols/vol41/no3/p32.htm

International Technology Education Association. (2000). Standards for technological literacy *Content for the Study of Technology* (Third ed., pp. 1-250): International Technology Education Association (ITEA) and Technology for All Americans Project.

Jackson, R., & Sørensen, G. (2010). Chapter 6 Social Constructivism *Introduction to international relations: Theories and approaches* (4th ed., pp. 160-180). Oxford: Online Resource Centre.

Joint Information Systems Committee. (2007). In Their Own Words. Retrieved June 2012, 2012, from http://www.jisc.ac.uk/media/documents/programmes/elearningpedagogy/iowfinal.pdf

Kennedy, G., Dalgarno, B., Bennett, S., Gray, K., Waycott, J., Judd, T., . . . Chang, R. (2009). Educating the net generation: A handbook of findings for practice and policy Retrieved from http://www.netgen.unimelb.edu.au/downloads/handbook/NetGenHandbookAll.pdf

Lai, K.-W. (2008). ICT supporting the learning process: The premise, reality, and promise. . In J. V. G. Knezek (Ed.), *International handbook of information technology in primary and secondary education* (pp. 215-230). New York: Springer.

Lehmann, H. P. (2001). Using grounded theory with technology cases: Distilling critical theory from a multinational information systems development. *Journal of Global Information Technology Management, 4*, 45-60.

Littlejohn, A., Margaryan, A., & Vojt, G. (2010). Exploring students' use of ICT and expectations of learning methods. *Electronic Journal of e-Learning 8*(1), 13-20.

Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science, 11*(5), 473-492.

Mbah, T. B. (2010). The impact of ICT on students' study habits. Case study: University of Buea, Cameroon. [Full length research paper]. *Journal of Science and Technology Education Research, 1*(15), 107-110.

McLeod, S. (2007). Lev Vygotsky. Retrieved June 2012, 2012, from http://www.simplypsychology.org/vygotsky.html

Middlehurst, R. (2003). Quality assurance and accreditation for virtual education: A discussion of models and needs (Vol. Paper for UNESCO Expert Meeting, Paris, pp. 1-10).

Mininday, T. J. (2009, 15 February). Track your time on the computer with Manictime. Retrieved July 2012, 2012, from http://www.makeuseof.com/tag/manage-and-monitor-your-application-usage-with-manictime/

Ministry of Education. (2004). Taking the next step: The interim tertiary e-Learning framework (pp. 12). Wellington, New Zealand: Ministry of Education.

Nelson, A. (1994). Researching adult transformation as autobiography. *International Journal of Lifelong Education, 13*(5), 389-403

NZ's tertiary eLearning portal. (2008). eLearning: NZ's tertiary eLearning portal. Retrieved 27/10, 2008, from http://www.elearn.govt.nz/elearn/elearn.portal?_nfpb=true&_pageLabel=home

Orlikowski, W. J. (1993). CASE tools as organizational change: Investigating incremental and radical changes in systems development. *MIS Quarterly 17*(3), 309-340.

Pearson, G., Young, A. T., National Academy of Engineering. Committee on Technological Literacy., & National Research Council (U.S.). (2002). *Technically speaking : why all*

Americans need to know more about technology. Washington, D.C.: National Academy Press.
Prensky, M. (2001). Digital Natives, Digital Immigrants. *On the Horizon, 9*(5), 6.
Rowlands, B. H. (2005). Grounded in practice: Using interpretive research to build theory. *The Electronic Journal of Business Research Methodology, 3*(1), 81-92.
Selwyn, N. (2007). The use of computer technology in university teaching and learning: A critical perspective. *Journal of Computer Assisted Learning, 23*, 83-94. doi: 10.1111/j.1365-2729.2006.00204.x
Sharpe, R., Benfield, G., Lessner, E., & DeCicco, E. (2005). *Final report: Scoping study for the pedagogy strand of the JISC learning programme*. Retrieved from http://www.jisc.ac.uk/uploaded_documents/scoping study final report v4.1.doc
Shaw, G., & Marlow, N. (1999). The role of student learning styles, gender, attitudes and perceptions on information and communication technology assisted learning. *Computers and Education, 33*(4), 223-234.
Smith, S. D., & Caruso, J. B. (2010). The ECAR study of undergraduateutudents and information technology, 2010 *Educause* (October 2010 ed., pp. 118).
Smith, S. D., Salaway, G., & Caruso, J. B. (2009). The ECAR study of undergraduate students and information technology, 2009 *Educause, 6*, 130. Retrieved from http://net.educause.edu/ir/library/pdf/ers0906/rs/ERS0906w.pdf
Stake, R. E. (2000). *Case Studies* (Second ed.). Thousand Oaks: Sage Publications, Inc.
Starr, R. G., & Fernandez, K. V. (2007). The Mindcam methodology: Perceiving through the native's eye. *Qualitative Market Research: An International Journal, 10*(2), 168-182. doi: 10.1108/13522750710740835
Strauss, A., & Corbin, J. (1990). *Basics of qualitative research : Grounded theory procedures and techniques*: Newbury Park, Calif. : Sage Publications.
Tepper, M. (2003). The rise of social software. *netWorker, 7*(3), 18-23.
The Joint Information Systems Committee. (2007). Student Expectations Study: Key findings from online research and discussion evenings held in June 2007 for the Joint Information Systems Committee (pp. 1-49).
Urquhart, C. (2001). *An encounter with grounded theory: Tackling the practical and philosophical issues*. PA, USA: IGI Publishing Hershey
Vrasidas, C. (2001). *Interpretivism and Symbolic Interactionism: "Making the Familiar Strange and Interesting Again" in Educational Technology Research*. Greenwich, CT: Information Age Publishing, Inc.
Wheeler, B., & Osborne, N. (2012). Case study 21: Shaping the path to digital: The Indiana University eTexts initiative. Retrieved June 2012, 2012, from http://www.educause.edu/library/resources/case-study-21-shaping-path-digital-indiana-university-etexts-initiative
Williamson, K., Bernath, V., Wright, S., & Sullivan, J. (2007). Research students in the electronic age. [Electronic Article]. *Communications In Information Literacy 1*(2).