Science and Mathematics Education Centre

Perceptions of the Cloud Assessment Learning Environment: a Case Study at a New Zealand Polytechnic

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature: 

Date: February 2013

ABSTRACT

This thesis presents an investigation into student perceptions of the cloud assessment learning environment and is based on the findings from a multi-method case study undertaken at a New Zealand polytechnic.

The cloud assessment learning environment is introduced in this study as a unique environment made possible by the recent advent of cloud computing technologies. A review of the literature has revealed numerous studies that have been conducted in similar areas of endeavour, but also highlighted a lack of knowledge and information specifically pertaining to the cloud assessment learning environment.

This study has been specifically designed to take advantage of multiple data collection methods in order to capture a rich multi-perspective data set relating to student perceptions of the various unique aspects of the cloud assessment learning environment. The data sources utilised within this study included a new instrument based on well proven and published studies in Science learning environments. The new instrument is the *Lecturer Interaction Questionnaire* (LIQ).

The LIQ results (a QTI variant), were combined with results from the *Cloud Assessment Questionnaire* (CAQ) an instrument unique to the study, concept maps, class interviews, focus group interviews, qualitative lecturer descriptions, participant observations, virtual participant observations, online activity statistics, attendance records, and achievement levels. The results of the study reveal consistent themes that are seen to emerge across multiple data sources showing the validity and reliability of the research design. The results are discussed in light of the existing literature and ultimately provide new insight into the various perceptions held by students and also many of the reasons behind those perceptions. Students are found to hold overall positive perceptions of the cloud assessment learning environment even despite some limitations experienced with the associated technologies. Overall, this thesis provides an in depth assessment of the unique perceptions users have of the cloud assessment learning environment, and provides a foundation for future work in the area.

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To my parents, thank you for giving me a positive introduction to education and for providing me with the confidence to succeed.

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To the rest of my colleagues, thank you for reminding me to shout morning tea now that I'm finished.

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Chapter 1 Introduction

1.1 Introduction

This thesis presents an investigation into student perceptions of the cloud assessment learning environment. The cloud assessment learning environment is a unique assessment learning environment made possible by the recent advent of cloud computing and the associated technologies. The implementation of a cloud assessment learning environment allows teachers to monitor and guide student progress over the duration of an assessment (Google, 2011a). This is in contrast to traditional assessment methods where teachers often only see student work at the end of the assessment (Race, 2007). Although the cloud assessment learning environment offers educators the benefit of being able to monitor and guide students throughout an assessment, an important question which exists as the fundamental motivation behind this study remains: what do students make of this new assessment environment?

The following sections will present foundational information relating to this investigation into student perceptions of the cloud assessment learning environment. This information will include: the thesis origin, research background information, the specific research objectives, limitations of the study, significance of the research, an overview of the methodology, and finally, an overview of the thesis as a whole.

1.2 Thesis Origin

The cloud assessment learning environment (which will be described in greater detail later in this thesis) was not something I intentionally sought out, it was something I quite simply stumbled upon. When I began my tertiary teaching career at UCOL in Palmerston North, New Zealand, one of my first tasks was to rejuvenate a second year Information and Communications Technology (ICT) degree paper titled 'Organisational Systems'. In New Zealand, a three year degree typically consists of eight papers per year (four per semester), with a paper existing as an individual unit of study. The option was available to continue teaching the existing content; however the paper as a whole was rather dry, with much of the content beginning to show its age. So, as is the way with the young and naive I began reinventing significant parts of the content in order to bring the paper up to speed. As a result, it seemed like a sensible decision to introduce some sort of collaborative wiki type tool into the paper (a wiki is a web site developed collaboratively by a group of users, allowing any user to add and edit content). Although it quickly became apparent that a significant amount of overhead

would be required to set up and maintain wikis for my students (i.e. installation, administration and maintenance). However, after some investigation a Google Sites solution was selected simply because Google Sites were hosted online for free by Google, and appeared relatively robust and intuitive (Google, 2012a). Although Google Sites lacked some of the more advanced features offered by other wiki solutions, such as discussion pages and revision comparisons, the zero maintenance overhead became the deciding factor (this was compounded by the fact the start of the semester was fast approaching and my zealous ideas of reinvention were proving a bite larger than I could chew). As a result, a multiple week, group assignment that required students to collaboratively create a Google Site for a given topic was introduced to the paper. The assignment instructions first required student groups to create a Google Site and have it shared between all members of their group, and also with myself, their lecturer.

Shortly after the Google Sites group assignment began I checked each of the groups Google Sites to make sure all group members were involved and that they had followed a number of administrative assignment instructions. During my checks, I was intrigued to find some groups had already made significant progress, while others had barely started. As the weeks rolled by, I found myself 'checking up' on the progress of each of the groups and was providing general, in class feedback about aspects of the assignment based on what I was seeing online. It was in the midst of this process that I had my 'eureka' moment. Inadvertently, I had stumbled into an assessment environment where I was able to monitor student progress throughout the duration of the assessment and give guidance where needed, when it was relevant and useful to students, feedback before the due date.

After further consideration and reflection on the Google Sites assessment, I began to realise the positives I had experienced were not restricted to group assignments or even to Google Sites. The positives were simply a result of the assignment artifact being stored online, in the cloud, and being shared between the student and lecturer from the beginning of the assessment. The strength of the cloud storage environment was its ability to facilitate synchronous collaboration between multiple users. I soon realised this approach to assessment could be used for individual written assignments, a form of assessment far more common and more universal than group based wiki assignments that used Google Sites. All that was required was a slight change of technology from Google Sites (wikis) to Google Docs (office documents) (Google, 2012b). Although the technology had changed slightly, the essential components were the same; the assignment artifact was still stored online (in the cloud) and shared

between the student and the lecturer. Once this underlying infrastructure was established, the process of monitoring progress and providing timely feedback could commence. Thus the first basic formula for the cloud assessment learning environment was given.

At about the same time that I was implementing cloud assessment learning environments for a number of assessments in different papers that I was teaching, I also began this doctoral study. Although I was initially unsure of the focus of my research, I soon came to the decision (after a few discussions with colleagues and my supervisor) to focus my efforts on investigating student perceptions of the cloud assessment learning environments. The underlying question being, what do students think of this approach to assessment? Do they prefer it? Do they feel more productive using it? Do they feel restricted by it? This then was the catalyst for both the excitement that this new idea brought into my quest for a doctorate, but also for a student based investigation on a highly collaborative and new way of interacting with students in a blended learning environment.

In this section the origin of this thesis has been described. The next section will aim to provide relevant background information with regards to technology, concepts, and the environment related to this study.

1.3 Background

This section aims to set the scene for the research by providing a working definition of cloud computing and essential details relating to this study. This will be followed by a clear description of what this thesis refers to as the 'cloud assessment learning environment'. Finally, the study will be given context by detailing the educational environment in which this research has taken place.

Cloud computing as a term and a concept was first encountered by the researcher during postgraduate study in information technology. At the time, cloud computing was emerging as a nebulous buzz word seemingly capable of describing almost anything that existed on the Internet. However, over the past few years the concept of cloud computing has steadily moved into the computing mainstream. Unfortunately, a universally accepted definition for cloud computing does not yet exist (Mell & Grance, 2011), and the researchers own working definition has only resulted from numerous hours of research and experience using various cloud computing tools for teaching and assessment. Therefore, the following section will present a definition of cloud

computing as it is understood by the researcher and as it is to be used for the purposes of this study.

The first step in understanding cloud computing, is to understand each of the terms, cloud and computing, individually. Computing is a generally understood term and can be defined as the process of utilising computer technology to complete a task (BusinessDictionary.com, 2012). The term cloud, when used in the context of computing, simply refers to the Internet or online environment (Dictionary.com, 2012). Therefore, combining these definitions, cloud computing can be plainly defined as the process of utilising online computer technology to complete a task. It is this simple definition of cloud computing that will be used throughout this thesis. Further exploration into the origin of the concept of cloud computing will be presented during the literature review, the second chapter of this thesis.

As mentioned in the previous section, the origin of this study can be traced back to the researcher's experiences teaching on an information and communications technology (ICT) bachelor degree in Palmerston North, New Zealand. In this role, the researcher first taught cloud computing as a new technology to second year ICT students. Cloud computing and its associated tools were presented as alternatives to traditional desktop computing tools. For example, Google Docs as a cloud computing word processing tool (Google, 2012b) was compared and contrasted with Microsoft Word, a traditional desktop word processing tool. However, (as mentioned) it was during a four week assessment where students had to create a website using Google Sites (a cloud computing website development tool) that the researcher first began to notice the unique assessment environment that the cloud computing tool had enabled. Due to the fact the student websites existed in the cloud, or online, from the beginning of the assessment, the researcher was able to observe the growth of each of the student websites over the four week assessment period. Being able to observe student progress for the duration of the assessment allowed the researcher to identify and assist various 'at risk' students, i.e. students who were late starting, slow to progress, or moving in the wrong direction with their work. This contrasted strongly with traditional assessment methods where student work is usually only seen by teachers after the assessment due date (Race, 2007). As a result of this experience, the researcher began to develop a wider and more universal approach to using cloud computing tools for assessment. This enhanced approach to assessment is referred to by the researcher as the cloud assessment learning environment and forms the basis for this study. Accordingly, the next section will aim to provide a clear description and

definition of the cloud assessment learning environment to be used for the remainder of this thesis.

The cloud assessment learning environment exists when the collaborative sharing features of a cloud computing tool (e.g. Google Docs) are utilised for a continuous assessment. Continuous assessments are those assessments where students are given an extended period of time (usually weeks) to complete an assessment task (e.g. write a report). At the beginning of the assessment (day 1) each student uses a cloud computing tool to start their assessment (e.g. create a blank document in Google Docs). Each student then shares their work with their teacher by using the collaborative sharing feature of the cloud computing tool. It is this act of 'sharing' that allows the teacher to then monitor and guide each student throughout the duration of the assessment. The cloud assessment learning environment can therefore be defined as the learning environment that exists when the collaborative sharing features of cloud computing tools are utilised by teachers to monitor and guide students during continuous assessments. Figure 1.1 and Figure 1.2 provide a visual representation of a traditional assessment environment as compared to the cloud assessment learning environment.

The researcher's first experience with the cloud assessment learning environment occurred during semester 1, 2009. This study focuses on the researcher's use of the cloud assessment learning environment with Bachelor of Information and Communications Technology (BICT) students undertaking a compulsory second year IT Project Management paper in Palmerston North, New Zealand during semester 2, 2011. The research has utilised a multi-method ethnographic case study approach that has collected data relating to student experiences before, during and after a four week project management plan (PMP) assessment where students engaged with the cloud assessment learning environment. The underlying motivation behind each of the data sources included in this study was to provide data relating to the motivating question behind this study (i.e. what do students think of this new assessment environment?). Further information regarding the research sample and assessment details are given in the methodology section, chapter three of this thesis.

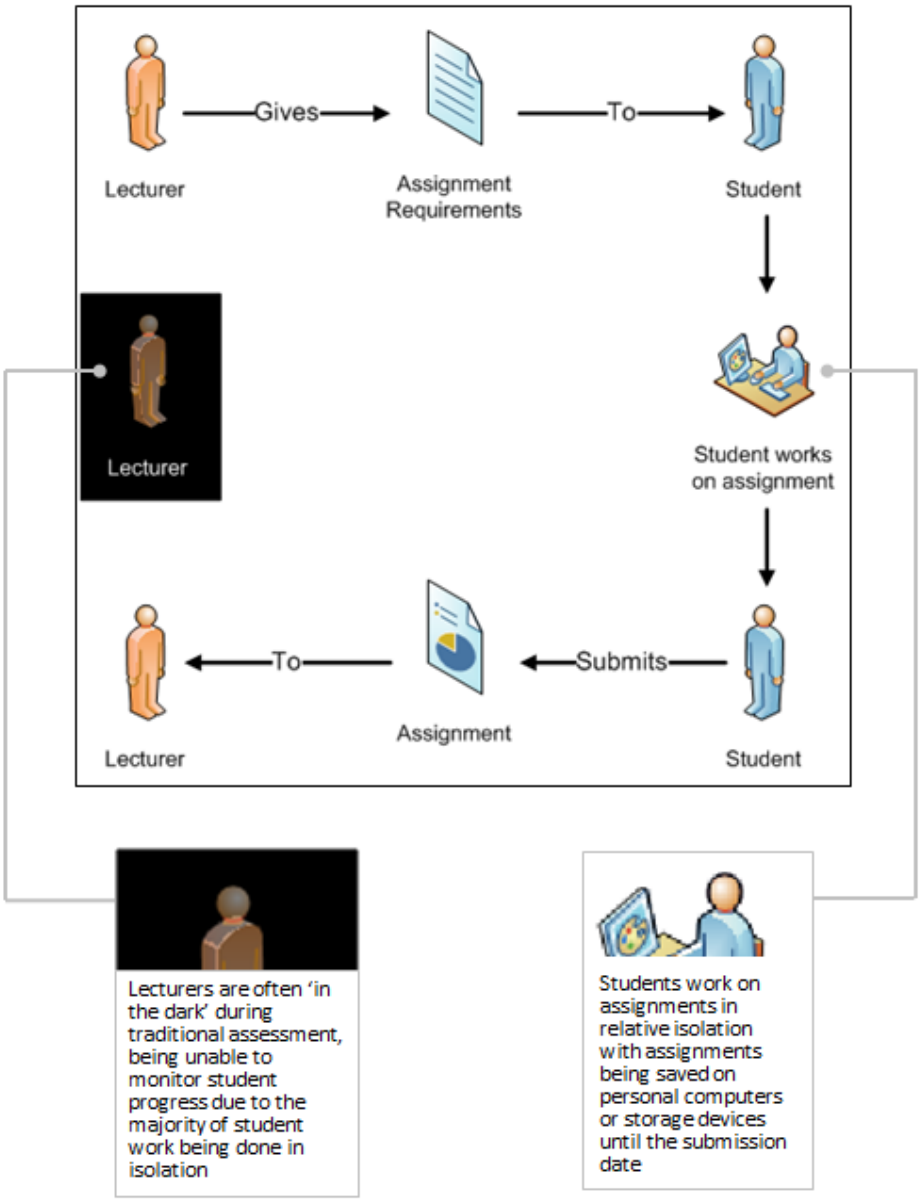

Figure 1.1 Traditional Assesment Learning Environment

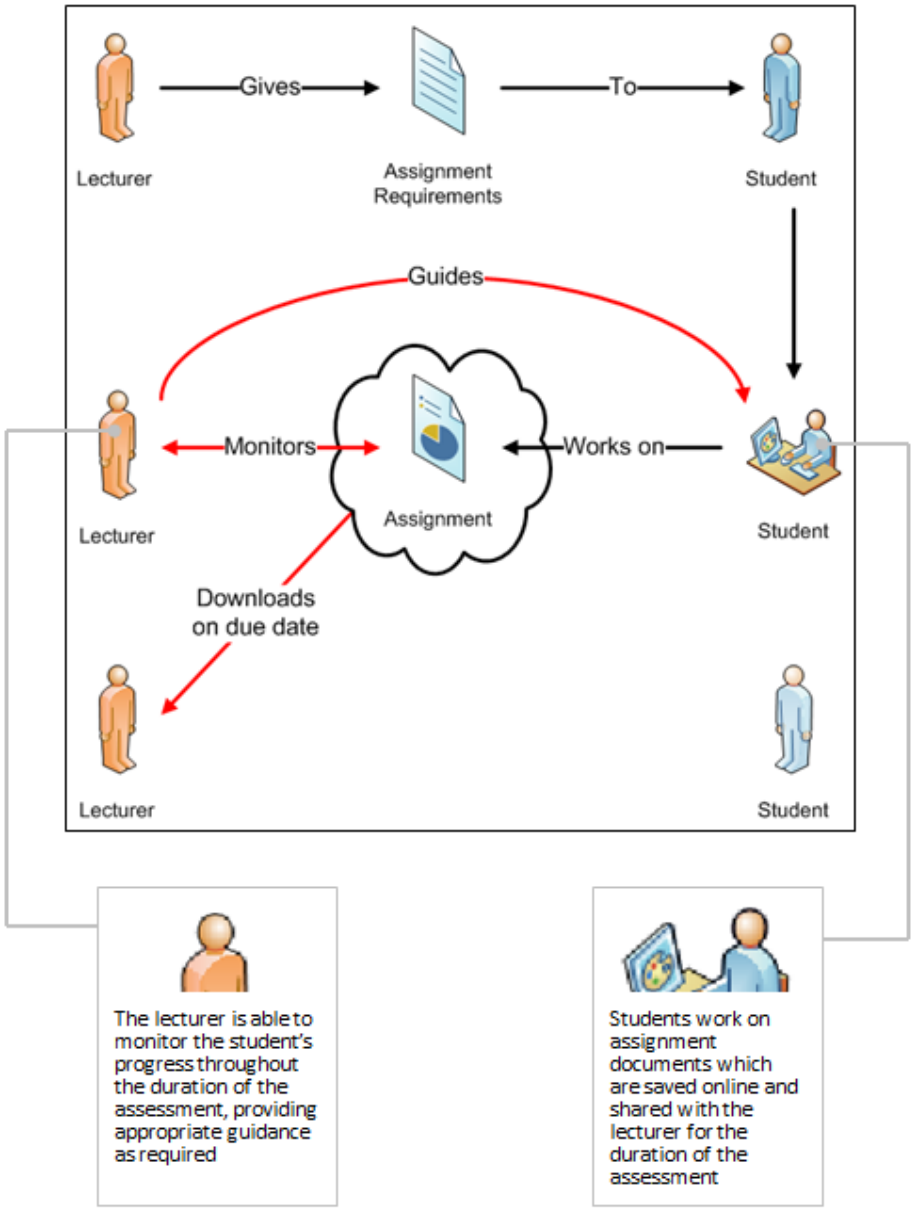

Figure 1.2 Cloud Assessment Learning Environment

1.4 Research Objectives

The goal of this research is to specifically investigate student perceptions of the cloud assessment learning environment and discover if relationships exist between these perceptions and student attitudes towards subject, computing confidence and achievement. The study also seeks to discover if there is a conceptual change in student understanding of the cloud assessment learning environment over time and if engagement with the environment impacts teacher and student perceptions of teacher-

student interpersonal behaviour. The specific research questions asked in this study are as follows:

1. Are the instruments used in this study valid and reliable when used with this research sample?
2. Are there differences in teacher and student perceptions of teacher-student interpersonal behaviour in the cloud assessment learning environment?
3. What factors of the cloud assessment learning environment do students perceive as positive and negative?
4. Is there a conceptual change in student understanding of the cloud assessment learning environment over time?
5. Is there a relationship between student perceptions of the cloud assessment learning environment and their level of achievement?
6. Is there a relationship between student perceptions of the cloud assessment learning environment and their attitude towards the subject in which it is used?
7. Is there a relationship between student perceptions of the cloud assessment learning environment and their level of computing confidence?

The perceived positive and negative factors of the cloud assessment learning environment mentioned in the third research question refer to factors which students may perceive as either enabling or inhibiting within the cloud assessment learning environment.

Beyond the specific research questions, a more generalised objective of this study is to provide new knowledge and understanding of the cloud assessment learning environment and open up avenues for future study into this new and emerging area of research. Another intended outcome is to validate the instruments used for the assessment of this unique learning environment.

1.5 Limitations

In this section the limiting factors of the research will be discussed. The research presented in this thesis revolves around a multi-method case study centred on a four week cloud assessment learning environment assignment undertaken by 50 second year ICT students from UCOL, Palmerston North, New Zealand. Although the study has produced a substantial amount of in-depth data, the research was limited by a number of factors which will now be addressed.

The first limitation is due to the case study nature of the research. Specifically, the focus on ICT students from UCOL in Palmerston North, New Zealand, limits the degree in which the conclusions made about the localised research sample can be generalised to a wider population (Cohen, Manion, & Morrison, 2000). This is due to the fair assumption that students in the research sample may perceive the cloud assessment learning environment differently from other students not in the research sample (e.g. Nursing students from Beijing, China) (Cohen et al., 2000). However, this study does not attempt to provide universal conclusions of student perception of the cloud assessment learning environment, but instead aims to provide new understanding of the area of study by uncovering significant perceptions of the learning environment.

The next limitation stems from the fact the research sample is relatively small (50 students). Again, this limits the degree in which conclusions can be generalised (Bogdan & Biklen, 2003). However, it is worth nothing that the research sample actually equates to 100% of the students who undertook the cloud assessment learning environment assignment, 77% of the BICT second year student body, 34% of the overall BICT student body, and 2% of the wider Palmerston North, UCOL student body.

Another limiting factor to be aware of is the gender composition of the research sample which consisted of 42 (84%) male and 8 (16%) female students. Although the research sample was male dominant this did not appear to introduce a gender bias into the study as no significant difference arose when the male and female members of the research sample were compared. Although gender was a not a key variable within this study, the topic of gender is again briefly discussed later in this thesis in the interest of completeness.

Data collection fatigue in students was also a factor that was considered when designing this study. Although it would have been interesting to ask the research sample numerous other questions in various ways, thus potentially increasing validity and reliability of the collected data through methodical triangulation (Cohen et al., 2000), this was essentially impractical due to what is often called survey or data collection fatigue (Porter, Whitcomb, & Weitzer, 2004). In order to compensate for this limitation, direct data collection methods (e.g. questionnaires and interviews) were carefully selected and timetabled to minimise fatigue as research suggests survey fatigue has its biggest impact when instruments are administered back-to-back (Porter et al., 2004). Also to help reduce this fatigue, numerous indirect data collection methods were also employed (e.g. participant observations, online activity logs) which

still provided quality data without directly fatiguing the research sample. An overview of the research method employed by this study will be discussed later in this chapter with a more in depth description included in chapter three.

Participant observations were made throughout the study by the researcher, a data collection method which alone may have significant limitations. Nevertheless, these observations helped provide rich qualitative data concerning the research sample and were also balanced against the other data sources in this study. These observations, although a valuable data source, were made under obvious practical limitations, e.g. the researcher was primarily only able to observe students during timetabled classes. Although this provided an informative insight into the behaviour, attitude, and perceptions of the research sample, the members of the research sample were also able to engage with the cloud assessment learning environment outside of timetabled classes (another unique feature of this study). Furthermore, access could even occur at off campus locations, situations where students were unobservable in the traditional sense of the word. However, to compensate for this limitation, the online activity of student engagement with the cloud assessment learning environment was also collected. This data essentially provided a way to make participant observations of students interacting with the cloud assessment learning environment outside of timetabled classes, a data collection method that in this study has been termed virtual participant observations.

There were also a number of variables that were not specifically examined when conducting this study, e.g. ethnicity, age, gender, etc. Although this data was collected, it did not relate directly to any of the research questions, and as a consequence, less emphasis was given. However, a brief discussion concerning these additional variables has still been included in chapter five. This practical inability to cover all possible variables simply limits the research in the area of scope, however not to the detriment of the research given the underlying goals of the study.

In this section the limitations of the study have been discussed, namely, a localised and small research sample, potential gender bias, survey fatigue, and unexamined variables. Compensatory measures relating to the various limitations were also included where appropriate. The next section will proceed by exploring the significance of this study and areas of contribution.

1.6 Significance

This research is significant for a number of key reasons, each of which relate to the technology utilised, the unique cloud assessment learning environment created, and the additional variables examined alongside the environment. These areas of significance will be addressed in this section.

Perhaps the most significant aspect of this research is its core focus of using emergent cloud computing technologies to create a unique learning environment. As mentioned earlier, cloud computing is a relatively new buzzword often used to describe a variety of concepts relating to online software and infrastructure (Armbrust et al., 2010). The term first appeared in the literature in 1997 in a paper titled 'Intermediaries in Cloud-Computing: A New Computing Paradigm' (Chellappa, 1997). However, the term only began to gain prominence after Google's CEO, Eric Schmidt, used the term at the 2006 Search Engine Strategies Conference (Schmidt, 2006). Google Trends (see Figure 1.3) shows 'cloud computing' started to become a significant Google search term in late 2007 and has been steadily increasing ever since (with a peak and potential plateau from 2011 to 2012).

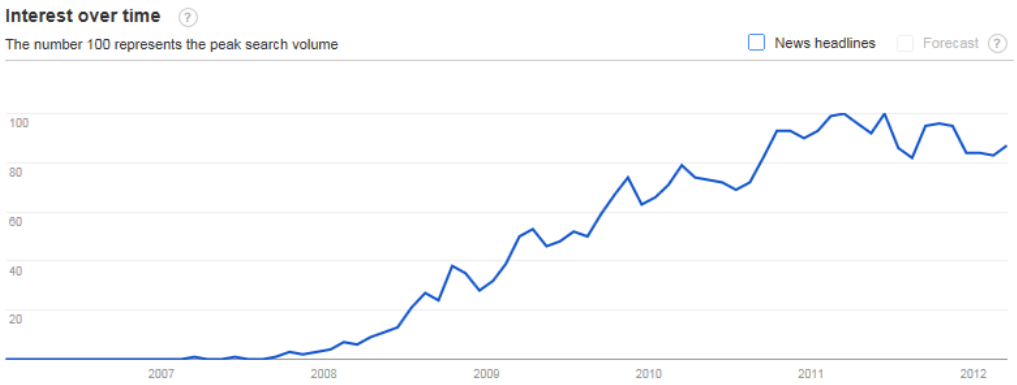

Figure 1.3 Google Trends Graph for 'Cloud Computing'

Google Trends (see Figure 1.4) also shows 'Google Docs' (a popular cloud computing service offered by Google) has been increasing in search popularity since the tools launch in late 2006.

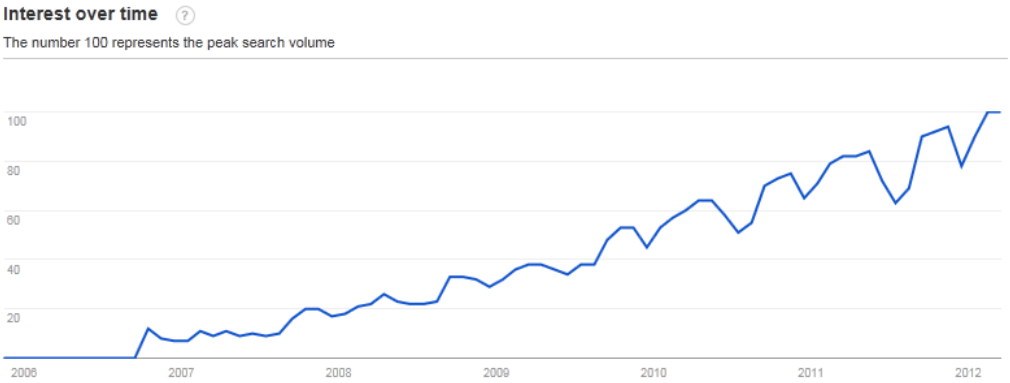

Figure 1.4 Google Trends graph for 'Google Docs'

Research involving cloud computing has also increased significantly over the past few years. Table 1.1 shows the Google Scholar document count for the exact phrase over past 7 years.

Table 1.1 Google Scholar document count for 'cloud computing'

Year	Google Scholar Document Count*
2012	36,900
2011	20,700
2010	12,000
2009	5,860
2008	1,370
2007	425
2006	328
2005	230

** Figures taken January 2013*

The above rough statistics highlight the growing popularity of cloud computing as a term, concept, and area of research. Further examination into the cloud computing literature will be given in chapter two, which more directly emphasises the growing popularity of the field of research. At the same time, chapter two also draws attention to the lack of research specifically on cloud assessment learning environments. Therefore, this research grows in significance due to the uniqueness and depth of the study in this emerging area of research.

Another significant aspect of this research relates to the examination of teacher-student interpersonal behaviour in the cloud assessment learning environment. Although significant research has been conducted in various learning environments

regarding teacher-student interpersonal behaviour (also covered in chapter two), this is to the author's knowledge, the first time research has been conducted that examines teacher-student interpersonal behaviour within a cloud assessment learning environment. Therefore, this study will make a unique contribution to the teacher-student interpersonal behaviour body of knowledge. Additionally, this research makes use of a version of the *Questionnaire on Teacher Interaction* (QTI) (see Appendix A) that has been adapted to suit tertiary students engaging in a cloud assessment learning environment. This will therefore contribute new information regarding the adaptability, reliability and validity of the instrument, as well as providing comparable results from a unique learning environment. Interestingly, this study also utilises a pre-test post-test design as opposed to a single collection approach, this has resulted in before and after results relating to teacher-student interpersonal behaviour which again separates this study from much of the existing work in the field.

In order to collect data regarding specific aspects of the cloud assessment learning environment a *Cloud Assessment Questionnaire* (CAQ) (see Appendix B) was also developed specifically for this study. This instrument has been designed to focus on distinct characteristics of the environment including the lecturers ability to monitor student work, the use of cloud computing technologies, the early feedback mechanism enabled by the environment, cloud storage and automatic submission, and whether student have a preference between the cloud assessment learning environment and a traditional assessment environment. The application and validation of this new instrument also provides another contribution to future researchers of cloud assessment learning environments, and is significant in the sense that it is the first instrument designed to collect data relating to specific characteristic of the environment.

Ultimately this study seeks to enhance the teaching, learning and assessment processes employed by educators through the utilisation of cloud computing technology. Although this study has been conducted in a specific area of the wider educational spectrum, the findings from this study will be able to be utilised in numerous educational contexts. One closely related area of study which will likely be able to build on the findings of the study is that of peer review. The cloud assessment learning environment creates a unique relationship that gives the lecturer the ability to continually review student progress and provide feedback. A small alteration to the setup and application of the environment could easily result in a similar environment tailored to peer review whereby students could be in a position where they are able to

continually review (and be reviewed) by their peers. Although this peer review environment is not the focus of this thesis, the finding from this study will likely provide interesting implications for the peer review field of study.

Finally, a unique contribution is also made to the wider area of educational research through application of an integrated multi-method ethnographic case study research design. As will be covered in the following section, a number of complementary quantitative and qualitative data collection methods have been employed by this study in either single, multiple or continuous collection modes in order to produce rich, reliable and valid data. The combination of data collection methods used in this study provides a novel example of methodological possibilities available within learning environments research.

To summarise, this section has drawn attention to the uniqueness and significance of this study. The increasing interest in cloud computing has been presented. The unique contribution this study will make to the wider research community has been mentioned (more detail will be given in chapter two). The contribution this research makes regarding the use of specific research instruments and the research design has also been covered. The next section will present an overview of the research methodology.

1.7 Methodology Overview

As mentioned, a multi-method ethnographic case study approach was undertaken for this research, with the researcher acting as a participant observer. The case study centred around a summative assessment where students had four weeks to write a project management plan assignment for a given scenario using a cloud assessment learning environment. Although the assessment only lasted four weeks, the data collection process spanned the entire semester. This extended period of data collection was utilised in order to comprehensively address various research question variables, e.g. student attitude towards subject, computing confidence, academic achievement, conceptual change and student-teacher interpersonal behaviour, both before and after engagement with the cloud assessment learning environment. For a visual overview of the method see Figure 1.5, shaded boxes indicate data collection occurrences and strength of colour indicates strength of student involvement.

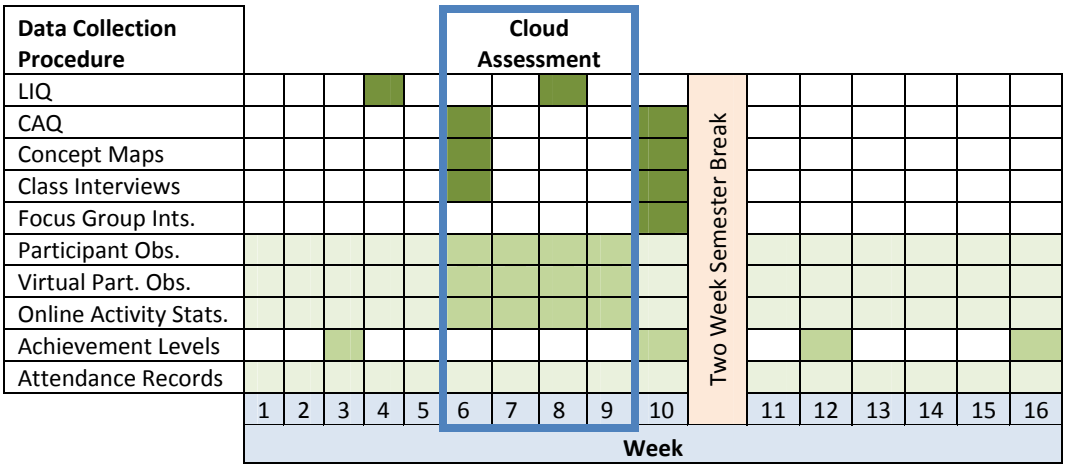

Figure 1.5 Method Overview

Although the study includes a number of qualitative data sources, a substantial amount of quantitative data was also collected. Both the qualitative and quantitative data were collected via a variety of methods. These methods were: student questionnaires (with qualitative and quantitative items), concept maps, class interviews, focus group interviews, participant observations, virtual participant observations, online activity statistics, student achievement levels, and student attendance records. The data collection involved both direct student participation (e.g. questionnaires) and indirect student participation (e.g. participant observations), as mentioned, these collection methods were balanced in order to minimise student data collection fatigue.

In order to compensate for the limitations of this study it was decided to collect both qualitative and quantitative data using varying methods in order to provide a comprehensive data set for the study (Bogdan & Biklen, 2003; Cohen et al., 2000; Freebody, 2003). This multi-method approach to data collection was specifically selected with methodological and data triangulation in mind. The expectation was that the same student perceptions of the cloud assessment learning environment would clearly emerge across the different data sets. This convergence of information for each of the parts in turn enhancing the reliability of the conclusion made about the whole (Freebody, 2003). Greater detail and justification of each of the data collections methods used in this study will be given in chapter three.

1.8 Thesis Overview

In this chapter an introduction to the thesis has been presented. The origin of the thesis was described, background information relating to the study has been given, the research objectives have been stated along with the specific research questions,

limitations of the study have been detailed, the significance of the research has been highlighted and finally, an overview of the research methodology has been given.

Chapter two will present a literature review relating to this study and will aim to highlight the lack of research in the area of cloud assessment learning environments. Chapter three will provide an in-depth description of the research methodology including explanation and justification of each of the data collection methods used for the study. Chapter four will present the results of the data collection phase of this study. Chapter five will discuss the findings in depth as they relate to the research questions and emphasis will be given to convergent themes from the multiple data sources. Finally, chapter six will systematically address each of the research questions in light of the discussion and will present the conclusions from this study.

Chapter 2 Literature Review

2.1 Introduction

The previous chapter introduced this study, provided background information, outlined the project objectives and gave an overview of the research methodology. In this chapter the literature relating to this study will be reviewed. Due to the fact that this study exists loosely within the overlap between cloud computing and learning environments research, both of these fields of study will be reviewed with particular focus on the literature involving the key variables present in this study. To reiterate, the key variables from the research questions are: teacher-student interpersonal behaviour, student perceptions of the cloud assessment learning environment, conceptual change in understanding over time, level of achievement, attitude towards subject, and computing confidence (refer to the research questions presented in the previous chapter). Many of studies reviewed in this chapter make use of quantitative scale based instruments, and as a result, often report Cronbach's alpha as a statistical indication of validity and reliability. Cronbach's alpha is a measure of the average correlation or internal consistency of items within a scale and is used as a gauge of scale reliability (Cronbach, 1951; Santos, 1999). For comparative reasons, Cronbach's alpha coefficients have been included within this review (where available), and will be later compared and contrasted with the findings from this study.

However, before the statistical reliability of quantitative instruments is covered, attention will first be given to the cloud assessment learning environment. As the cloud computing environment exists as a significant component within this study, the literature review will begin by investigating studies conducted in this unique learning environment. Specifically the review will begin by examining the origin of the underlying technology, i.e. cloud computing, and its use within education.

2.2 Cloud Computing

As mentioned in chapter one, cloud computing is a relatively new term in the world of computing with its first mention occurring in 1997 (Chellappa, 1997). Despite the first mention during the late nineties, the term did not enter the mainstream until nearly a decade later (see significance section in chapter one), consequently this section aims to cover both the origin of the concept and the terms introduction into mainstream usage. Accordingly, this section will proceed by revisiting the definition of cloud computing used within this thesis, next an exploration into the origins of the concept of cloud

computing will be given, following this the origin of the cloud symbol will be explored and finally the use of cloud computing in education will be discussed.

2.2.1 Cloud Computing Definition

Although cloud computing as a term has become quite well known in ICT circles, some debate still exists surrounding an exact definition (Armbrust et al., 2010; Wang et al., 2008) and applications in an educational context. Armburst et al. (2010) describe cloud computing as:

> "both the applications delivered as a service over the Internet and the hardware and systems software at data centres that provide the services" (p. 50).

The National Institute of Standards and Technology (NIST) describe cloud computing as:

> "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, applications, and services) that can be rapidly provisioned and related with minimal management effort or service provider interaction" (Mell & Grance, 2011, p. 2).

Wang and von Laszewski propose an alternative definition,

> "A computing cloud is a set of network enabled services, providing scalable, QoS guaranteed, normally personalised, inexpensive computing platforms on demand, which could be accessed in a simple and pervasive way" (Wang et al., 2008, p. 3).

A much more basic description of cloud computing is given by Cohen, as cited by Geelan (2009) who describes it as,

> "internet centric software" (Geelan, 2009, p. 1).

However, as mentioned for the purposes of this study, cloud computing is defined as the process of utilising online computer technology to complete a task, a simplified definition that is in basic agreement with the literature and fit for the purposes of this study.

Interestingly, when cloud computing technologies are examined two main categories tend to emerge. The first category encompasses those technologies that use the cloud for end to end communication and online storage with any intensive processing being

achieved via the use of traditional locally installed applications (e.g. working on a Word document locally and saving it online, in the cloud, on a remotely located server), this category of services are also commonly called cloud storage, a form of Infrastructure as a Service (IaaS) (Hoefer & Karagiannis, 2010). The second category encompasses those technologies that also use the cloud for communication and online storage but also go a step further and allow any intensive processing to be achieved in the cloud (e.g. collaborating on a Google document in the online cloud environment), the main advantage of the second group of technologies is that no locally installed software is required to use the system, the software is in the cloud, this category of cloud computing is also often referred to as Software as a Service (SaaS) (Hoefer & Karagiannis, 2010). It is this version of cloud computing (SaaS) that has been utilised in this study to implement the cloud assessment learning environment. Therefore, to summarise, cloud computing is the process of utilising online computer technology (specifically SaaS) to complete a task. With this definition in mind, the next sections will begin to explore the origins of both the term and concept of cloud computing.

2.2.2 The Cloud Symbol

One of the first questions asked by the researcher at the outset of this literature review concerned the cloud symbol, simply put, why is cloud computing called cloud computing? A quick search revealed that the cloud symbol has traditionally been used in network diagrams to represent a network or the Internet (Bala, 2010; Kumar, Cheng, & McGibbney, 2010), thus cloud computing was Internet or online computing. However, this answer only led to another question: why does the cloud symbol get used to represent the Internet? Investigation into this second question resulted in a slightly tangential, yet historically interesting exploration that delved back beyond the origin of the Internet itself, to its predecessor the Advanced Research Projects Agency Network (ARPANET).

ARPANET was essentially the first widespread packet switched computer network (Leiner et al., 1997). When ARPANET was first created and its design discussed academically in the late 1960's, it consisted of a fixed number of nodes (initially only four) that could all be visually represented in a single diagram (Computer History Museum, 2006), see Figure 2.1.

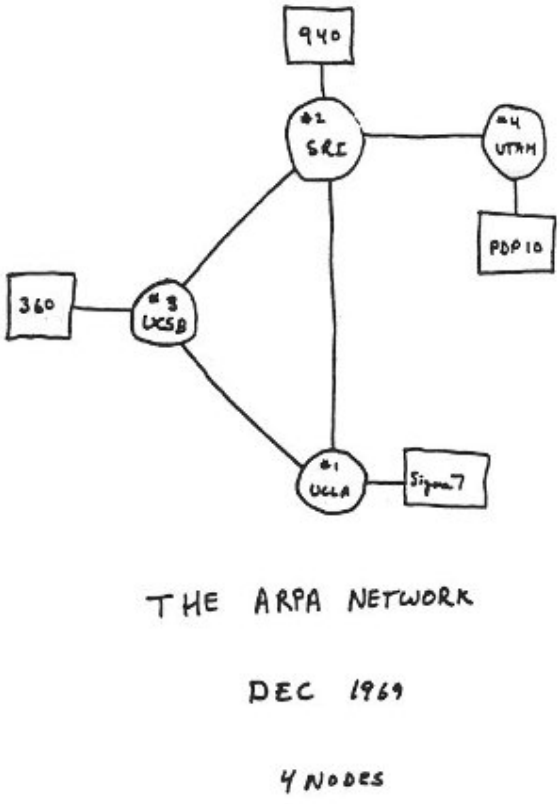

Figure 2.1 Four Node ARPANET Diagram 1969

As ARPANET grew in size, its ability to be represented visually in a single diagram reduced (Kirstein, 1973), see Figure 2.2 and Figure 2.3.

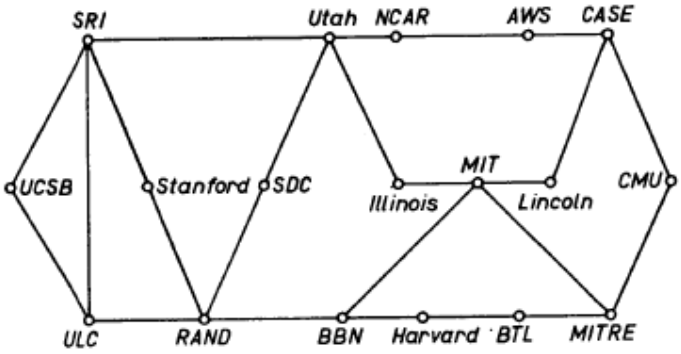

Figure 2.2 Eighteen Node ARPANET Diagram 1973

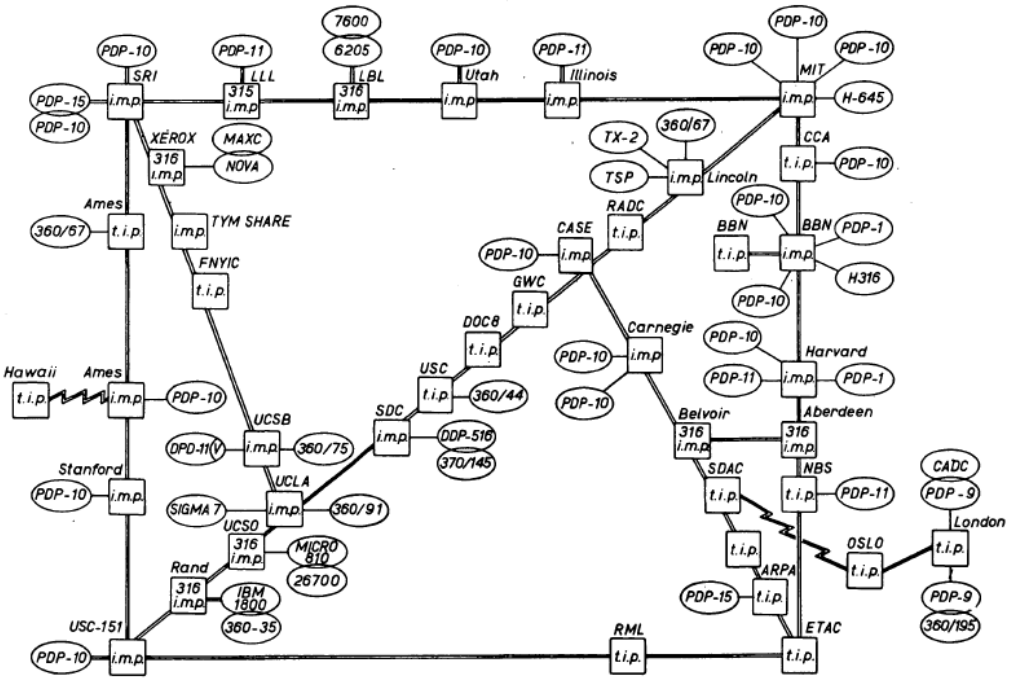

Figure 2.3 Approximate ARPANET Diagram 1973

Eventually, ARPANET grew beyond what could feasibly be depicted in a single diagram. The network itself and theoretical networks also began to be discussed as single entities. This occurred during the early 1970's at which point ARPANET and the concept of a computer network began to be depicted as nebulous blobs (Cerf & Kahn, 1974; Cosell et al., 1975), see Figure 2.4 and Figure 2.5.

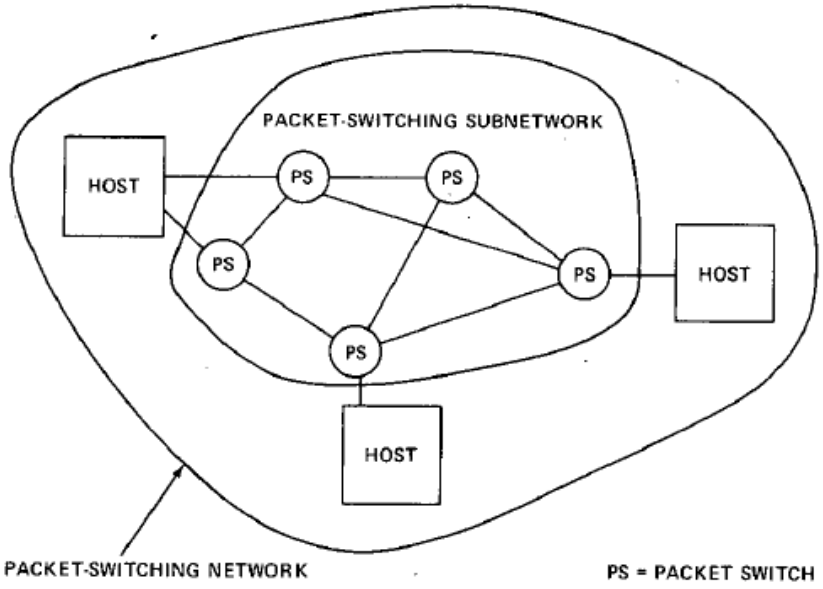

Figure 2.4 Blob Network Diagram 1974

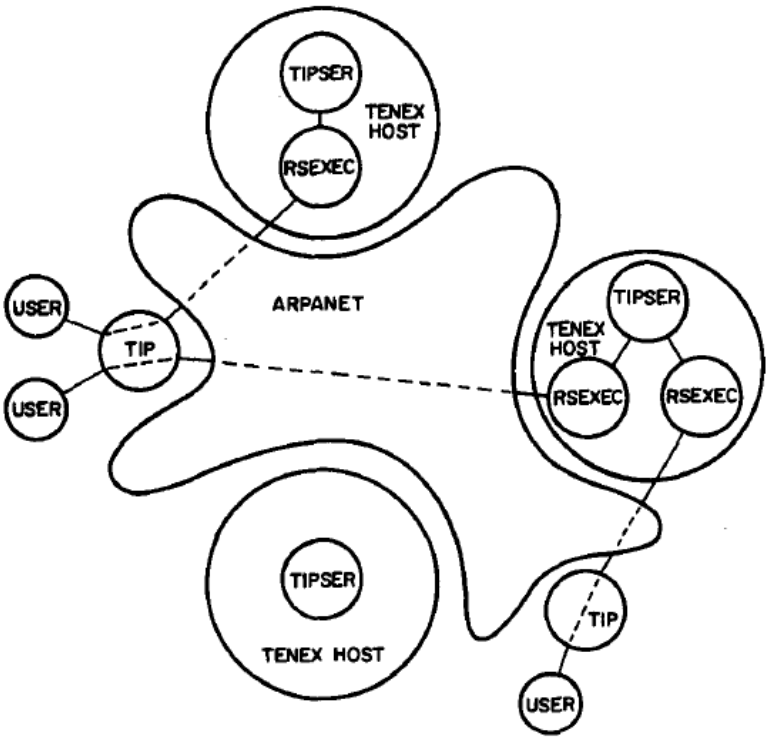

Figure 2.5 Blob ARPANET Diagram 1975

By the mid 1970's ARPANET and networks in general began to be represented by cloud like blobs, some of the earliest depictions coming from Vinton Cerf and co (Cerf, McKenzie, Scantlebury, & Zimmermann, 1976).

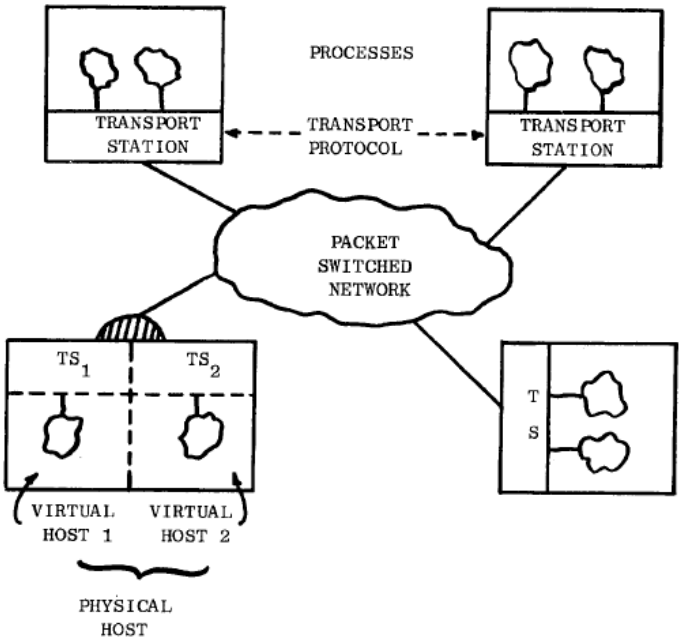

Figure 2.6 Cloud Network Diagram 1976

Finally, by the 1980's, aided by the advent of computer graphics the cloud symbol had established itself as the de facto symbolic representation of the Internet (Hinden, Haverty, & Sheltzer, 1983), see Figure 2.7.

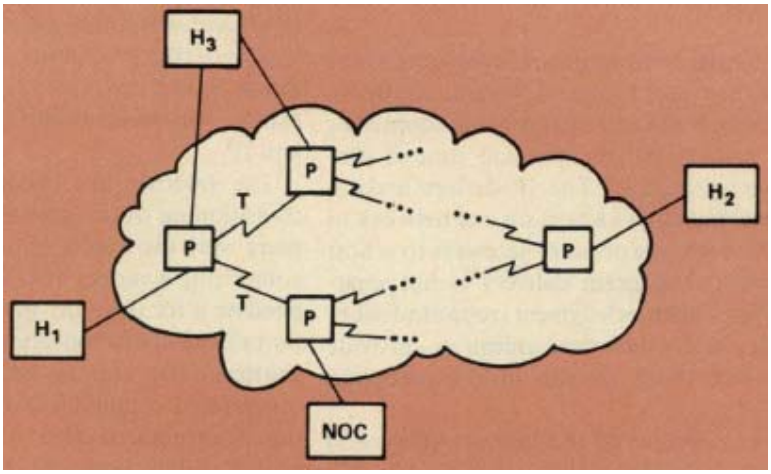

Figure 2.7 Cloud Symbol Representing the Internet 1983

2.2.3 Cloud Computing Concept

While the term cloud computing is relatively new, the underlying concept behind cloud computing has existed for significantly longer. In a speech at the MIT Centennial in 1961 John McCarthy provides perhaps the earliest example of the concept, stating:

> "If computers of the kind I have advocated become the computers of the future, then computing may someday be organized as a public utility just as the telephone system is a public utility... The computer utility could become the basis of a new and important industry." (Abelson, 1999, p. 1)

Beyond this, the idea of having computing resources centrally located and remotely accessed can actually be viewed as a throwback to early client server mainframe computing solutions (Weber, 2011). Before the advent of the personal computer (PC) computer processing power was essentially restricted to computer mainframes (Voas & Zhang, 2009). Mainframes allowed users to access the processing power via thin clients (computer terminals without any processing power). However the systems could not support multiple concurrent users and often were managed through a time sharing approach. In many ways, the current approach to cloud computing mimics the mainframe approach to computing, however the mainframe server has been replaced by the Internet, and cloud computing has the key advantage of supporting multiple concurrent users (Voas & Zhang, 2009).

Perhaps one of the earliest examples of web based cloud computing occurred in the mid 1990's with the arrival of free online email services such as Hotmail and Yahoo! Mail. These webmail services allowed users to access, manage, and send email messages entirely through a web interface accessed via a web browser (Miller, 2008; Weber, 2011). At the turn of the century, during the early 2000's social networking services began to take centre stage on the World Wide Web. These services can be accessed entirely through a web browser and are also examples of cloud computing (Buyya, Ranjan, & Calheiros, 2009). With these services, each user's social information, connections and interactions are stored and occur online, in the cloud and require nothing more than an internet connection and web browser to use.

More recently cloud computing and specifically the term 'cloud' has been used to market cloud computing solutions, significant examples include Apple's iCloud (Apple, 2012), Microsoft's Microsoft Cloud Solutions including Microsoft Private Cloud, Windows Azure, and Office 365 (Microsoft, 2012), as well as Google's Google Drive (Google, 2012c) and Google Cloud Connect (Google, 2012d). All of these examples aim to provide cloud services for business and or personal consumer use. The services range from simple online storage, integrated desktop and cloud facilitated collaboration, through to entirely cloud based computing solutions. As mentioned, the term software as a service (SaaS) is also commonly used to describe cloud based software solutions, many of these systems aim to provide free online alternatives to traditional desktop applications. For example, Google Docs (now a part of Google Drive) exists as a free online word processing application alternative to traditional desktop word processing applications like Microsoft Word. Google Docs is also the primary cloud computing tool used within this study.

2.2.4 Cloud Computing Summary

This section has presented a review of the origins of both the term and the concept of cloud computing. Despite the concept existing for decades (even predating the Internet), modern cloud computing as it is commonly understood today did not enter the mainstream until after the advent of the World Wide Web in the mid 1990's, the term itself not entering common vernacular until a decade later during the late 2000's. Since its introduction many of the technologies that make up the wider spectrum of cloud computing have been adopted by numerous users for various purposes all over the world. The next section will aim to investigate the use of these cloud computing technologies specifically within the context of education.

2.3 Cloud Computing in Education

Due to the wide range of technologies that are conceivably encompassed by the term and concept of cloud computing, researching the related literature with regards to its use within an educational context proved to be a reasonably complex task. Technically speaking, numerous elementary technologies could be classed as examples of cloud computing (e.g. webmail, discussion forums, etc.). Consequently, in order to focus the scope of this section, elementary technologies that are generally well understood within an educational context have not been included. Instead, focus has been given to those technologies that are a more complete representation of cloud computing (i.e. those that involve more than simple end to end communication). Accordingly, this section will proceed by exploring various instances of cloud computing that have been used in education.

2.3.1 Wikis in Education

A wiki can be defined as a set of linked web pages, created through the incremental development by a group of collaborating users (Leuf & Cunningham, 2001). The key feature of wiki technology that separates the wiki from other web based technologies is their open, collaborative, nature. The most well-known example of a wiki in action is Wikipedia; the online encyclopaedia exists in a constant state of incremental development as a result of the millions of contributions made by users from all over the world (Wikipedia, 2012). Educationally, wikis have been used and studied in various collaborative classroom environments and student group environments. Furthermore, as mentioned in the introduction, it was a wiki solution (Google Sites) that was the original catalyst for this study. As will be seen, much of the literature reviews the suitability and limitations of the technology within an educational context, accordingly a selection of wiki related studies will now be presented, followed by a brief summary.

A study by Guth (2007) focused on the issue of public versus private wikis for educational use. The study highlights that wikis used in educational settings are often installed within existing institutional learning managements systems (LMS) and are consequently made private (i.e. only students with access to the LMS can access the wiki), or semi-public (i.e. only students with access to the LMS can edit the wiki, although it is still viewable by others). The Guth (2007) study suggests that making educational wikis public would result in greater educational benefits. The study also discusses the advantages and disadvantages of private and public wikis based on the analysis of two groups of students who engaged with both types of wikis over a two semester period. The Guth (2007) study also found that students developed a greater

sense of collaboration when using public wikis. Conversely, students had a greater sense of ownership when collaborating on semi-public wikis. Interestingly, Guth (2007) also found that students felt an increased sense of responsibility regarding quality of work when contributing to public wikis. Ultimately, the Guth (2007) study concluded that students preferred using semi-public wikis.

Bruns and Humphreys (2005) investigated the use of wikis for teaching and assessment within the context of a New Media Technologies (NMT) course at the Queensland University of Technology. The study focused on what was called the M/Cyclopedia Project where students enrolled in the NMT course were required to collaboratively develop encyclopaedia type entries on a wiki as part of a group assessment. Students were subsequently also required to develop encyclopaedia entries for a selected sub topic as part of an individual assessment. The researchers noted that coordinating unique topics for the students became very challenging and somewhat problematic with multiple students attempting to develop the same or overlapping sub topics. Issues were also noted regarding students unfamiliarity writing encyclopaedia type entries with many students contributing essay type entries. The study also identified the fact that the class wiki ended up being used in manner contrary to the fundamental intention of the technology, noting that allowing universal collaboration between students would have made effective assessment virtually impossible. The study concluded that despite the challenges encountered, wikis had been found to be very useful, specifically for collaborative group work. It is also worth noting that data concerning student perceptions of the wiki based learning environment was not formally collected from the students during the study and all findings presented in the study appear to have been derived from the researchers' experiences as participant observer lecturers within the NMT course.

In a paper by Wheeler, Yeomans, and Wheeler (2008), the potential for wiki-type technology to promote and support collaborative learning was examined. The study focused on qualitative findings from a number of undergraduate teacher training students who engaged with wiki technology during their studies. It should be noted that the Wheeler, Yeomans, and Wheeler (2008) study reports on the use of wiki technology as a teaching and learning tool and that the class wiki was not used for student assessment. The study also found a number of limitations as identified by the students. The first limitation stemmed from student unfamiliarity with the wiki software and identified a number of students who felt stressed and confused regarding the structure and use of the tool. The second limitation concerned students who felt

the wiki activities did not suit their learning preferences citing the tool as being unstructured, too open and in need of boundaries. The Wheeler, Yeomans, and Wheeler (2008) study reported that students began to apportion certain areas of the wiki to specific people in order to avoid collaborator conflict. This self-organisation unfortunately resulted in reduced student collaboration which was noted as a limitation as many students were found only to read the pages they had worked on. Another interesting limitation revolved around the issue of ownership, the study found students became protective of pages they had edited. One student was quoted as saying "I don't like the fact that it's anonymous. I want credit for what I have done", another stated "I think I will cry if anyone changes my page". Wheeler, Yeomans, and Wheeler (2008) also found a number of technological issues students encountered when using the tool that result in student contributions not being saved. Wheeler, Yeomans, and Wheeler (2008) also identified a number of benefits regarding the use of the technology. Students felt increased responsibility with regards to making accurate and relevant contributions due to the fact their work would be seen by others. A number of students also reported that they believed their writing and critical thinking skills had improved through their use of the shared space. Ultimately the study concludes that wikis have a place in the classroom, however their use and intention should be clearly communicated to students and collaboration over competition should be emphasised.

In a paper by Parker and Chao (2007) the many potential uses of wikis in education are reviewed. The paper draws on the literature and details how wikis have been used for student research projects, collaborative annotated bibliographies, publishing course materials, a shared knowledge base, brainstorming, presentations, and group authoring. The study also notes that wikis are essentially very useful for any project that does not necessitate individual authorship. The Parker and Chao (2007) paper also highlights a number of problems that have been identified with using wikis in the classroom, they included: all content is modifiable by any user, all content is public (student may wish to keep pages private but are unable to), and simultaneous edits are allowed but are not successful (can result in students contributions being overridden or lost). Parker and Chao (2007) conclude that educators can prepare students to be innovative collaborators by incorporating wikis into the classroom.

Although the use of wikis in education has been reasonably well documented, research has shown that the technology has some limitations, specifically in the areas of individual work and assessment. The literature reported here has shown that when

used appropriately, wikis can function as an innovative medium, ideal for collaborative student work. However, the literature has also shown that the technology becomes problematic when used outside of its intended purpose, i.e. individual work and assessment where student collaboration is not desired. Interestingly, the cloud assessment learning environment (as implemented in this study) is focused on exactly this type of individual student assessment, this is a key distinguishing factor between the cloud assessment learning environment and wikis. To summarise, the literature has shown that wikis are ideally suited to collaborative learning environments but at the same time, are less than ideal for individualised student work or assessment.

2.3.2 Learning Management Systems

Although a number of different terms exist that describe similar types of systems, for the sake of this study, a Learning Management Systems (LMS) will be defined as an all-in-one software solution that can facilitate online management, learning, and assessment (Paulsen, 2002). A number of LMS's are reasonably well known including: Blackboard, Moodle, and WebCT. This section will proceed by examining a selection of studies related to these systems.

A recent study by Bridge and Appleyard (2008) compared electronic and paper-based assignment submission and feedback techniques. The study focused on the experiences of 47 students who submitted assignments and received feedback via the Blackboard LMS. Research participants were asked to complete a questionnaire aimed at gaining student perceptions of the online submission and feedback system. The participants were asked to compare their online experience with previous experiences of paper-based assignment submission and feedback processes. The study found that 88% of student reported time saving and 93% of the students preferred having their feedback delivered online rather than handed out in printed form. Interestingly, the main disadvantage of electronic assignment submission cited by the students was student distrust of the assignment receipt system. Bridge and Appleyard (2008) recommend the use of electronic assignment submission, particularly in situations where students may be remotely located. Bridge and Appleyard (2008) also conclude that electronic submission is also best suited to assignments that do not require large graphical components due to the resulting increased size of assignment files.

A study by Petrus and Sankey (2007) conducted a comparative analysis of two online assignment submission technologies, Writely and Moodle. Interestingly, subsequent to their study Writely was actually acquired by Google and went on to become what is

known today as Google Docs. The study focused on the survey results of small sample of 13 students. After engaging with both assignment submission technologies students were asked to complete a questionnaire that contained both quantitative and qualitative questions. The researchers found that the quantitative data provide a clear indication that students preferred Moodle over Writely while the qualitative data gave clear reasons as to why this was the case. The reasons given by the students included: technical issues using Writely, formatting issues when using Writely, and lack of notification when submitting with Writely. Interestingly, in order to submit assignments using Writely, students were required to share their document with their lecturer (as opposed to having it shared with their lecturer throughout the assessment which is a distinguishing characteristic of the cloud assessment learning environment). The study also noted two main benefits students found with Writely were the collaborative features and ability to modify their assignments prior to the submission deadline. However, the study ultimately concludes by recommending Moodle for assignment submission.

Ngai, Poon, and Chan (2007) conducted an empirical examination of the adoption of WebCT using the *Technology Acceptance Model* (TAM). The study actually extends the TAM to include technical support, with the resulting model describing potential relationships in the LMS's that include: System Usage, Intention to Use, Attitude, Perceived Ease of Use, Perceived Usefulness, and Technical Support. The study utilised a 25 item survey aimed at assessing the six components of the TAM and was completed by 1,263 students. The Ngai, Poon, and Chan (2007) study found that technical support had a direct effect on the perceived ease of use and perceived usefulness of WebCT. Technical support was also found to have a strong indirect effect on attitude. Ngai, Poon, and Chan (2007) conclude that tertiary institutions should provide effective training, user support and encouragement when introducing a new LMS.

The literature has shown that students are generally supportive of LMS's for teaching and assessment, often citing various aspects of LMS's as benefits including: convenience, time saving, and ease of use. A number of other LMS related studies are also reviewed later in this chapter regarding their relationship to academic achievement.

2.3.3 Google Docs in Education

Recently, a growing amount of research into the use of Google Docs in education has been developing. Google Docs is also the technology that was used to implement the

cloud assessment learning environment that forms the focus of this thesis. The majority of the existing studies that involve Google Docs do not necessarily implement a cloud assessment learning environment, however as the technology used is the same as in this study, a number of these studies have been reviewed.

As mentioned in the previous section, a study that involved the use of Writely (the precursor to Google Docs) was conducted to investigate assignment submission (Petrus & Sankey, 2007). Although Writely was used by students for assignment work, a cloud assessment learning environment was not implemented as students only shared their work with their instructors upon completion as a form of assignment submission.

A study by researchers from the University of Agder in Norway conducted a case study investigation into student perceptions of collaborative writing using Google Docs and EtherPad (Brodahl, Hadjerrouit, & Hansen, 2011). The collaborative writing model utilised in the study is very similar to the cloud assessment learning environment, however the key difference is that the interactions between members during the collaborative writing process are peers, student to student, whereas the cloud assessment learning environment enables interaction between students and their lecturers. The study focused on 201 education students who were assigned a collaborative writing task and were surveyed upon completion to which 166 responded. The survey consisted of nine statements relating to the collaborative writing environment to which students could respond according to a five point Likert scale ranging from Strongly Agree to Strongly Disagree. The study found that students with a high digital competency had a positive attitude towards the cloud based technologies and that gender did not play a role. The study also found that the tools did not work as expected for 70.5% of the students. However, the study also revealed that almost half (47%) of the students enjoyed being able to comment and edit others contributions to group work. The study concluded that students tended to prefer Google Docs over EtherPad, however it was noted that EtherPad was unavailable for a period of time during the study which likely would have contributed to this statistic.

ÓBroin and Raftery (2011) conducted a study on the use of Google Docs for the support of project-based learning. The study reports findings based on a case study of a group of students who used Google Docs for a three month collaborative group project where students worked on producing a quality manual. At the conclusion of the assessment students were asked to complete a short questionnaire, to which 26 students responded. The questionnaire consisted of six questions focused solely on the use of

Google Docs as a technology. The study identified a number of benefits cited by the students including: collaboration, simultaneous editing, and ease of use. Students also reported a number of limitations that they had encountered when using Google Docs, these included: errors when simultaneously editing the same region of text, spontaneous deletions of text, returning to the top of the document after auto saving, problems adding charts, slowness, and occasional server unavailability. Interestingly, although identified issues outweighed identified benefits in number, 17 out of 26 (two thirds) of the students also stated that they would use Google Docs again, citing the ease of use and collaborative features as key reasons. Interestingly, the groups also shared their collaborative documents with their lecturers, who in turn monitored student progress and gave feedback, thus creating a cloud assessment learning environment. However, this aspect of the assessment was not identified as a focus of the study, nor was any data collected regarding student perceptions of this unique assessment learning environment, the only data that was collected related to Google Docs solely as a technology.

Although a number of studies have explored the use of the collaborative features of Google Docs, it is interesting to note that the cloud assessment learning environment (even when unknowingly implemented) has not yet formed the focus of any research. Put simply, the existing studies into the use of Google Docs in education have not yet examined the unique characteristics of the cloud assessment learning environment or student perceptions of the environment, both of which are key focal areas of this study.

2.3.4 Cloud Computing in Education Summary

The literature has revealed that various cloud computing technologies have been steadily incorporated into various forms of education (Guth, 2007; Paulsen; 2002; Petrus & Sankey, 2007; Brodahl et al, 2011). Wikis have been shown to be useful for collaborative group work, learning management systems have been found useful for overall course management including assignment submission, and Google Docs has also been documented as a useful tool for collaborative group work. Although these previous studies have incorporated the cloud computing technologies to varying degrees, it is worth noting that the cloud assessment learning environment has yet to be intentionally or specifically studied.

2.4 Learning Environments

As mentioned, the cloud assessment learning environment exists as an as yet unstudied, unique learning environment with a specific focus on assessment. This

section aims to review the literature relating to the wider field of learning environments research and will pay particular attention to those learning environment studies that are similar to the cloud assessment learning environment in either concept or technology.

The field of learning environments research is a well-established area of study. Historically, learning environments research tended to focus on face-to-face classroom based learning environments with numerous early studies focusing primarily on secondary school classrooms environments (Fraser, 1989). However, since its inception, the field of learning environments research has expanded to different levels and forms of education and has also started exploring computer-based blended, online, and mobile learning environments (Skelton, 2009; Snell & Snell-Siddle, 2008).

2.4.1 Learning Environments History

The origins of learning environments research is often traced back to two significant researchers and their respective instruments, Walberg's *Learning Environments Inventory* (LEI), and the *Classroom Environment Scales* (CES) developed by Moos. Both instruments have been validated, reused and adapted in numerous studies over the years (Fraser, 1989, 2002).

The LEI was originally developed by Herbert Walberg as part of his research and evaluation activities on Harvard Project Physics (Fraser, 1989). The LEI contains 105 statements to which students can agree or disagree with according to a four point scale (Strongly Disagree, Disagree, Agree, and Strongly Agree). The 105 items are used to measure the classroom climate according to 15 different scales (seven items per dimension). A simplified version of the LEI called the *My Classroom Inventory* (MCI) has also been created for younger children (Fraser, 1982). As mentioned, the LEI has been used in numerous studies proving the instrument to be valid and reliable in a number of different contexts, many of these studies have been compiled by Fraser (Fraser, 1989, 2002).

Statistically, the LEI was initially validated based on two research samples consisting of 464 and 1,048 North American secondary school students from eight different reference groups (Fraser, 1982). The Cronbach alpha coefficients for the first research sample ranged from .58 to .86 for the fifteen scales with the majority (14 out of 15) being over .60. The Cronbach alpha coefficients for the second research sample ranged from .54 to .85, again with the majority (13 out of 15) being over .60.

As mentioned, standing next to the LEI in the history of learning environments research is the *Classroom Environment Scales* (CES) (Fraser, 1989). The CES was originally developed by Rudolf Moos during his work in the development of social climate scales. The CES instrument contains nine scales with ten true or false items per scale resulting in a 90 item instrument. Sample items from the instrument include: "The teacher takes a personal interest in students" and "Students in this class get to know each other really well". Interestingly, the instrument has actual and preferred forms which allow students to describe their current (actual) classroom and also the ideal (preferred) classroom.

Since the initial development of the CES and the LEI both instruments have paved the way for a number of subsequent research projects that have often used either the CES or LEI as a departure point. Both instruments have been used as a basis for, have had scales used in, or have inspired in some way a number of subsequent specialised learning environments research instruments, some of which include: the *Technology Rich Outcomes Focused Learning Environments Inventory* (TROFLEI), the *What Is Happening In This Class* (WIHIC), the *Science Laboratory Environment Inventory* (SLEI), the *Web-Based Learning Environment Inventory* (WebLEI), the *Computer Classroom Environment Inventory* (CCEI), the *Distance and Open Learning Environment Scale* (DOLES), the *Distance Education Learning Environment Survey* (DELES), and the *Perceptions of Learning Environments Questionnaire* (PLEQ). Accordingly, a selection of these instruments will now be examined.

2.4.2 Technology-Rich Outcomes-Focused Learning Environments Inventory

The *Technology-Rich Outcomes-Focused Learning Environments Inventory* (TROFLEI) was developed to include specific dimension to assess technology and outcomes of a given learning environment (Aldridge, Dorman, & Fraser, 2004). The instrument built on an existing learning environments instrument, the *What Is Happening In this Class*? (WIHIC), and adds a focus toward technology and student outcomes. The instrument consists of 10 scales with eight items per scale, resulting in an 80 item instrument, each item being a five point Likert scale. The scales included in the TROFLEI are: Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Investigation, Cooperation, Equity, Differentiation, Computer Usage, and Young Adult Ethos. In a similar vein to a number of other learning environments instruments, the TROFLEI is administered with actual and preferred forms (i.e. students can describe their actual learning environment as well as their preferred learning environment). The TROFLEI instrument was validated with a research sample of 1,249 high school students from

Australia and achieved relatively high Cronbach alpha coefficients ranging from .77 to .95 for each of the scales, all bar one being .84 or higher. Accordingly, the study concluded that the TROFLEI was proven to be a valid and reliable instrument for measuring classroom environments.

2.4.3 Web Based Learning Environment Inventory

The *Web Based Learning Environment Inventory* (WebLEI) was developed as a response to the unique nature of web based learning environments that have now become commonplace in many tertiary institutions (Chang & Fisher, 2003). The instrument consists of four main scales that aim to measure student perceptions of web based learning environments, the scales are: Emancipatory Activities (online access, student autonomy, etc.), Co-Participatory Activities (flexibility, collaboration, reflection, etc.), Qualia (enjoyment, success, frustration, etc.), and Information Structure and Design Activities. Interestingly, the first three scales were adapted from previous work by Tobin on *Connecting Communities Learning* (CCL) (Tobin, 1998). The complete instrument consists of 37 Likert type items spread across the four scales. The WebLEI instrument was validated with a research sample of 334 undergraduate and graduate students, the results of which produced Cronbach alpha coefficients ranging from .65 to .88 (Chang & Fisher, 2003). Ultimately, the study found the WebLEI to be a valid and reliable instrument for measuring student perceptions of web based learning environments.

2.4.4 Computer Classroom Environment Inventory

The *Computer Classroom Environment Inventory* (CCEI) was developed in order to capture student perceptions of computer-based instructional settings (Maor & Fraser, 1996). The instrument consists of five scales: Satisfaction, Investigation, Open Endedness, Material Environment, and Organisation). Each scale is represented by six five point Likert scale questions resulting in a total of 30 items. The instrument itself was partially based on other existing instruments including the LEI. The instrument was validated with 120 students who engaged in computer-based classrooms with Cronbach alpha coefficients ranging from .62 to .91. The study found that students showed improvement with regards to enquiry skills and also perceived their classes as more investigative and open ended in nature.

2.4.5 Distance Education Learning Environment Survey

The *Distance Education Learning Environment Survey* (DELES) was developed by Walker and Fraser (2005) with the intention of providing an instrument tailored to the

measurement of post-secondary school distance education learning environments. The instrument contains 34 items spread across six scales: Instructor Support, Student Interaction and Collaboration, Personal Relevance, Authentic Learning, Active Learning, and Student Autonomy. The instrument was validated in a study that involved a research sample of 680 post-secondary school students enrolled in distance education classes. The study found the instrument to be valid and reliable and produced Cronbach alpha coefficients that ranged from .75 to .95 for the six scales. The study also found that student interaction and collaboration were noteworthy factors present in high-quality distance education. Interestingly, the instrument also included a seventh scaled focused on student attitude toward the subject. This independent scale consisted of eight items and was derived from the *Test of Science Related Attitudes* (TOSRA) and was found to have a Cronbach alpha reliability coefficient of .95. The TOSRA instrument will be covered in greater detail later in this chapter. Ultimately, the study concludes that the DELES instrument is suitable for assessing student perceptions of distance education learning environments.

2.4.6 College and University Classroom Environment Inventory

The *College and University Classroom Environment Inventory* (CUCEI) was developed by Treagust and Fraser (1986) in order to provide a learning environments research instrument capable of measuring student perceptions of small higher education classrooms. The instrument is comprised of seven scales which include: Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, and Individualisation. The instrument was administered to 372 students and was found to have sufficient internal consistency with Cronbach alpha coefficients ranging from .63 to .90 for individual student perceptions of actual and preferred learning environments for each of the seven scales. The instrument was also trialled with a research sample of 200 Spanish university students (Marcelo, 1988). In the Spanish study all scales were found to be valid expect for the Involvement scale.

2.4.7 Perceptions of Learning Environment Questionnaire

The *Perceptions of Learning Environment Questionnaire* (PLEQ) is an instrument also aimed at collecting student perceptions of their learning environment (Clarke, 1995). However, in contrast to many of the other instruments reviewed, the PLEQ is qualitative in nature and contains semi-structured open ended questions. The PLEQ instrument was designed to overcome some of the limitations inherent with the existing quantitative instruments (i.e. inability to investigate why students perceive their classrooms they way that they do). The instrument provides a semi-structured

format where students are able to write about what helps or hinders their learning in a given environment and also why they believe this to be the case.

In a study by Clarke (1995), the PLEQ instrument was used to collect tertiary students' perceptions of the learning environments. The study involved a research sample consisting of 1,249 tertiary students from the Queensland University of Technology. During analysis, the researcher found the two most frequently occurring themes relating to when students felt their learning was helped were when practical application/experiential learning occurs, and when presentation/explanation by the lecturer was clear. With reference to when students felt their learning was hindered, the two most frequently occurring themes identified by the study were when the class was not disciplined by the lecturer, and when the pacing of the presentation by the lecturer was not appropriate. For each of these themes, numerous reasons were given by the students for each of the statements. The study also found that approximately 40% of the comments made by students related to poor teaching. The study concludes that university lecturers have a responsibility to improve their teaching practice through professional development and the review of student feedback on teaching.

Subsequent to Clark's (1995) initial work on the PLEQ instrument, Devlin (2002) examined the strengths and limitations of the instrument and presented a report on a modified version of the questionnaire, PLEQ(II). The study trialled the PLEQ(II) on 100 first year undergraduate students from the University of Western Australia. The study was motivated by what the researcher had identified as a limitation of the original instrument. Although the PLEQ did well to discover what helped and hindered the student learning experience, the findings tended to be externally focused (i.e. what the lecturer or others did or didn't do), and seemed to omit the students own contribution (i.e. what the student did or didn't do that helped or hindered learning). The updated version expanded the original instrument by providing semi-structured questions that provided students with the opportunity to express how they helped or hindered their own learning. The study found that the PLEQ(II) achieved its goal and produced results that not only focused on what others did, but also on the student's own contribution to learning. However, the researcher also concludes that data obtained through questionnaires can be limited and that using the PLEQ(II) findings to guide interviews would enhance the findings of subsequent studies.

2.4.8 Cloud Assessment Learning Environment

As has been previously covered, the cloud assessment learning environment is a unique assessment learning environment made possible by the use of cloud computing technology and is the core variable of this study. Earlier in this chapter, Google Docs was shown as a technology that can be used to implement a cloud assessment learning environment. However, to reiterate, the mere use of Google Docs (or other cloud computing technology) for assessment does not imply that a cloud assessment learning environment has been implemented (e.g. students only sharing their work with the assessor at the conclusion of the assessment as a means of assignment submission). Conversely, other technologies apart from Google Docs could also be used to implement a cloud assessment learning environment (e.g. Zoho or Microsoft 365).

As has been seen in this section, the cloud assessment learning environment has yet to be specifically studied, the term itself being unique to this thesis. Although a number of studies and learning environments instruments have conceptually come close, there does not exist an instrument or a study that has had a specific focus on student perceptions of the cloud assessment learning environment. This gap in the literature can be seen to stem from the uniqueness of the learning environment in question.

2.4.9 Learning Environment Summary

The literature has shown that learning environments research is a relatively mature field of research with studies having been conducted over a number of decades in numerous countries, languages and learning environments. The literature has also shown that the majority of instruments, and consequently the studies into learning environments have been primarily quantitative in nature.

Interestingly, the literature has also revealed that most learning environments research tends to have a focus on overall learning environments for a given group of students (e.g. the classroom or programme of study). As mentioned, a unique aspect of this study (aside from the cloud computing technology) is the primary focus on a learning environment that relates specifically to a type of assessment that exists as a single component within a larger learning environment. Although some of the existing instruments come close to matching the cloud assessment learning environment, ultimately they are insufficient due to the unique attributes of the environment (e.g. cloud computing technology, assessment focus, student-teacher relationship, etc.). As a consequence, this study utilises a new questionnaire that has been inspired by existing learning environments instruments which has been specifically designed for the cloud

assessment learning environment. This new instrument will be discussed in greater detail in the next chapter, Methodology.

Although a number of related instruments and studies have been reviewed in this chapter, a significant area of learning environments research that has not yet been covered relates specifically to teacher-student interpersonal behaviour. This particular area of study (teacher-student interpersonal behaviour) is also one of the key variables within this study and it will therefore be reviewed separately in detail in the following section.

2.5 Teacher-Student Interpersonal Behaviour

The second research question in this study asks if there are differences in teacher and student perceptions of the teacher-student interpersonal behaviour in a cloud assessment learning environment. As the literature will show, significant research into the field teacher-student interpersonal behaviour can be seen to originate from earlier work on general interpersonal behaviour. Accordingly, the literature relating to interpersonal behaviour will first be reviewed before leading into specific studies on teacher-student interpersonal behaviour.

2.5.1 Interpersonal Behaviour

The Leary Model of interpersonal behaviour (Leary, 1957, 1958) is often cited as one of the key proponents of early research into teacher-student interpersonal behaviour. An early version of the Leary model included 16 dimensions with two levels of behaviour and assumes that an individual's interpersonal behaviour is motivated by a need to maintain self-esteem and reduce anxiety. The 16 dimensions of the model were later reduced to eight categories of interpersonal behaviour (Levy, Creton, & Wubbels, 1993). The eight categories represented interpersonal behaviour in relation to two key scales; dominant versus submissive behaviour (influence) and cooperative versus oppositional behaviour (proximity), with each behaviour being annotated by two letters representing the prevailing behaviours: DC, CD, CS, SC, SO, OS, OD, and DO, where D, C, S, and O stand for dominance, cooperation, submission, and opposition. Accordingly, a two-dimensional coordinate system was used to plot interpersonal behaviour according these eight categories, see Figure 2.8. Depending on the level of dominance or submission and the level of opposition or cooperation exhibited, any given behaviour can be plotted within one of the four quadrants.

An issue with the Leary model is its use of four quadrants for the mapping of eight distinct categories of behaviour. This results in different behaviours being mapped in

the same quadrant (e.g. SC and CS). This issue has been suggested as one of the motivating factors that led early researchers in teacher-student interpersonal behaviour to develop the model of interpersonal teacher behaviour, an adaptation of the Leary model (Wubbels & Levy, 1993). The model of interpersonal teacher behaviour refines the Leary model by splitting the four quadrants into eight sectors with relate specifically to each of the eight behaviour categories, see Figure 2.9. Each sector is labelled according to dimensions specific to potential teacher behaviour, they are: Leadership (DC), Helping and Friendly (CD), Understanding (CS), Responsibility and Freedom (SC), Uncertain (SO), Dissatisfied (OS), Admonishing (OD), and Strict (DO). The model is circumflex in nature with behaviours, in theory, correlating most closely with adjacent behaviours and correlating the least with opposite scales.

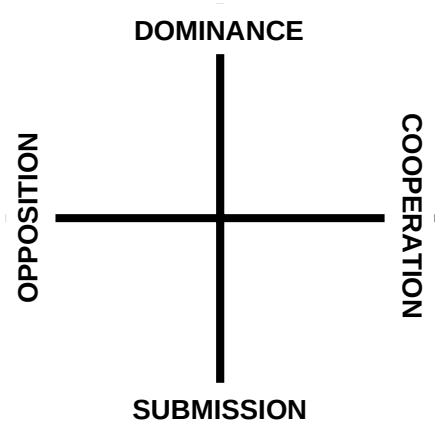

Figure 2.8 The Two-Dimensional Coordinate System of the Leary Model

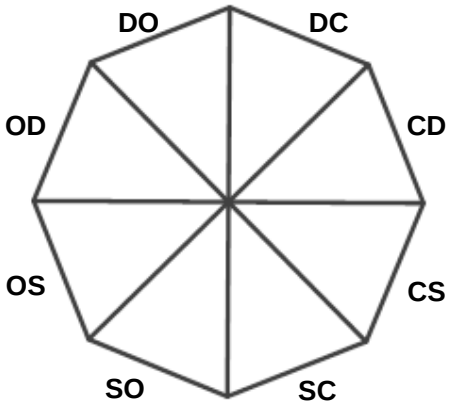

Figure 2.9 The Model for Interpersonal Teacher Behaviour

In order to determine behaviour levels, a 128 item Interpersonal Adjective Checklist (IAC) was originally used with the Leary model. However, this instrument was found to

be cumbersome in an educational setting and also contained a number of items not suited to teaching (Rickards, 1998; Wubbels, Brekelmans, Créton, & Hooymayers, 1990). As a consequence, early work into teacher-student interpersonal behaviour led to the development of the *Questionnaire on Teacher Interaction* (QTI) which was created for use within an educational environment and also corresponded directly to the model of interpersonal teacher behaviour (Wubbels & Levy, 1993). Consequently, the following section will proceed by examining the QTI instrument and related studies.

2.5.2 Questionnaire on Teacher Interaction

The QTI was developed to assess perceptions of teacher-student interpersonal behaviour within a traditional classroom learning environment. The commonly used Australian short version of the instrument includes 48 five point Likert scale items and measures perceptions of teacher behaviour according to eight different dimensional scales (six items per dimension), with numerous studies being proponents of this approach (Fisher, Fraser, & Cresswell, 1995; Fisher, Henderson, & Fraser, 1995; Fisher & Rickards, 1998). Each dimension describes an attribute of a given teacher's interpersonal behaviour. As mentioned, the eight dimensions are: Leadership, Helping and Friendly, Understanding, Responsibility and Freedom, Uncertain, Dissatisfied, Admonishing, Impatience, and Strict. Although the QTI was originally developed by researchers in the Netherlands, it has subsequently been translated and used in numerous studies in various countries, including: Australia, Canada, Israel, Slovenia, Turkey, Korea, Taiwan, Brunei, Singapore, and the U.S. (Wubbels & Brekelmans, 2005). A selection of studies that have utilised the QTI will now be reviewed.

In a study by Coll, Taylor, and Fisher (2002), the QTI was administered in a culturally diverse tertiary context in the Pacific Islands. The study involved a research sample of 257 first and second year tertiary science students representing a total of 12 different ethnicities, most of whom spoke English as a second or third language. The study found that the QTI instrument maintained reasonably good internal consistency for each of its eight scales despite the language barrier. The Cronbach alpha coefficients ranged from .58 to .84 with the lowest reliabilities coming from the Responsibility and Freedom scale (.58) and the Strict scale (.60), with all other scales being above .70. In contrast, the study also tested a second instrument, the *College and University Classroom Environment Inventory* (CUCEI) and found it to only be reliable in two of its six scales with Cronbach alpha coefficients reaching as low .30 for some of the scales. The difference in reliability findings between the two instruments was attributed to the simplicity of the QTI items in contrast to the comparatively complex nature of the

CUCEI items. Interestingly, the study found that student perceptions of teacher-student interpersonal behaviour did not vary depending on ethnicity. However, the study did find that student perceptions varied according to gender, which the researchers' state corresponds to findings from previous studies. Ultimately, the study revealed that students found their classrooms highly teacher dominated.

A study by Telli, den Brok and Cakiroglu (2007), investigated the relationship between student perceptions of teacher-student interpersonal behaviour and attitude towards subject in a Turkish science setting. The study used a Turkish version of the QTI with a research sample of 7,484 students from 278 Turkish science classes. The study found the QTI scales to have reasonably good reliability with the lowest Cronbach alpha coefficient being .66 for Responsibility and Freedom and all other scales having coefficients of .86 or above. The study found positive associations between proximity and student attitudes, findings which largely coincided with those of previous, similar studies. The study concludes that it is not only important for Turkish teachers to relate to students, but to also maintain interpersonal control.

A significant study published in 2006 reports on a cross-national comparative study into teacher-student interpersonal behaviour (den Brok, Fisher, Wubbels, Brekelmans, & Rickards, 2006). The study compared QTI data from 1,713 Singaporean students, 644 students from Brunei and 726 Australian students. Again the QTI instrument was proven reliable with Cronbach alpha coefficients for each of the scales ranging from .56 to .86 across the three samples. Interestingly, the Responsibility and Freedom scales achieved the lowest values across all three samples: Singapore .57, Brunei .58, and Australia .61, the next set of lowest coefficients came from the Strict scale and ranged between .56 and .63. The study found that the scales appeared to be one-dimensional in Australia, Singapore and Brunei, however multi-group factor analyses found that the items contributed differently to these scales across countries, suggesting different scale meanings between countries.

Another related study investigated teacher-student interpersonal behaviour in relation to student motivation in an Indonesian secondary school mathematics context (Maulana, Opdenakker, den Brok, & Bosker, 2011). The study administered an Indonesian version of the QTI to 1,900 Mathematics and English as a Foreign Language (EFL) secondary school students. Again, the QTI was found to be reliable with Cronbach alpha coefficients for each of the scales ranging from .60 to .78. Interestingly, the Responsibility and Freedom scale and the Strict scale produced the lowest

Cronbach alpha coefficients, .61 and .60 respectively. The study found that students tended to report higher positive interpersonal behaviour ratings than negatives ones. The study also found that students generally reported noticeable levels of both cooperation and dominance. The researchers suggest that this finding may be cultural due to the fact the teaching profession is a highly respected occupation in Indonesia with teachers often maintaining distance, both physically and psychologically from students, implicitly showing that they are in charge of the learning process. The study only found moderate correlations between teacher-student interpersonal behaviour and student motivation which contrasted with previous studies; again the researchers attributed this difference to cultural factors unique to the study.

A Dutch study that investigated interpersonal teacher behaviour and student outcomes utilised the original 77 item Dutch version of the QTI (den Brok, Brekelmans, & Wubbels, 2004). The QTI was administered to 826 physics students and 941 EFL students. The Cronbach alpha coefficients for each of the QTI scales proved to very high with most scales having values above .90, however the Responsibility and Freedom scales and the Strict scale were slightly lower with values of .84 and .88 for the Physics students (however these are both still very good values). The study found that student perceptions of the cooperativeness of their teachers are important for their own personal motivation; however this did not have a noticeable impact on student levels of achievement. The study also found some slight differences between the two samples, teacher Influence was slightly positively related to physics students test scores but had no association with EFL student test scores.

A study by Stolarchuk and Fisher (2001) investigated teacher-student interpersonal behaviour in science classrooms where students used laptop computers. The study involved 433 science students from 23 different Australian schools. The study also utilised an attitude scale from the *Test of Science Related Attitudes* (TOSRA) instrument (reviewed later in this chapter) and the three scales from the *Test of Enquiry Skill* (TOES). The study also employed qualitative data collection via a number of student interviews, the researchers state that this qualitative data was used to help explain and verify the quantitative data. The QTI scales were again proven reasonably reliable with seven of the eight scales producing Cronbach alpha reliability coefficients ranging between .77 and .97, however the Responsibility and Freedom scale produced a noticeably lower value of .59. The study found that teacher-student interpersonal behaviour was more strongly related to student attitude than it was to student enquiry

skills. Interestingly, the study notes that the qualitative data revealed that students felt their teachers were not using the computers extensively to teach enquiry skills.

A study by NeSmith (2005) examined whether or not student perceptions of teaching had an influence on student achievement. The study focused on QTI findings from 433 American high school students. The study also collected qualitative data in the form of student interviews and observations of various classroom environments. Statistically the QTI was again found to be reasonably reliable with Cronbach alpha coefficients ranging from .60 to .80. Interestingly, the three lowest Cronbach alpha values came from the Uncertain scale (.60), Responsibility and Freedom scale (.63), and the Strict scale (.64). The qualitative data revealed that students were a lot more resilient than what the researchers had expected. In situations where the researchers had observed teachers who they felt were ineffective in their teaching practices (low student interaction), the researcher had assumed the QTI results would reveal that students disliked these teachers, however this was not the case. Combined with interview data, the researcher found that students not only liked but also respected these teachers. The researcher noted that the combination of both quantitative and qualitative data was essential in revealing this phenomenon. Ultimately, the NeSmith (2005) study found statistically significant relationships between five of the eight QTI scales and student achievement levels. The Leadership and Understanding scale was found to be positively related to student achievement, while Strict, Dissatisfied, Uncertain, and Admonishing were found to be negatively related to student achievement.

2.5.3 Questionnaire on Teacher Interaction Summary

The literature has shown that the *Questionnaire on Teacher Interaction* (QTI) has been successfully used and validated as a reliable instrument for measuring teacher-student interpersonal behaviour at various levels of study. The literature has also so shown that validity of the instrument remains at an acceptable level even when adapted for different levels of study, and even when translated into different languages. Interestingly, the Responsibility and Freedom scale and the Strict scale are often found to produce lower Cronbach alpha reliability values than the other scales within the instrument. Qualitative data has also been utilised in order to help explain and validate the QTI instrument. Furthermore, the literature has also revealed that teacher-student interpersonal behaviour is often studied alongside other factors (e.g. gender, attitude, motivation, achievement, etc.) in an attempt to identify any observable relationships that may exist between the variables.

Based on its widespread use and proven reliability and validity, the QTI has been used in this study as the basis for an adapted version of the instrument, the *Lecturer Interaction Questionnaire*, (LIQ) which will be discussed in greater detail in the following chapter. The next section will now shift focus to studies relating to the measurement of conceptual change in understanding within an educational context, a key element of the fourth research question.

2.6 Conceptual Change in Understanding

An interesting aspect of this study is its goal to determine if students experience a conceptual change in understanding of the cloud assessment learning environment over time. The study also asks if there are differences in perceptions of teacher-student interpersonal behaviour relating to the cloud assessment learning environment. Accordingly, this section will examine the literature relating to the measurement of conceptual understanding and conceptual change in understanding.

As will be shown by the literature, measuring the conceptual change in understanding of a given phenomenon is best achieved by conducting a before and after analysis of the subject or subjects in question, commonly referred to as a pre-test post-test research design (Cohen et al., 2000). Interestingly, a study by Treagust and Duit (2008) provides an in-depth discussion on the theoretical, methodological, and practical challenges faced by researchers of conceptual change in science education. Regarding methodology, the study concludes that it is often the case that more than one sources of evidence is needed to accurately judge conceptual change. Accordingly, numerous studies have utilised various before and after data collection methods in order to capture conceptual change in understanding amongst subjects, these include: questionnaires, interviews, concept maps, and participant observations. Therefore, the following sections will present the conceptual change literature based on the form of data collection employed by the study, this will then be followed by a collective summary of the studies covered.

2.6.1 Measuring Change with Questionnaires

A study by Cook and Leckey (1999) investigated changes in first-year university student opinions and attitudes toward learning and expectation of life at university. The study utilised a pre-test post-test research design where participating students were surveyed once at the beginning of their study and again at the end of their first semester with the same questionnaire. The questionnaire used for the study focused on various areas including: background information, preferred teaching and learning

styles, study methods and practice, learning support, intentions (pre-semester) and experiences (post-semester). The questionnaire included a combination of open ended qualitative short answer questions and quantitative four point Likert scales questions. The researchers note that the pre-test post-test questionnaire results provided reliable data that highlighted changes in student opinions from both a qualitative and quantitative standpoint. The study found that many of the study habits possessed by students prior to beginning university persist into and during the first year of study. The study also notes that although the existing study habits may have worked well in a school setting, that they were often not compatible with university education. The study also found that many students begin with unrealistic views regarding workload expectations, lecturer availability, and class size. In concluding, the researchers suggest that deliberate strategies should be put in place to inform applicants about the university environment and support new students in the development of tertiary level study skills. Relating to this study, student expectations will also be contrasted with their experiences as data will be collected both before (expectations) and after (experiences) students engage with the cloud assessment learning and environment.

A longitudinal study conducted by the University of Leeds investigated changes in student perceptions of their key skills upon entry to higher education (Whittle, Pell, & Murdoch-Eaton, 2010). The study reported on changes in student responses to a questionnaire that had been given to first-year undergraduate students over the previous nine years. The questionnaire asked students to self-assess their ability to perform 31 generic study related skills and was completed by 2,065 students over a nine year period. The study analysed and compared student responses on a year by year basis to determine the emergence of any notable trends. The study found that over the nine year period a number of trends had emerged. An increase in the practice of a range of information technology (IT) skills was noted. However, decreases in student confidence to perform laboratory, data handling and numeracy tasks were also exposed. The study attributes the changes to increased availability of computing technology and changes to the secondary school curriculum. The study concludes by emphasising that the observed trends have implications for course design for a range courses, in particular those with practical and numeracy related components.

A study into the effectiveness of a network simulation tool to communicate complex data communications concepts was conducted by researchers from Queensland University of Technology (Goldstein, Leisten, Stark, & Tickle, 2005). The study employed a pre-test post-test survey in order to capture change in student

understanding of specific concepts. The survey consisted of ten multiple choice questions and was first administered after a lecture on a particular topic. The students then engaged with a simulation based learning environment which aimed to communicate the same concepts. The survey was administered a second time at the conclusion of the simulation session. The study found students displayed improved understanding after engaging with the simulation and attributed this improvement not only to the simulations ability to demonstrate concepts, but also its ability to engage and guide students, as well as being able to provide students with feedback. In a similar fashion to the introduction of the simulation environment, the cloud assessment learning environment will also be introduced to the research sample in order to capture any conceptual changes in understanding potential caused by the experience.

A recent study by Papstergiou (2009) investigated the educational effectiveness of game-based learning for computer science education as well as its impact on student motivation. The study utilised a pre-test post-test control group research design where students were split into two groups (game-based and traditional) and taught the same material via different approaches (game-based and traditional). Both groups of students completed a pre-test questionnaire and a post-test questionnaire in order to capture changes in understanding. The study found that students who participated in the game-based group showed improved knowledge of the computer science concepts taught, as well as higher levels of motivation. The study concludes that with computer science educational settings, computer games can be exploited as effective and motivational learning environments.

2.6.2 Measuring Change with Interviews

Researchers from the University of Helsinki conducted a study that investigated changes in student's epistemological beliefs (Lahtinen & Pehkonen, 2012). The study focused on the results of a semi-structured focus group interview with a group of randomly selected students from an Orientation to Research Work course. The semi-structured focus group interview approach was selected in order to allow the researchers to explore student perceptions of their own experiences as well as to allow students to take ownership of the interview, thus allowing them to speak more freely. A significant part of the interview stemmed from the question 'what happened to you during the course?' Interestingly, in the data analysis phase the researchers did not identify individual members but treated the group as a whole who collaboratively constructed a joint perspective. During the interview students reflected back on their initial beliefs and how their views had changed, as well as those activities they believed

had contributed to the change. Interestingly, this current study also utilises reflective focus group interviews as a method for gauging conceptual changes in understanding. The study found that students began with a simple view of knowledge as absolute which can be discovered, however over time, during their own academic investigation, students began to broaden their perspectives and view knowledge as something that is individually constructed based on experience and individual understanding.

A study by Sandoval and Morrison (2003) examined the impact that a four week technology-supported unit had on student understanding of the nature of science. The study employed a pre-test post-test interview research design where students were interviewed individually prior to undertaking the unit and again, after the completion of the unit. The interviews were structured and including 21 questions specific to the nature of science. During analysis, students' pre-test and post-test interviews were compared and contrasted. Interestingly, this study found that based on the interview data, the ideas and opinions expressed by students did not undergo any significant change over the course of the unit. Relating to this study, pre-test and post-test class interviews were also conducted around a similar four week time period (i.e. the time the research sample spent engaging with the cloud assessment learning environment).

The experiences of change in understanding of subject matter taught by university lecturers were recently investigated in study by researchers from the UK and Australian (Trigwell, Prosser, Martin, & Ramsden, 2005). The study focused on data obtained from interviews with 31 university lecturers from various subject areas. Each lecturer was interviewed in depth prior to teaching a given subject and again after the conclusion of the unit. The study found that of the 31 participants, 11 experienced changes in understanding of the subject matter that they had just taught, and 20 did not experience any changes in understanding. The study also found that those participants who did not experience change were more likely to view teaching as the transfer of knowledge, whereas those participants who did experience change were more likely to view teaching as the changing or development of students' conceptions.

A study by researchers from the University of Colorado investigated perceived benefits of research experiences by undergraduate science students over a three year period (Seymour, Hunter, Laursen, & DeAntoni, 2004). The study focuses on the data collected from interviews with 76 students. Most students were interviewed individually. However, students who worked with a single faculty advisor were interviewed as a small focus group. The interviews were semi structured and included a list of benefits

that faculty members believed could be benefits from undertaking scientific research which was used as a starting point for the interviews. Each interview was reflective in nature and focused primarily on student experiences and individually perceived benefits of scientific research. The study found student responses were overwhelmingly positive and cited numerous benefits gained from their research experiences.

2.6.3 Measuring Change with Concept Maps

In a paper by Dykstra, Dewey, Boyle, and Monarch (1992), concept maps are described as a method for tracking conceptual change in student understanding of physics concepts. The researchers note that concept maps represent student knowledge of concepts, terms, and features of the subject. The researchers also note that successive concept maps can be seen to display conceptual changes in student understanding over time. Interestingly, the paper also highlights the significance of those items which are missing from concept maps, indicating that omissions may suggest a gap in student understanding or knowledge.

A study by Fellows (1994) investigated conceptual changes in student understanding of science related concepts. In an interesting approach, the researcher constructed concept maps based on the written work of individual students over a 12 week period. The changes in the concept maps over time were then used to assists in the analysis of student conceptual development and change. The study found that over time students displayed changes in central concepts, complexity, and organisation of ideas as the lessons progressed.

A study conducted at Michigan State University used concept maps to trace conceptual change in pre-service teachers enrolled in an introductory multicultural/special education course (Trent, Pernell, Mungai, & Chimedza, 1998). The study analysed pre and post concept maps, explanatory paragraphs, and comparative essays of 30 undergraduate students enrolled in the course. For the study participants completed a concept map focused on 'effective teaching for culturally diverse learners' and were also required to include an explanatory paragraph of the concept map. Subsequently, the participants completed a second concept map and explanatory paragraph on the same topic at the completion of the unit. Interestingly, after completion of the second concept map, students were returned their original concept maps and were asked to write a comparative essay on the differences between their two concept maps. The concept maps were analysed both quantitatively and qualitatively with both the

number of concepts noted as well as the type of concepts included (e.g. general versus content-specific). Interestingly, this type of analysis has also been adopted for the current study and will be discussed in greater detail in the following chapters. The study found that students post concept maps were constructed to include significantly more concepts, were more specific, and were more integrated than their pre concept maps.

2.6.4 Participant Observations of Change

A study that examined student teachers' experiences in learning to integrate technology in the classroom was conducted by Brown and Warschauer (2006). The study utilised both multiple data collection techniques, these included: surveys, interviews, student online discussion groups, and participant observations. The researchers focused the participant observations on changes in students' technological skills and understandings to triangulate findings gained from the other data collection activities. The participant observations were later analysed to identify the emergence of any significant themes. The study found four major patterns emerged from the data which were: positive shift in student attitude toward technology use, insufficient exposure to technology integration, peripheral role of technology in teacher preparation experience, and the pivotal role of field placements. Interestingly, despite apparent shortcomings regarding technology use within the teacher education course and field placements, student attitudes towards technology use for education were observed to improve over the course of the study. In concluding, the researchers suggest that in order to improve the use of information and communications technology in schools a number of steps should be taken which include: better utilisation of the technology during preparation courses and field placements, and mentors who are proficient users of the technology in education.

A study by study by O'Neal from Emporia State University conducted an investigative comparison of asynchronous online discussions and traditional classroom discussions in an undergraduate education course (O'Neal, 2009). In the study the researchers utilised participant observations as a data collection method to supplement discussion transcripts. Students were separated into two groups (online and traditional) and were given the same instructions regarding a topic of discussion. Acting as a participant observer the researcher was able to observe the interactions of each group throughout the development of each discussion. The study found that the quality of discussion that occurs in online and traditional environments is comparable when specific content-related questions are provided to structure the discussions. The study

also noted that student experiences during each type of discussion were similar, with both groups citing the benefits of sharing ideas, listening to other students with different experiences, and interacting with other students. Interestingly, the study ultimately compared a traditional approach to discussions with a new online approach to discussions. Relating to this current study, a traditional approach to assessment is also being compared with a new, online approach to assessment.

A study by Hendriks and Maor (2004) investigated the interaction of a group of science and mathematics teachers and their social construction of knowledge through computer-mediated communications. The study utilised a multi-method case study approach that incorporated various data collection techniques including participant observations. In analysis, triangulation of data from each of the data sources was conducted to produce valid and reliable themes and findings (a process also utilised by the current study). The Hendriks and Maor (2004) study found that research participants felt that their understanding of various issues were broadened rather than changed as a result of social interaction.

2.6.5 Conceptual Change in Understanding Summary

The literature has shown the measurement of conceptual change in understanding can be achieved using a variety of data collection methods including: questionnaires, interviews, concept maps and participant observations. Regardless of the form of data collection utilised, the literature shows that a common approach to capturing conceptual change is through the use of a pre-test post-test research design where data is collected from research participants both prior to and after the introduction of some phenomena. The pre-test and post-test data is then commonly compared and analysed in order to identify changes in understanding or opinion. A secondary theme can also be seen through the use of multiple data sources in order to improve the validity and reliability of captured data. Consequently, elements of the above mentioned approaches have been incorporated into this study and will be described in greater detail in the following chapter. It is worth noting that although conceptual change in understanding has been studied in a number of educational contexts, the cloud assessment learning environment has not yet been the focus of a conceptual change in understanding study.

2.7 Level of Achievement

The fifth research question aims to discover if a relationship exists between student perceptions of the cloud assessment learning environment and student levels of

achievement. As student levels of achievement exists as a key variable in this research question, the literature relating to academic achievement has been reviewed and the findings are presented in this section. Although some discussion can occur regarding the definition of student achievement, for the sake of this study, academic achievement will be simply represented by the quantitative mark achieved in assessment. Finally, due to the vast number of studies that involve student achievement, particular focus has been given to those studies that most closely relate to the cloud assessment learning environment. However, it should be noted that the studies reviewed in this section, although they are similar, do not encompass the cloud assessment learning environment specifically. This is typical of the types of references available and highlights the gap in the literature.

2.7.1 Achievement in Computing Courses

A study by Chen (2002) investigated the impact that different learning strategies had on academic achievement in an introductory information systems course. The study involved a research sample of 197 business information system students. In this instance, the findings of this study are particularly interesting as they are derived from a research sample which is similar to that which has been used for this thesis. The study found that students with higher levels of effort regulation (the ability to maintain focus and effort despite distractions) achieved higher test scores. Interestingly, through the collection of online activity data, this thesis also reports elements of student effort (covered in greater detail in the following chapters). Students who studied with peers were also found to achieve lower test scores. Interestingly, prior computing experience did not help students gain higher levels of academic achievement.

Researchers from the University of Alabama in Huntsville conducted a study into the impact combined graduate and undergraduate computer science courses had on student performance (Etzkorn, Weisskop, & Gholston, 2004). The aim of the study was to discover if either of the two groups of students (undergraduate and graduates) suffered academically due to being placed in courses with members of the other group. The study compared and analysed the academic achievement levels of the two student groups in both combined courses and in courses for undergraduates only. The study found that neither graduates nor undergraduates suffered academically (with regards to achievement levels) in combined courses.

A study based at the University of Pittsburgh investigated gender, achievement and persistence in an undergraduate computer science program (Katz, Allbritton, Aronis, Wilson, & Soffa, 2006). Again, this study provides interesting data from a similar research sample as examined by this thesis. One of the goals of the study was to discover which variables are predictors of academic success for computers science students. The Katz, Allbritton, Aronis, Wilson, and Soffa, (2006) study made use of two surveys which included both closed quantitative questions and open ended qualitative questions. The first survey was administered at the beginning of the course and focused on student background information while the second survey was administered toward the end of the course and had a focus on future study intentions. The study found that achievement was predicted by various background factors including: Scholastic Aptitude Test (SAT) scores, prior experience in calculus courses, home computer access, computing experience, and high school computing mentors.

2.7.2 Achievement in Blended and Online Delivery

A study published in 2005 reported on the impact student study patterns had on achievement in web-based and blended distance learning courses (Romano, Wallace, Helmick, Carey, & Adkins, 2005). Study patterns (i.e. last minute cramming versus spaced review) were compared across different modes of delivery (i.e. entirely web-based versus blended) and were also examined in relation to course achievement and student attitude. Interestingly, these variables (achievement and attitude) are also examined by this thesis. The study involved a research sample of 163 undergraduate teacher education students. Student online behaviours were monitored and used to determine study patterns. Interestingly, the study found students with face-to-face contact (blended delivery) tended to procrastinate more than the entirely web-based students. The study also found that achievement levels were mixed and were not predicted by level of procrastination or delivery mode. However, the study did discover that even though students at the beginning of the course had comparable ratings for course expectations, by the end of the course, those students with higher levels of procrastination tended to have a more negative attitude towards the course.

A similar study by Morris, Finnegan and Wu (2005) examined student engagement in entirely online courses with relation to student persistence and achievement. The study involved 354 students and used computer logs to monitor student participation and duration of participation. The study found that significant differences in online participation between withdrawers and completers and also between successful and unsuccessful completers. As expected, students who withdrew were found to have

lower levels of overall participation, but were also shown to have lower levels of participation even before withdrawing. The Morris, Finnegan and Wu (2005) study also revealed that unsuccessful completers had significantly lower levels of online participation. In concluding, the researchers note that number of discussion posts viewed, number of content pages viewed, and seconds on viewing discussion pages were good predictors of academic success. Interestingly, this thesis also utilises online activity statistics and observed online behaviour as data sources.

A recent study by Melton, Graf and Chopak-Foss (2009) investigated student achievement and satisfaction in blended learning versus traditional general health courses. The study utilised a pre-test post-test control group design and involved 251 students, 153 of which were enrolled in a traditional delivery mode while 98 were enrolled in a blended delivery mode. The study found that students in the blended delivery mode of the course showed overall higher levels of course satisfaction and academic achievement. In concluding, the researchers suggest that blended learning delivery can create a win-win situation for both instructors and students. However, the researchers also note that the higher levels of satisfaction and achievement could also be the result of a more active classroom teaching approach employed in the blended delivery course. This is interesting in the context of the current study due to the fact that the cloud assessment learning environment also involves both face-to-face and online interaction between teachers and students.

Larson and Sung (2009) conducted a three way comparative study on the impact that online, blended, and face-to-face delivery modes have on student performance. The study focused on 168 students enrolled in a Principles of Management Information Systems course. 22 students participated in the online delivery mode, 83 in the blended delivery mode, and 63 in the traditional face-to-face delivery mode. The study found that there was no significant difference in student academic achievement between delivery modes. However, the Larson and Sung (2009) study did find that students who participated in the online and blended delivery modes had higher levels of course satisfaction. Again, this is interesting due to the similarities between online and blended delivery modes and the cloud assessment learning environment.

2.7.3 Achievement and Computer Based Assessment

In a study by Ricketts and Wilks (2002) suggestions were reported on how to improve student performance through computer-based assessment. The study found the initial introduction of a multi-choice computer-based assessment led to a drop in student

performance when compared to previous years where a hand marked version of the same assessment had been used. However, the Ricketts and Wilks (2002) study also found that when the user interface for the computer-based assessment was changed from a single, scrollable page to a one question per page, multi-page assessment student performance increased. Participating students were also surveyed regarding their experience of the test at the end of each computer-based assessment. The study concludes that computer-based assessments are generally acceptable to students with the speed of marking and feedback being particularly appreciated. However, the study also states that the acceptability is highly influenced by the way in which the questions are presented citing presentations that require scrolling as being less desirable than multiple page presentations with minimal scrolling.

A study by Clariana and Wallace investigated the test mode effect in relation to paper-based versus computer-based assessment (Clariana & Wallace, 2002). The study involved 105 undergraduate business students who participated in the same assessment. Approximately half the students took a paper-based version of the assessment while the other half used a computer-based version. The students were also surveyed in order to capture additional information relating to student characteristics. Interestingly, the study found that gender, competitiveness, and computer familiarity were not related to student performance. Clariana and Wallace, (2002) also found that computer-based assessment positively impacted student performance, particularly amongst higher attaining students. This is noteworthy as it provides a comparison between student perceptions of traditional paper based assessments and equivalent computer based assessments, variables similar to those examined by this thesis.

A related study from 2005 investigated, by way of comparison, student achievement in a computer-based mathematics assessment with student achievement in an equivalent paper based mathematics assessment (Poggio, Glasnapp, Yang, & Poggio, 2005). The study involved 644 students who volunteered to be 'double' tested with both a computer-based assessment and then again with a paper-based version of the same assessment. The study found that there was very little difference in student performance between the different forms of assessment. The study concluded that scores achieved in computer-based assessments will be equivalent to those obtained from traditional forms providing that the computer-based assessment is a true replication of the traditional assessment.

A more recent study compared online instruction with face-to-face instruction of scientific writing techniques (Phadtare, Bahmani, Shah, & Pietrobon, 2009). The study focused on a small case study of 48 students who were randomly assigned to one of two 24 member groups (online and face-to-face). The study examined manuscript quality (achievement) and student satisfaction. The Phadtare, Bahmani, Shah, and Pietrobon, (2009) study found that overall, online students had higher levels of achievement (manuscript quality) and higher student satisfaction. The study also noted that online participants had notably higher communication events than the face-to-face students. This is interesting in relation to this study as the cloud assessment learning environment also facilitates online communication. Phadtare, Bahmani, Shah, & Pietrobon, (2009) conclude that the online learning and assessment environment used in the study was better than the face-to-face approach in terms of writing quality and student satisfaction.

Researchers from Kings College London recently conducted a study that compared student academic performance in online assessment with academic achievement in traditional paper-based assessments (Escudier, Newton, Cox, Reynolds, & Odell, 2011). The research sample consisted of 266 undergraduate dental students who undertook tests of the same knowledge base in both traditional paper-based and online computer-based formats. The study also involved focus group discussions with participants to further explore their perceptions of the online format. The study found that there was a high degree of consistency in student performance between the two test formats, although a minority of students tended to perform better in the online assessment. The study also found that students did not feel disadvantaged by the online format of the assessment. The study concludes that online computer-based assessments are both fair and acceptable to students and can even provide some advantages over traditional paper-based assessments. Again, this is interesting in the context of the current study as it provides a comparison between traditional assessment and computer based assessment.

2.7.4 Level of Achievement Summary

The literature has shown that level of achievement has been used as a research variable in numerous studies often with the goal of determining the impact other factors may have on academic performance (Clariana & Wallace, 2002; Escudier et al., 2011; Larson & Sung, 2009; Romano et al., 2005). Studies also often attempt to determine what, if any factors are predictors of academic success. This section has specifically focused on achievement in computing related courses, achievement in blended and online courses,

and achievement with computer-based assessment. The literature relating to academic achievement is extensive and often provides differing viewpoints (e.g. whether prior computing experience is a predictor of achievement). Interestingly, most of the research into achievement and computer-based assessment has tended to focus on multi-choice controlled assessments as opposed written assessments.

2.8 Student Attitude Toward Subject

The sixth research question aims to discover if there is a relationship between student perceptions of the cloud assessment learning environment and student attitudes toward subject (which in the case of this study is IT Project Management). Ajzen (1989) defines an attitude as

> "an individual's disposition to respond favourably or unfavourably to an object, person, institution, or event, or any other discriminable aspect of the individual's world" (p. 241).

Relating to this study, the "other discriminable aspect of the individual's world" is the academic subject in which the student (individual) is engaging with the cloud assessment learning environment (i.e. the IT Project Management paper). Therefore, this section will review the literature relating to the measurement of student attitudes towards specific academic subjects and the use of various instruments that have been used to collect attitudinal data in educational environments (den Brok et al., 2005; Hassan, 2008; Ketelhut et al., 2007; Hayden et al., 2011; Rickards, 1998; Spinner & Fraser, 2005).

2.8.1 Students' Attitude Questionnaire

A recent study that investigated the impact different instructional strategies had on students' attitude towards mathematics utilised the *Students' Attitude Questionnaire* (SAQ) (Akinsola & Olowojaiye, 2008). The instrument included 22 four point Likert scale items. The study employed a pre-test, post-test approach to capture changes in student attitudes in order to determine if attitudes were impacted by the introduction of various instructional strategies. In a similar manner, the current study aims to determine if student attitudes are impacted by engagement with the cloud assessment learning environment. The research sample consisted of 312 senior secondary school students, and based on these responses the SAQ was found to valid and reliable with a Cronbach alpha reliability coefficient of .81.

The study found that the introduction of a *Behavioural Objective-Based Instructional Strategy* (BOBIS) and a *Study Question-Based Instructional Strategy* (SQBIS) improved student attitudes towards mathematics when compared to a traditional instructional strategy. The researchers conclude that the instructional method employed in the classroom plays a key role in shaping student attitudes towards mathematics learning. The researchers also recommend that BOBIS and SQBIS instructional strategies be employed in order to improve student attitudes towards mathematics.

2.8.2 Attitudes Toward Computer Science

A comparative study into student and faculty attitudes towards computer science developed and employed a 32 item, five point Likert scale questionnaire (Lewis, Jackson, & Waite, 2010). The questionnaire was developed based on four key sources: a learning analysis survey for physics, an interview study of student attitudes toward computer science group work, faculty suggestions, and a related study on student attitudes about the roles of aptitude and effort in academic success. The research sample consisted of 13 faculty members, 71 CS1 students, 48 CS2 students, and 41 senior capstone students.

The study found students attitudes towards computer science would often change as they progressed throughout their studies. The study also found that in certain areas faculty attitudes were often quite different from student attitudes towards the same concept. In concluding, the authors note that the survey results present a number of challenges for computer science faculty members, and that ways to improve student attitudes about certain areas of computer science education should be considered.

2.8.3 Attitudes Toward Science Inventory

A study by Gogolin and Swartz (1992) investigated non-science college student attitudes towards science using both quantitative and qualitative data collection methods. The study utilised the *Attitudes Toward Science Inventory* (ATSI) as the quantitative instrument and an interview questionnaire was used for qualitative data collection. The researchers argue that quantitative instruments that yield a single attitudinal score fail to distinguish between different aspects of attitude. The researchers go on to state that the effects of one attitudinal variable may in fact cancel or dilute another variable if combined to produce a single score. Accordingly, the ATSI instrument used in the study measures attitude according to six distinct dimensions: perceptions of the science teacher, anxiety toward science, value of science in society, self-concept in science, enjoyment of science, and motivation in science. The six

dimensions of the ATSI instrument are represented by eight five point Likert scale items per dimension resulting in a 48 item instrument. The qualitative interview questionnaires were used to probe for deeper understanding of complex attitudes. Interestingly, the study captured data from the research sample both prior to and after completing a science focused course (a similar process has also been utilised in this study).

The study found the quantitative instrument to have a reasonable internal consistency with Cronbach alpha reliability coefficients for each of the scales ranging between .73 and .90. The results of both the quantitative and qualitative data indicated that there existed a significant difference in attitude between science and non-science students. The science students had more positive attitudes towards science and also displayed lower levels of anxiety towards science related material. However, non-science students also demonstrated improved attitudes and decrease anxiety after having completed the science course.

2.8.4 Scientific Attitude Inventory

The *Scientific Attitude Inventory* (SAI) was developed by Moore and Sutman (1970) and was intended for use with high school students. The instrument simply aimed to provide a valid and reliable inventory of scientific attitudes (Moore & Sutman, 1970). The original SAI contained twelve position statements with the first six being intellectual attitudes while the remaining six were emotional attitudes. Each statement can be thought of as a scale and is represented by five Likert scale items, resulting in a 60 item instrument. The initial study found the instrument to be valid and reliable and the authors also suggest that the inventory could be expanded or modified to suit different academic contexts.

Twenty five years after its initial development Moore and Foy (1997) revisited the inventory and updated the instrument to produce the *Scientific Attitude Inventory II* (SAI II). In their review of the original SAI they note that the inventory had been used in numerous studies and had been successfully translated into both Hebrew and Thai. Moore and Foy site a number of issues with the original SAI as reasons for revising the instrument, these issues included: dated language, gender bias, and readability of items. The SAI II was field tested and was proven to have a high Cronbach alpha reliability coefficient of .78 based on the data from 557 respondents. The study concludes that the updated version of the SAI, the SAI II is a substantial improvement over the original inventory.

2.8.5 Test of Science Related Attitudes

The *Test of Science Related Attitudes* (TOSRA) was first developed by Fraser (1978) and built on previous work in the field of science education attitudes (Fraser, 1977; Klopfer, 1971). The instrument was originally designed to capture student attitudes towards science related subjects and has been proven to be a valid and reliable way for measuring student attitudes towards science related subjects in a number of studies (covered in the following sections). The original work was conducted with a focus on secondary school students, however the instrument has subsequently been adapted to measure student attitudes at higher levels of education (Hassan, 2008; Ketelhut, Dede, Clarke, Nelson, & Bowman, 2007), varying subjects areas (Hayden, Ouyang, Scinski, Olszewski, & Bielefeldt, 2011; Spinner & Fraser, 2005), unique learning environments (Ketelhut et al., 2007), and varying cultural settings (den Brok, Fisher, & Scott, 2005; Hayden et al., 2011), and also on a national scale (Rickards, 1998).

A study by Ketelhut, Dede, Clarke, Nelson, and Bowman adapted the TOSRA instrument in order capture tertiary student attitudes towards a multi-user virtual environment (Ketelhut et al., 2007). The adapted instrument had additional scales for other variables relating to the study and was proven valid with Cronbach alpha reliability coefficients for each of the scales ranging from .80 to .93. The paper concludes that multi-user virtual environments are likely to add to the spectrum of resources available for the assessment of student learning.

A 2005 study by den Brok, Fisher and Scott adapted the Enjoyment of Science Lessons scale from the TOSRA instrument for use with Brunei primary school students (den Brok, Fisher, & Scott, 2005). The modified scale was tested on a research sample of 1,305 students. Interestingly, this study also involved the QTI (covered earlier in this chapter) in order to collect data relating to teacher-student interpersonal behaviour, as well as an analysis of student achievement. Although reliability statistics are not given in the study, the discussion and conclusion imply the adapted TOSRA instrument provided valid and reliable data. Ultimately, the study concluded that teacher interpersonal behaviour had a direct impact on student achievement, and that this also had an indirect impact on student attitudes toward the subject.

A recent study that investigated summer camp student attitudes towards *Science, Technology, Engineering and Mathematics* (STEM) careers employed the use a reduced version of the TOSRA instrument (Hayden et al., 2011). Interestingly, the condensed version of the instrument was administered twice during the study (once at the

beginning and once at the end of the camp) in order to capture any change in student attitudes over the course of the summer camp. The study found that students who attended the summer camps left with an increased interest and improved attitude towards STEM careers.

A 2008 study that investigated attitudes toward science among Australian tertiary and secondary school students employed the use the *Science Interests and Motivation in Science Questionnaire* (SIMSQ) (Hassan, 2008). Interestingly, the SIMSQ was derived in part from items from the TOSRA instrument. The study confirmed an acceptable level of reliability for each of the scales within the SIMSQ instrument, including those derived from TOSRA items with Cronbach alpha reliability coefficients ranging from .71 to .85. The study concluded that tertiary students had more positive attitudes toward science than secondary students and suggests a number of reasons including motivation, career interest, self-confidence, and differences in learning environments.

The *Project Work Related Attitudes Instrument* (PWRAI) was also developed and validated as a means for measuring student attitudes toward a computer-mediated project-based learning environment (Seet & Quek, 2010). Similarly to the SIMSQ instrument, the PWRAI included a number of items that were adapted from the original TOSRA instrument. The study found a positive association between students' perceptions of certain dimension of the learning environment and their attitude towards the subject.

The *Test of Mathematics Related Attitudes* (TOMRA) is a modified version of the TOSRA instrument (Spinner & Fraser, 2005). The TOMRA has itself has been used in a number of studies much like the TOSRA, however with an obvious mathematics focus (Hoang, 2008; Sitthikoson & Malone, 2008; Taylor, 2004).

The literature has shown that the TOSRA instrument provides a valid and reliable way to measure student attitudes toward science related subjects. The literature has also shown that the TOSRA instrument maintains its validity and reliability when administered to students of various cultures and levels of education. Adapted versions, reduced versions, and other instruments based on the TOSRA have also been shown as valid and reliable ways for assessing student attitudes towards various subjects.

2.8.6 Student Attitude Toward Subject Summary

The literature has revealed that a number of instruments, both quantitative and qualitative have been used to measure student attitudes towards various subjects

(Gogolin & Swartz, 1992; Lewis et al, 2010; Spinner & Fraser, 2005). Interestingly, many of the instruments tend to focus on or be tailored to specific subject areas (Gogolin & Swartz, 1992; Lewis et al, 2010; Spinner & Fraser, 2005). Due to the widespread use, proven reliability and adaptability, the TOSRA instrument has been used as a basis for developing the student attitude towards subject section of an instrument used in this study (den Brok et al., 2005; Hassan, 2008; Ketelhut et al., 2007; Hayden et al., 2011; Rickards, 1998; Spinner & Fraser, 2005). As will be discussed in the following chapter, a 10 item short survey adaptation of the TOSRA has been used which reduces the extra work for participants when compared to the full 44 item TOSRA whilst providing a well validated platform from which to gauge student attitudes towards subject. It is also worth noting that items and scales from other instruments were also considered, as well as supplementing the quantitative scale with qualitative items and other data sources. Further detail regarding the measurement of student attitude toward subject used within this study will be given in the next chapter, Methodology.

2.9 Computing Confidence

The final research question in this study asks whether or not a relationship exists between student perceptions of the cloud assessment learning environment and students level of computing confidence. As will be seen, the literature reveals that computing confidence is at times treated as an individual variable (Levine & Donitsa-Schmidt, 1998), as a component of a general computing attitude variable (Loyd & Gressard, 1984), and also as the inverse of computing anxiety (Newby, 1998). Accordingly, this section will provide a review of the literature relating to student computing confidence, attitude and anxiety with an underlying focus on measurements of confidence.

2.9.1 Students' Preconceptions of Computing

A study conducted at the University of Kent at Canterbury investigated students' preconceptions of computing (Carter & Jenkins, 2001). Notably, the study incorporated a multi-method approach for data collection that included the use of a survey, short answer written questions, and student interviews.

328 UK tertiary students completed the survey which was the first stage of the data collection process. Of particular interest was a five point Likert scale item on computing confidence. The survey found that there was no significant difference in confidence levels between students who had previously attended public schools

compared to those students who had previously attended state schools. The study also found there was no significant difference in computing confidence amongst students aged between 18 and 44, however students aged 45 or older appear to be show lower levels computing confidence. Finally, the survey also revealed there was no significant difference in computing confidence levels between male and female students, although in isolation female students who had previously attended single-sex schools tended to have a higher level of computing confidence than female students who had previously attended co-ed schools.

The second stage of the study required students to respond to three simple open ended questions relating to computing. Interestingly, the study found that student responses to these questions fell into categories that corresponded closely to their admitted levels of confidence. Students with quantitatively low confidence ratings provided qualitatively negative descriptions of computers and computing relating concepts.

Finally, the researchers conducted semi-structured informal group interviews with a number of self-selected students in order to gain greater insight into the data collected from the surveys (a data collection activity also employed by this study). The researchers found the relaxed nature of the interviews worked well with students prompting each other and providing useful insights. The interviews re-confirmed to the researchers that students who undertaking compulsory computing courses are less positive than students who freely elect computing.

In concluding the researchers note that they needed to embrace qualitative data collection in order to find out more detailed information. They indicate that the multi-method approach in using both quantitative and qualitative methods enabled them to discover not only what was happening, but also why the students felt the way they did about computing. This provided further support for the utilisation of multiple methods of inquiry in this study.

2.9.2 Computing Competence and Confidence Tool

A recent study by Dange (2010) examined computing confidence amongst postgraduate students at an Indian university. The goal of the study was to determine if compulsory computing courses were still required at the postgraduate level. The study also employed a multiple method approach by utilising a quantitative survey and focused qualitative interviews. The focused interviews were structured and were included in order to further elaborate issues that arose from the survey data. The research sample consisted of 200 postgraduate students evenly selected from arts and

science courses. In measuring computing confidence, the instrument asked respondents to rate their own general level of computing confidence but also included items focused on confidence levels relating to specific software tools.

The study found that despite being at a postgraduate level, basic computer training programmes were highly utilised by the students. The interviews revealed that upon entering university some students had a misconception regarding their computing ability and as a result felt overly confident. Once exposed to the complexities of computing these students experienced a drop in their confidence levels. In concluding, the researchers determined that the compulsory computing courses should not be removed from the university's postgraduate programmes.

2.9.3 Attitude Towards Computers Instrument

A 2004 study investigated the reliability of a new instrument for measure computing attitudes titled the *Attitude Towards Computers Instrument* (ATCI)(Shaft, Sharfman, & Wu, 2004). In their review of the literature the authors cite 31 different scales that have been used to measure computer related attitudes. Of the 31 different scales mentioned, the majority (25) used Likert scale items and ranged from 12 to 48 items for each of the scales. Interestingly, the ATCI itself only contained eight items, and used semantic differential items. Each item consisted of two opposite adjectives relating to computers which were situated at different ends of a seven point scale (e.g. 1 = helpful and 7 = harmful).

The study found the ATCI to be reliable with a Cronbach alpha reliability coefficient of .76. Interestingly, the authors suggest that the instrument could be used to detect changes in computer attitudes if administered at different points in time. The study also concluded that due to the reduced size of the instrument (i.e. 8 items) participant fatigue and response bias had been limited.

2.9.4 Computer Attitudes and Confidence Questionnaire

The Computer Attitudes and Confidence Questionnaire (CACQ) was developed by Levine and Donitsa-Schmidt (1998) from Tel-Aviv University, Israel. The instrument was developed for a study that investigated a causal model which linked computer experience, computer-related attitudes, computer-related confidence, and perceived computer-based knowledge. The study included a research sample of 309 students in grades 7-12 with the sample consisting of 149 male students and 160 female students.

The instrument itself consisted of four sections: demographic characteristics, computer use and experience, computer attitudes and confidence, and perceived computer knowledge. Of particular interest to this thesis is the computer attitudes and confidence section which was based on several existing questionnaires (Levine & Donitsa-Schmidt, 1998). The computer attitudes and confidence section initially consisted of 57 five point likert scale items, however, after being validated using principal component factor analysis with Varimax rotation 15 of the items were omitted which resulted in 42 total items . The instrument was found to be valid and reliable with the computer confidence scale items attaining a reasonably high Cronbach alpha reliability coefficient of .90.

The study found that computer experience has a positive effect on both computer confidence and attitudes toward computers. The study also indicated that even though computer confidence and student attitudes towards computers were highly correlated, they were in fact different psychological constructs and should be treated as separate variables. This is of particular interest to this study which has elected to treat computing confidence and student attitude towards subject as two individual variables.

2.9.5 Computer Attitudes Survey

The *computer attitudes survey* (CAS) was an early research instrument developed to assess student attitudes towards computers (Loyd & Gressard, 1984). The instrument was developed in the early 1980's when computers began to commonly appear in educational settings. The instrument consisted of 30 items divided evenly into three sub scales: computer liking, computer anxiety and computer confidence. Each item consisted of a statement and six possible responses ranging from strongly agree to strongly disagree. The CAS instrument was validated with a research sample of 151 students. The study found that the three scales were sufficiently stable to be used as separate measures for computer liking, anxiety and confidence. The authors also suggest that the scales could be used to evaluate changes in computer attitudes as a result of a computer education program.

A follow up study expanded the CAS instrument to include a fourth scale titled computer usefulness, which aimed to measure the perceived usefulness of computers (Loyd & Loyd, 1985). The updated version also reduced the possible responses from six to four, still ranging from strongly agree to strongly disagree. Interestingly, the study involved a research sample of 114 teachers, as opposed to students. The Cronbach alpha reliability coefficients for the four subscales (computer anxiety,

computer confidence, computer liking, and computer usefulness) were .90, .89, .89, and .82 respectively. The results of the study revealed that the anxiety and confidence scales showed high correlation suggesting both scales were essentially measuring the same trait. The study also found that attitudes seemed to be related to computer experience. Finally, the authors concluded that the CAS instrument could be reliably used to assess computer attitudes of adults who are similar to the teachers tested in the study.

2.9.6 Attitude towards Computing and Computing Courses

The *Attitude towards Computing and Computing Courses* (ACCC) questionnaire was originally developed by Newby (1998) and built primarily on the CAS instrument but also took into consideration a number of other computer attitudinal instruments. For the ACCC, the author reduced the CAS scales from four to three by consolidating computer anxiety and confidence into a single scale due to their high correlation. The ACCC also added a new, fourth scale that focused the usefulness of the course (this was due to the study having a focus on computer laboratories as learning environments). Finally, the ACCC also reduced the number of items in each scale to seven, resulting in a 28 item instrument with four scales: Anxiety, Enjoyable, Usefulness of Computers, and Usefulness of Course. Interestingly, due to the computing courses component of the ACCC instrument, the ACCC studies are also relevant to the student attitude towards subject variable present in this study.

The original study by Newby found the instrument was valid and reliable with the scales obtaining Cronbach alpha reliability coefficients ranging from .72 to .90 with a research sample consisting of 387 students from Australia, the UK, and the United States of America. Of particular interest is the anxiety (confidence) scale which achieved a Cronbach alpha coefficient of .90. The study concluded that lower computing anxiety (higher computing confidence), greater enjoyment, and positive perceptions of computer usefulness were associated with classes that were more cohesive, open-ended, integrated between laboratory and non-laboratory classes, and had technology that was seen as adequate. Ultimately the study found that the ACCC was a reliable instrument for measuring student attitudes. Since its development, the ACCC has been used in other studies as a means of capturing student attitudes towards computing and computer related courses and has also been used to help develop other instruments, some of these studies will now be examined.

A study by Okan (2008) used the ACCC as part of a study that investigated computing laboratory classes as language learning environments. The study involved a research sample of 152 university students undertaking a one year compulsory education course in English at a Turkish university. Again, the study found the ACCC instrument to be valid and reliable with the scales attaining Cronbach alpha reliability coefficients ranging from .72 to .79, with the anxiety scale achieving the highest internal consistency with .79. These statistics are particularly interesting as the instrument was first translated into Turkish before being administered and as indicated by the authors, suggests cross-cultural validity of the instrument. The study also found that students did not feel any fear or anxiety when computers were used.

A study by Pyatt and Sims (2012) used the ACCC (in conjunction with three other instruments) as the basis for the development on a new instrument, the *Virtual and Physical Experimentation Questionnaire* (VPEQ). Items from the ACCC were specifically used to create two scales for the VPEQ titled 'usefulness of computers' and 'anxiety towards computers'. The study found the new instrument to be valid and reliable with each of the scales obtaining Cronbach alpha reliability coefficients ranging between .72 and .90. Ultimately, the study found students demonstrated positive attitudes towards both virtual and physical experimentation environments.

A subsequent study by the original author of the ACCC used the instrument to compare attitudes towards open and closed computer laboratories (Newby, Rickards, & Fisher, 2001). The ACCC instrument was further proved to be valid and reliable with the four scales obtaining Cronbach alpha reliability coefficients ranging from .64 to .90 with the anxiety (confidence) scale obtaining an internal consistency of .88. The study found students who engaged with open computer laboratories had increased computer anxiety. The authors suggest that this could be due to the lack of support in open laboratories as opposed to closed laboratories where staff members are present to provide help with unfamiliar software. In concluding the study draws on previous work that indicates that student attitudes are associated with levels of achievement (Newby & Fisher, 2000) and ultimately recommends that a mix of both open and closed computer laboratories would result in the most positive student experience.

2.9.7 Computing Confidence Summary

This section has shown that a number of instruments have been used to gauge computing confidence, and that computing confidence is often treated as a component of computing attitude and also as the inverse of computing anxiety. The literature has

also shown that the majority of studies have focused on quantitative data collection, often relying on Likert scale items. However, qualitative methods have also been shown to support quantitative results by providing more detailed information relating to concepts that arise from quantitative data. Building on the existing literature, a quantitative and qualitative measure of computing confidence has been incorporated into an instrument used within this study in order address the last research question, i.e. is there a relationship between student perceptions of the cloud assessment learning environment and student levels of computing confidence? Details regarding the development of this section of the instrument are given in the chapter three of this thesis.

2.10 Literature Review Summary

In this chapter the literature relating to cloud computing and learning environments research has been reviewed, as well as the literature relating to the other key variables present in each of the research questions. The chapter began by detailing the origins of cloud computing, this was followed by an examination of the literature relating specifically to cloud computing in education. The literature relating to learning environments was also examined and particular attention was given to studies that related to the key variables present in this study (including teacher-student interpersonal behaviour). The review of the literature revealed that a number of studies have been conducted into the areas of cloud computing and learning environments research, however the review also highlighted that there existed a lack of research into student perceptions of the cloud assessment learning environment. This chapter has also reviewed the literature relating to the measurement of conceptual change in understanding, levels of achievement, student attitude toward subject, and computing confidence, all of which are significant components of this study. Accordingly, the next chapter will detail the multi-method research design that has been used by this study. This will include a description of the data collection instruments and activities utilised in order to investigate the cloud assessment learning environment as well as the other key variables from within this study.

Chapter 3 Methodology

The previous chapters have introduced the research and provided a review of the literature relating to the various aspects of this study. This chapter will proceed by presenting an overview of the research method and a description of the research sample. This will be followed by the method rationale which will explain why a multi-method ethnographic case study approach was selected for this study. Following this, the research questions will be revisited and descriptions of each of the data collection methods used in this study will be presented. Each explanation will aim to justify the inclusion of the data collection method and will also describe the research question variables that the collected data has been used to address. Finally, the section will conclude by presenting a data collection timeline in order to illustrate when the various data collection methods were used throughout the study.

3.1 Method Overview

In order to investigate student perceptions of the cloud assessment learning environment, and consequently address the research questions, a multi-method ethnographic case study approach was selected for the study with the researcher acting as a participant observer. Both qualitative and quantitative data were collected from the research sample through a variety of methods, these were: the LIQ instrument (an adaptation of the QTI), the CAQ instrument (a questionnaire unique to this study that is focused on aspects of the cloud assessment learning environment), concept maps, class interviews, focus group interviews, written lecturer descriptions, participant observations, virtual participant observations, online activity statistics, attendance records, and achievement levels. Furthermore, a number of the aforementioned data collection methods have also been used in a pre-test post-test design. Accordingly, both qualitative and quantitative data were collected with the results from the various data sources being used to help support, validate and triangulate the overall findings through methodological triangulation (Cohen et al., 2000). Further explanation and justification of the selected data collection methods will be given later in this chapter. The data was collected over the course of a 16 week semester, with the majority of data being collected during a four week period while students were engaging with the cloud assessment learning environment.

3.2 Research Sample

As mentioned in chapter one, the research sample consisted of 50 *Bachelor of Information and Communications Technology* (BICT) students undertaking a

compulsory second year IT Project Management paper at the *Universal College of Learning* (UCOL) in Palmerston North, New Zealand. UCOL is a New Zealand government funded polytechnic and institute of technology with three campuses in the lower half of the North Island of New Zealand (UCOL, 2012). The Palmerston North campus (where this study was conducted) is the largest and main UCOL campus which is attended by approximately 2,500 equivalent fulltime students each year, with the remaining (approximately) 1,200 equivalent fulltime students attending either the Whanganui or Wairarapa campuses (UCOL, 2011). UCOL offers a variety of programmes in a number of fields including: computing, nursing, design, radiography, fashion, cookery, exercise and sport science, automotive engineering, and carpentry. The BICT degree is inherently focused on computing, with graduates moving into careers in computer programming, web development, database development, networking, and other ICT related fields. The research sample consisted of students roughly half way through this degree.

Of the 50 students in the research sample 42 (84%) were male and eight (16%) were female. The 50 participants represented 100% of the students enrolled in the IT Project Management paper in which the research was conducted. Participants varied in age from 18 to 58 years, with a mean class age of 27, a mode age of 20, and median age of 24. Figure 3.1 shows the gender based age distribution of the research sample as at the start of the cloud assessment learning environment assessment. The research sample also included six international students (four male, two female) where English was a second language.

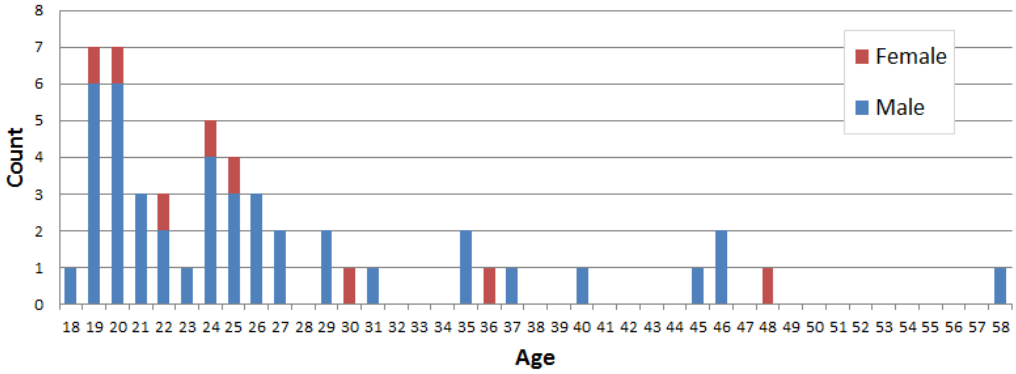

Figure 3.1 Research Sample Age Distribution by Gender

The researcher was the sole teacher of the IT Project Management paper in which this study was conducted. The study focused specifically on student experiences during a *project management plan* (PMP) assessment that was conducted within a cloud

assessment learning environment. The assessment required students to use Google Docs (a cloud computing word processing tool) to write a PMP for a given scenario over a four week period (due at the end of week nine of the semester). The researcher utilised various features of the cloud assessment learning environment to monitor and guide students throughout the assessment process, engaging as an integral part of the environment. In addition to Google Docs, the students were also able to access various resources relating to the wider paper using Moodle, UCOL's learning management system. Prior to the PMP assessment, students had already completed a summative assessment on Project Briefs, subsequent to the PMP assessment, students went on to complete two more summative assessments, a project management theory test and a Microsoft Project practical test. Table 3.1 provides an overview of the assessment layout for the semester (the Week column represents the week the assessment took place or in the case of the PMP Assignment the assessment due date).

Table 3.1 Assessment Overview for the IT Project Management Paper

Week	Assessment	Weighting
4	Project Brief Test	10%
9	PMP Assignment	30%
12	Project Management Theory Test	40%
16	Microsoft Project Practical Test	20%

Prior to beginning the IT Project Management paper in semester two, 2011 (which commenced August 1st), the 50 BICT students had already participated in two or three semesters at UCOL on the BICT degree programme and were familiar with the wider institutional environment (the variation depended on the semester of initial enrolment). All of the participants had also already been taught by the researcher on at least one of their previous papers and were therefore also familiar with the researcher as a lecturer. This reduced the number of uncontrolled variables in the classroom climate as students had experience with the researcher and other factors in the wider institutional setting, enabling the research to be conducted in the research samples natural environment (Cohen et al., 2000). In terms of teacher-student interpersonal behaviour, the research samples prior experience with the researcher had acted as a 'settling in' period allowing time for perceptions to stabilise (den Brok et al., 2004; Wubbels, 1997).

As the study consisted of multiple data collection methods, gaining student permission for each individual aspect of the data collection would have been impractical.

Therefore, student consent to be involved in the study as a whole was gained at the beginning of the semester, as per the ethics application and approval for this study. The overall study, students' role within the study, and data collections methods were explained during an information session in the first week of the semester. Students were given a participant information sheet (see Appendix C) and an opportunity to ask the researcher any questions about the research. At the conclusion of the research information session, students were invited to complete consent forms and thereby volunteer as participants for the study. Of the 44 students who attended the initial information session all 44 students consented, the remaining six students who were not in attendance were followed up at the next available opportunity and were provided with the same information. Consequently, the final six students also all consented to the study. Obtaining consent at the beginning of the semester also worked to reduce the Hawthorne effect which states that a bias effecting can occur when participants realise their role within the research (Cohen et al., 2000). Due to consent being obtained once at the beginning of the semester (as opposed to periodically throughout the semester), students were able to continue on with their studies in a relatively natural state.

3.3 Method Rationale

As previously stated, this study utilises multiple qualitative and quantitative data collection methods. This multi-method approach to the research has been specifically selected in order to provide a comprehensive view of student perceptions of the cloud assessment learning environment and to enable validation of the collected data through triangulation. Triangulation can be described as the use of two or more methods of data collection in the study of some aspect of human behaviour (Cohen et al., 2000). Cohen et al. (2000) go on to highlight that:

> "Triangular techniques in social sciences attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint and, in so doing, by making use of both quantitative and qualitative data." (p. 112)

Flick (2009) highlights an advantage of combining qualitative and quantitative methods by indicating that the different methods complement each other in the study of an issue by compensating for the weaknesses of each individual method. It has also been suggested that the internal reliability of a study is also enhanced through the use of multiple data collection procedures (Freebody, 2003).

Essentially, this study has been designed in a way that takes advantage of a number of complementary data collection methods in order to capture the most complete description possible of the research sample in relation to each of the research variables. Accordingly, the study consists of a mix of a number of different approaches to educational research, many of which have having been alluded to throughout the previous two chapters (each of these unique approaches will soon be covered in the subsequent sections).

Freebody (2003) states that the ethnographic researcher aims "to deal with the people they are studying by documenting their various ways of life on their own terms and turf, by participating in these ways, and by discreetly observing people, events and interactions" (p. 56). Ethnographic research commonly involves participant observations, field notes, and interviews (Cohen et al., 2000). Therefore, this study is ethnographic as the researcher has acted a participant observer, has collected field notes, and has conducted interviews with the research sample in order to document their perceptions of the cloud assessment learning environment in a natural tertiary learning environment.

A case study can be described as a single instance of a bounded system that provides a unique example of real people in real situations which can enable readers to understand ideas more clearly than presenting them as abstract theories (Cohen et al., 2000). Furthermore, Freebody (2003) states that:

> "case studies focus on one particular instance of an educational experience and attempt to gain theoretical and professional insights from a full documentation of that instance" (p. 81).

Accordingly, this study is also a case study in the sense that it focuses on the in depth documentation of 50 IT Project Management students engagement with a cloud assessment learning environment for an individual PMP assignment.

A one group pre-test post-test design can be used to assess the impact that a particular variable (in this case the cloud assessment learning environment) has on a group (i.e. the research sample) (Cohen et al., 2000). As this study aims to discover if engagement with the cloud assessment learning environment has an impact on perceptions of teacher-student interpersonal behaviour, and whether engagement impacts student perceptions of the environment, a pre-test post-test design has been incorporated into the research design. Accordingly, the LIQ instrument, CAQ instrument, concept maps,

and class interviews were conducted twice throughout the study, once before and again after students had engaged with the cloud assessment learning environment. It is also worth noting that a pre-test post-test control group design was considered, however it was deemed unnecessary by the researcher as the control group students would have simply been engaging with a traditional assessment environment, an environment to which every member of the research sample was already familiar. Also, by involving every member of the research sample with the cloud assessment learning environment a complete representation of the entire sample could be achieved. Furthermore, students were able to compare their experiences of the cloud assessment learning environment with their prior experiences with traditional assessment environments (which essentially would have been the purpose of the control group, i.e. to compare the new environment with the old). Finally, dividing the research sample in half would have resulted in two groups of 25 students which is below the suggested sample size of 30 cases for statistical analysis of data (Cohen et al., 2000, p. 93).

Finally, as shown in the literature review, the combination of multiple data collection methods (both qualitative and quantitative) have been successfully utilised in previous learning environments studies (see Chapter 2). This combination of the various data collection methods has often provided qualitative reasons behind the statistical findings and conversely quantitative support for qualitative findings. This is also the intention behind the design of this study. The following section will briefly review the research questions before each of data collection methods are explained.

3.4 Research Questions

The specific research questions for this study, as mentioned in chapter one, are as follows:

1. Are the instruments used in this study valid and reliable when used with this research sample?
2. Are there differences in teacher and student perceptions of teacher-student interpersonal behaviour in the cloud assessment learning environment?
3. What factors of the cloud assessment learning environment do students perceive as positive and negative?
4. Is there a conceptual change in student understanding of the cloud assessment learning environment over time?
5. Is there a relationship between student perceptions of the cloud assessment learning environment and their level of achievement?

6. Is there a relationship between student perceptions of the cloud assessment learning environment and their attitude towards the subject in which it is used?
7. Is there a relationship between student perceptions of the cloud assessment learning environment and their level of computing confidence?

In order to address each of the research questions a number of different data collection methods have been employed. The underlying goal was to collect a significant amount of data relating to each of the variables present in the research questions. The key variables being:

- Validity and reliability of data collection methods
- Perceptions of teacher-student interpersonal behaviour
- Student perceptions of the cloud assessment learning environment
- Student conceptual change in understanding of the cloud assessment learning environment
- Student levels of achievement
- Student attitudes toward subject
- Student levels of computing confidence

The specific data collection methods used in the study will be detailed in the following section along with the research variables targeted by each collection method.

3.5 Data Collection Methods

The study utilised eleven unique methods for collecting data relating to the research questions, the methods were: the LIQ instrument, the CAQ instrument, concept maps, class interview, focus group interviews, lecturer descriptions, participant observations, virtual participant observations, online activity statistics, attendance records, and achievement levels. This section will proceed by describing and justifying the use of each of the eleven data collection methods.

3.5.1 Lecturer Interaction Questionnaire

The *Lecturer Interaction Questionnaire* (LIQ) is a version of the *Questionnaire on Teacher Interaction* (QTI) that was adapted for the New Zealand tertiary environment (see Appendix A). The QTI was selected as a base instrument due to its proven validity and reliability and its focus on one of the key variables in this study (i.e. teacher-student interpersonal behaviour). As detailed in chapter two, the QTI is an instrument that aims to measure teacher-student interpersonal behaviour according to eight dimensions: Leadership, Helping & Friendly, Understanding, Responsibility & Freedom,

Uncertain, Dissatisfied, Admonishing, and Strict. The QTI instrument was adapted in a number of ways in order to make it more suitable for the New Zealand tertiary environment. The main area of adaption was to replace the title 'teacher' with 'lecturer', as the title 'teacher' is most strongly associated with primary and secondary school classrooms in New Zealand with the term 'lecturer' being the typical titled used in the tertiary sector. The LIQ used in this study has retained the 48 item size of the original Australian short version of the QTI instrument as well as the eight scales (or dimensions). However, a number of items were slightly changed in order to make the instrument more appropriate to a New Zealand tertiary setting. Additionally, the 'Admonishing' scale was renamed as 'Impatience" to better suit the updated items. For example, the original QTI included an item within the admonishing scale which was "It would be easy to have an argument with the teacher". In a primary or even secondary school classroom environment where the teacher is in a clear authoritative position, an argument between the teacher and a student would not be an appropriate occurrence. However, in the New Zealand tertiary environment, students often engage in healthy debate with lecturers and fellow students, a practice which is both commonplace and even encouraged. Consequently, the item was replaced with "The lecturer would have a short temper" an alternative item that corresponded to the scale, but also described a behaviour considered inappropriate at the tertiary level. The eight dimensions of the LIQ are shown in Figure 3.2. It is worth noting that the eight dimensions have been placed on the axes of the diagram as opposed to being in line with the sectors (as is the case with common QTI data), this has been done in part to help differentiate the LIQ from the QTI.

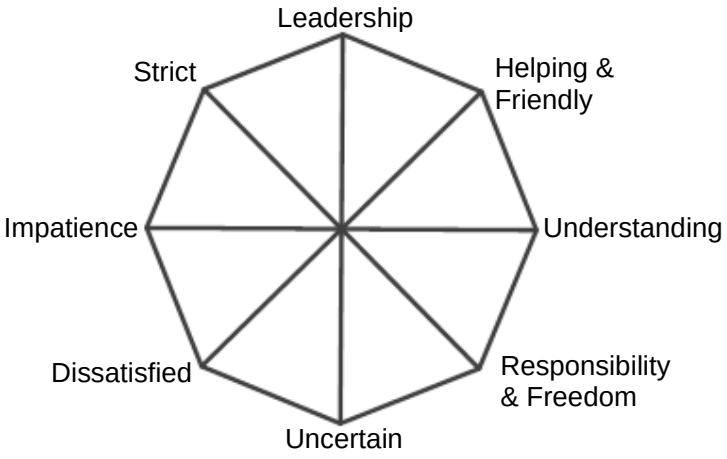

Figure 3.2 Modified Model for Lecturer Interpersonal Behaviour

The LIQ was administered twice during the study and was primarily used to address the first two research questions, i.e. validity and reliability of the instrument and student and teacher perceptions of the teacher-student interpersonal behaviour. The first LIQ was completed by students in week four of the semester, two weeks prior to starting the PMP assessment and again, four weeks later (week eight of the semester) during the middle of their engagement with the cloud assessment learning environment. The researcher also completed lecturer versions of the LIQ to correspond with the student data. Each administration involved the completion of both ideal lecturer and current lecturer (self for the researcher) forms of the LIQ by both the students and the researcher. The timing of the first and second LIQ data collections was intentionally selected in order to first capture a baseline of teacher and student perceptions and then again to capture any changes in perceptions of teacher-student interpersonal behaviour that could be related to engagement with the environment. Interestingly, the LIQ data also tied in with the results from other data sources relating to student perceptions of the cloud assessment learning environment due to the environments encompassment and facilitation of teacher-student interaction.

The collected data was subsequently analysed with the *Statistical Product and Service Solutions* (SPSS) (formerly *Statistical Package for the Social Sciences*) software package (Coakes & Steed, 2009). The statistical analysis included internal validity (Cronbach alpha) for each of the scales, bivariate correlation between scales and the other quantitative data sources, mean comparisons and paired sample t-tests. Beyond this, the LIQ results were also analysed in conjunction with the qualitative findings from the other data sources (specifically those relating to teacher-student interpersonal behaviour) in order to ascertain reasons behind the LIQ findings. The results of the LIQ analysis will be presented in the following chapter and a comprehensive discussion of the results will also be given in chapter five.

3.5.2 Cloud Assessment Questionnaire

The *Cloud Assessment Questionnaire* (CAQ) is a questionnaire specifically designed for this study (see Appendix B), and has been used to help address each of the seven research questions. The CAQ consists of both short answer and Likert scale items that relate directly to the cloud assessment learning environment (as well as sections relating to attitude toward subject and computing confidence). As with the LIQ, the CAQ was administered twice during the study in order to capture student perceptions before and after engagement with the cloud assessment learning environment.

Although the literature reveals numerous research instruments for collecting data about various learning environments, there did not exist (before this study) an instrument specifically tailored to capture data about the cloud assessment learning environment. One of the main barriers that prevented the use of any of the existing instruments was their generalised focus on broader learning environments, and their lack of focus on specific aspects of assessment (e.g. feedback, submission, etc.). Also the unique characteristics of the cloud assessment learning environment further amplified the disparity. In addition, it was also evident that the existing instruments would not be capable of capturing data about the unique relationship that can emerge between the student and lecturer within the cloud assessment learning environment. Therefore, it was decided that designing a new instrument (adapted in part from existing instruments) specifically for this study would be the most appropriate solution, an instrument focused primarily on student perceptions of the core aspects of the cloud assessment learning environment.

In order to reduce data collection fatigue (as discussed in the limitations section of chapter one), qualitative and quantitative questions relating to computing confidence and attitude towards subject (two key variables from the sixth and seventh research questions) were also included as independent sections within the CAQ instrument. This resulted in the CAQ consisting of three distinct sections: student perceptions of the cloud assessment learning environment, student attitude towards subject, and students computing confidence. Within each section of the CAQ Likert scale items are immediately followed by written short answer questions on the same theme. This was a deliberate design of the instrument and aimed to capture reasons behind the perceptions being expressed by the students. This coupling of question types resulted in a rich data sets for each of the targeted variables. The combined data sets also proved to be particularly useful with regards to the triangulation of results (this will discussed further in the subsequent chapters).

The first section of the CAQ focused on key aspects of the cloud assessment learning environment. These key aspects were identified by the researcher during initial experiences with the environment during 2009 and 2010, and also as a result of a class brainstorm and discussion regarding the environment during 2010. The class brainstorm discussion occurred with a different cohort of IT Project Management students (i.e. from the previous year) and was conducted at the conclusion of the four week PMP assignment after students had finished engaging with the cloud assessment learning environment. From this initial brainstorm and discussion session five

significant aspects of the environment were identified, these were: the lecturer's ability to monitor student work, the use of a cloud computing word processor (i.e. Google Docs), the opportunity to request and receive feedback before the due date, cloud (or online) storage (including automatic submission), and preference between the cloud assessment learning environment and a traditional assessment environment. As a result, the CAQ developed for this study consisted of fifteen five point Likert scale items and six open ended short answer questions. These items were divided into five main areas which corresponded to the aforementioned areas of significance, they were: lecturer monitoring, cloud computing tools (i.e. Google Docs), feedback facilitation, cloud storage, and preference. For each of these subsections, three Likert scale items and one open ended question were given. Table 3.2 provides an overview of the CAQ instrument.

Table 3.2 CAQ Cloud Assessment Section Overview

Focus Area	**Items**	**Type**
Lecturer Monitoring	Questions 1-3	Quantitative
	Question 4	Qualitative
Google Docs	Questions 5-7	Quantitative
	Question 8	Qualitative
Feedback	Questions 9-11	Quantitative
	Question 12	Qualitative
Cloud Storage	Questions 13-15	Quantitative
	Question 16	Qualitative
Preference	Questions 17-19	Quantitative
	Question 20	Qualitative
General	Question 21	Qualitative

Lecturer Monitoring focused on student perceptions of having their assignment document shared with their lecturer for the duration of the assessment which enabled the monitoring of progress. *Google Docs* focused on student perceptions of the cloud technology used for the assessment (i.e. using a web browser to access and complete their assignment in Google Docs). *Feedback* focused on student perceptions of requesting, receiving and working with feedback before the due date. *Cloud Storage* focused on student perceptions of cloud based storage and submission of their assignments. *Preference* focused on students perceptions of using the cloud assessment learning environment and associated technology (i.e. Google Docs) for the assessment

as opposed to a traditional assessment environment with a desktop word processing tool (i.e. Microsoft Word). Finally, question 21 was an open ended short answer question that allowed students to express any other thoughts they had regarding the cloud assessment learning environment. In order to improve readability and make the questionnaire more understandable to the research sample the term 'cloud assessment learning environment' was not including in the questionnaire. Although, the term is used in this thesis to represent the environment that forms the focus of the study, it essentially describes a type of environment that can be implemented with any number of cloud computing tools. Therefore, the questionnaire was tailored to focus specifically on the instance of the cloud assessment learning environment that was being utilised for the study. Consequently the phrase 'Google Docs for assessment' was used within the questionnaire as it was a phrase that was clearly understandable by students and it directly represented the instance of the cloud assessment learning environment that the students were working with.

The student attitude toward subject section of the CAQ consists of eight five point Likert scale items and one short answer question. The Likert scale items were adapted from the *Test of Science Related Attitudes* (TOSRA) instrument. As mentioned in chapter two, the original TOSRA instrument was designed by Fraser and included 70 five point Likert scale questions (Fraser, 1978). A reduced version of the TOSRA consisting of eight questions has also been successfully utilised in a number of studies (den Brok, Fisher, & Koul, 2005; Seopa, Laugksch, Aldridge, & Fraser, 2003; Walker & Fraser, 2005). An adaptation of this reduced TOSRA was used for the attitude section of the CAQ with the language having been tailored to suit the research sample. Questions 1-8 (Likert scale items) and question nine (a short answer question) all focus of the student attitudes toward the subject in general (as opposed to student attitudes towards a specific assessment or technology).

The computing confidence section of the CAQ consists of nine five point Likert scale questions and three short answer questions. The Likert scale items were adapted from the *Attitude towards Computing and Computing Courses questionnaire* (ACCC), an instrument that has been proven valid and reliable for determining student attitudes towards computing (Loyd & Loyd, 1985). Again, as mentioned in the previous chapter, the original ACCC extended an existing instrument, the *Computing Attitudes Scale* (CAS) that had been proposed in previous work (Loyd & Gressard, 1984) and resulted in a 40 item instrument (see chapter two for further detail regarding the ACCC). However, in the interest of keeping the CAQ to a manageable size, a reduced number of questions

were selected and adapted to best suit the research sample and minimise data collection fatigue. Questions 1-3 (Likert scale items) and question four (written short answer) focused on students perceived computing skill level. Question 5-7 (Likert scale items) and question eight (written short answer) focused on student anxiety towards computers. Finally, question 9-11 (Likert scale items) and question twelve (written short answer) focused on student confidence with regards to teaching and learning computer skills.

As mentioned earlier, the CAQ was administered twice during the study in order to capture any change in student perceptions of the cloud assessment learning environment. Any conceptual change was expected to become evident through the comparative analysis of the pre-test and post-test data. The first CAQ was completed in class by students immediately after the assessment had been announced and an overview had been given. This occurred in week six of the semester, two weeks after the first LIQ and two weeks prior to the second LIQ. The first CAQ was intended to capture students initial perceptions of the cloud assessment learning environment just after indirect exposure (i.e. having had it explained) but prior to direct engagement (i.e. before starting the assessment with Google Docs). The second CAQ was completed by students in the first available timetabled class after the completion of the assessment. This occurred four weeks after the initial CAQ, and two weeks after the second LIQ. It is worth noting that the administration of the LIQ and CAQ was intentionally staggered in order to reduce data collection fatigue (i.e. one collection every two weeks as opposed to requiring students to complete both the LIQ and CAQ in a single session). Conversely, a number of other data collection activities were also intentionally timed to coincide with the CAQ data collection in order to optimise consistency of results (i.e. student perception of the environment as expressed through the CAQ's, concept maps, and interviews etc.). However, as the LIQ was primarily focused on a different set of variables (i.e. dimensions of teacher-student interpersonal behaviour) it was felt that scheduling the LIQ surveys with the CAQ data collection was not as necessary as it was for the other data collection activities.

As previously stated, the CAQ data has been used in this study to address each of the seven research questions. The first research question (validity and reliability of data collection methods) is addressed with regards to the CAQ in detail in chapter four and five from a number of angles including: statistical validation, internal validation, and triangulation with other data sources. The CAQ quantitative scales are validated statistically in similar fashion to the LIQ scales (i.e. Cronbach's alpha). The CAQ data is

also validated internally whereby the quantitative data are validated against the qualitative short answer results and vice versa. Finally, the CAQ is also validated through comparison with findings from other data sources (e.g. participant observations, interviews, etc.). Unlike the LIQ, the CAQ is essentially a new instrument designed specifically for this study, therefore there does not exist a body of previous studies that can be used for comparative purposes (with regards to validity and reliability and other findings). However, as the attitude toward subject and computing confidence sections have been adapted from existing instruments, the previous studies using the original instruments have been used to assist in the validation of these particular sections of the CAQ. Accordingly, the cloud assessment learning environment section of the CAQ has primarily been validated through triangulation with the other data sets presented in this study.

The CAQ has also provided a depth of information relating to each of the other key research variables. Data relating to student perceptions of teacher-student interpersonal behaviour was obtained from the sections relating to the lecturer monitoring and feedback sub-sections from within the instrument. Student perceptions of the cloud assessment learning environment were revealed by both first and second administrations of the CAQ. Conceptual change in student understanding of the environment was obtained through comparative analysis of the pre-test and post-test CAQ results. The student perceptions of the cloud assessment learning environment were also used to establish if any relationships existed between student perceptions and their level of achievement, attitude toward the subject and level of computing confidence. Finally, the attitude toward subject and the computing confidence sections provided both quantitative and qualitative data relating to the sixth and seventh research questions.

The CAQ results as they relate to the various research questions are first presented in chapter four with a discussion of the results in being presented in chapter five. Finally, chapter six provides conclusions built on the discussion of the results and systematically addresses each of the research questions.

3.5.3 Concept Maps

Concept maps (Novak & Cañas, 2008) have also been used within this study to help capture student perceptions of the cloud assessment learning environment. As with the CAQ data, the concept map data has also been used to assist in addressing each of the research questions.

Concept maps have been used in previous studies to capture conceptual understanding of various subjects and have also been used to capture conceptual change that can occur over time (Dykstra et al., 1992; Fellows, 1994; Trent et al., 1998). It was decided that using concept maps within this study would be an interesting and novel way to collect data about student perceptions of the cloud assessment learning environment. Previous research has suggested that concepts maps are an efficient way to collect unique data relating to conceptual change in students (Trent et al., 1998). It was also felt that this alternative approach to data collection would help break survey fatigue while at the same time provide an additional valuable data source that could be used for triangulation purposes.

Students completed two hand drawn concept maps throughout the study. The central or starting concept for each of the concept maps was 'Google Docs for Assessment', this being the term understood by students as representative of the cloud assessment learning environment. Students were asked to write down all that they could about what they understood or thought about the term 'Google Docs for Assessment' and were given total freedom to complete the concept maps to whatever extent they felt appropriate.

The first concept map was completed in conjunction with the first CAQ, that is, after the assessment had been explained, but before students had begun directly engaging with the cloud assessment learning environment. As with the first CAQ, this was timed in order to capture initial student perceptions about the cloud assessment leaning environment. Accordingly, the second concept map was completed by students in conjunction with the second CAQ with the intention to capture student perceptions after having engaged with environment for the duration of an assessment.

As it is generally understood that human perceptions can change over time, it was felt important that the concept map data be collected at the same time as the CAQ data. Conducting the concept map data collection at an earlier or later date could have potentially skewed the data due to possible conceptual change occurring between the CAQ and concept map data collections. Therefore, coinciding the concept map and CAQ data collections emerged as the most appropriate option as it was felt this timing would help ensure that the same student perceptions captured by the CAQ would also be captured by the concept maps. The uniformity of the data collection timing was also felt necessary from a validity reliability perspective.

As will be shown in the following chapters, the concept map data has provided unique information relating to a number of the key research variables. Validity and reliability of the various data collection methods has been assisted through the provision of unique data set which has been used for triangulation of results. Data relating to student perceptions of teacher-student interpersonal behaviour was obtained from concepts relating specifically to the teacher-student relationship that exists within the environment. Student perceptions of the cloud assessment learning environment were revealed through the combination of concepts from each of the concept maps. Conceptual change in student understanding of the environment was obtained through comparative analysis of the pre-test and post-test concept maps. Finally, student perceptions of the cloud assessment learning environment as obtained via the concept maps were also used to help identify common themes throughout the data and if any relationships existed between student perceptions of the environment and their level of achievement, attitude toward the subject and level of computing confidence.

3.5.4 Class Interviews

Whole class informal interviews were conducted twice throughout the study. The first class interview occurred at the same time as the first CAQ and first concept map data collections (i.e. on the day that the assessment was explained to students, but prior to students directly engaging in the cloud assessment learning environment). Accordingly, the second class interview also coincided with the second CAQ and second concept map data collections. The timing of these interviews was selected for the same reasons given for coinciding the second CAQ with the second concept map data collections (i.e. to ensure expressed opinions remained relatively uniform between the different data collection methods).

The literature shows that group interviews can provide in depth qualitative data on the beliefs, attitudes and opinions of interview participants (Cohen et al., 2000). One weakness of group interviews is that some members of the group can end up dominating the discussion, however these members can also be an asset to the group by putting forward ideas and encouraging discussion (Watts & Ebbutt, 1987). Nevertheless, group interviews are a useful data collection technique that can highlight common consensuses, areas of division and ultimately provide a wider range of responses than individual interviews (Cohen et al., 2000). Given these reasons, and the nature of the study it was felt advantageous to include whole class interviews within the study as yet another qualitative measure of the research sample.

The first class interview consisted of the class being asked a number of broad questions (e.g. what do you think about using Google Docs for the assignment? is there anything you are/aren't looking forward to? do you have any concerns or questions about the assessment?). The intention of the interview was to facilitate a class discussion on student expectations and perceptions of the assessment. During the class discussion the researcher discretely took brief notes, and also expanded these notes after the conclusion of the class. The notes included both a summary of the discussion topics, and also further details on the general feeling of the discussion and any non-verbal communication as expressed by the research sample during the discussion.

As mentioned, the second class interview was conducted at the completion of the project management plan assessment. This discussion occurred in class after students had completed the second CAQ and second concept map. The intention of the interview was to facilitate a reflective class discussion focused specifically on student experiences with the cloud assessment learning environment. Again, the researcher asked a collection of broad, open ended questions (e.g. how did you find the assignment? what did you like? what didn't you like?). Although starting questions were asked, the class was afforded time in order to allow the discussion to flow freely and focus on topics significant to the students. During the various discussions the researcher again discretely took quick notes on key points that were emerging. After the conclusion of the class interview, more detailed notes on the discussed topics were then recorded by the researcher.

The class interview data has been used to help address many of the research questions, specifically with regards to student perceptions of the cloud assessment learning environment, conceptual change in understanding, attitude towards subject, computing confidence, and teacher-student interpersonal behaviour. Validation and reliability of the data collection methods was also assisted through triangulation and comparative analysis. The results of the class interviews are presented and discussed in the following chapters.

3.5.5 Focus Group Interviews

Focus group interviews were conducted with two separate groups of students after the completion of the assessment. The interviews were semi-structured and included a number of key questions to direct the discussion towards specific aspects of the cloud assessment learning environment.

One key advantage of focus group interviews is the dynamic nature of the interview whereby both the interviewer and multiple interviewees can participate in a natural conversation about a given topic (Cohen et al., 2000). The cross pollination of opinions can often serve as a great catalyst for the discussion of significant aspects of a given topic. The focus group interviews were also considered as an ideal way to further explore ideas that had emerged during the class interviews by providing focused accounts of student perceptions of the cloud assessment learning environment, computing confidence and attitudes toward the subject.

The two focus group interviews were conducted at the conclusion of the assessment in the hours directly after students had completed the second CAQ and the second concept map, with the researcher acting as the interviewer. Again, for the same reason given for conducting the CAQ's in conjunction with the concept maps, it was also decided to conduct the focus group interviews on the same day (i.e. delaying the focus group interviews could provide time for student perceptions to become different from those captured by the CAQ and concept maps). An open invitation was offered to all students to participate in the focus group interviews from which eleven students volunteered, 22% of the research sample (further detail relating to the make-up of the focus group participants is given in chapter five). Due to student availability, the eleven students were split into two separate focus groups. The first focus group consisted of seven students and lasted approximately 30 minutes. The remaining four students formed the second focus group and were interviewed for approximately 24 minutes. Both interviews were recorded using Audacity, an audio recording software package (Audacity, 2012), additional notes were also taken by the interviewer throughout both interviews.

Each interview loosely followed the structure of the CAQ whereby starting questions and statements were given by the interviewer on the topics found in the CAQ (i.e. cloud assessment learning environment, attitude towards subject and computing confidence), the interviews also included discussion around aspects of teacher-student interpersonal behaviour within the cloud assessment learning environment. This was done in order to ensure that both focus groups (at least) discussed the same key topics. Although the interview was led through the aforementioned topics, the researcher intentionally allowed the interview to flow as a natural group discussion about the various subjects, as opposed to an interviewer centred dialogue. This was an intentional decision as the literature shows that interviews that are allowed to flow, tend to naturally focus on those subjects considered most significant to interviewees

(Cohen et al., 2000), therefore time was allowed in order to let each discussion fully evolve.

Due to the fact that the post-assessment interviews were intended to review student perceptions of the entire assessment process, it was felt unnecessary to conduct pre-assessment interviews (i.e. focus group interviews to coincide with the first CAQ and concept maps). Furthermore, the focus group interviews were also reflective in nature (e.g. now that the assessment is over, how do you think it went?) and consequently allowed participants to contrast how the felt at the beginning, during, and after the assessment, a practice (i.e. a reflective discussion interview) that has also been successfully utilised in other studies (Lahtinen & Pehkonen, 2012). The decision to only conduct post assessment focus group interviews were also made in the interest of reducing data collection fatigue.

In a similar way to the class interview results, the focus group interviews have been used to help address many of the research variables including: student perceptions of the cloud assessment learning environment, conceptual change in understanding (obtained through reflective discussion), attitude toward subject, computing confidence, and perceptions of teacher-student interpersonal behaviour. The focus group interviews have also been used to help address the validation and reliability of the collected data through triangulation and comparative analysis. The results of the each of the focus group interviews are presented and discussed in chapters four and five.

3.5.6 Lecturer Descriptions

Written descriptions of both an ideal lecturer and the student's current lecturer were also anonymously completed by focus group interview students at the conclusion of their respective interviews. Focus group participants were presented with a single lined piece of paper divided into two sections (ideal and current) with instructions to describe their ideal lecturer and to describe their current lecturer. The data was collected in order to provide a qualitative measure to be used for triangulation and comparative analysis with the results of the LIQ's (which quantitatively asked students to describe their ideal and current lecturers in terms of teacher-student interpersonal behaviour).

It was decided that collecting the data entirely anonymously would be advantageous for the study as a whole. This was primarily done to ensure students felt completely free to describe their ideal and current lecturers as honestly as possible. The

anonymous nature of this particular data collection was used as a validity and reliability check for the other data sources concerning teacher-student interpersonal behaviour (a key variable from the second research question). I.e. if no bias existed in the previously collected data (e.g. LIQ results), the anonymous results should still correspond to the non-anonymous results. Conversely, if the anonymous results varied from the non-anonymous results this could be an indicator of a bias existing within the previously collected data. The results and a discussion of the anonymous lecturer descriptions are also presented in the following chapters.

3.5.7 Participant Observations

The researcher acted as a participant observer for the duration of the study. In this role, the researcher collected data in the form of hand-written field notes throughout the semester in which this study occurred. The recorded observations focused primarily on the variables present in the research questions, i.e. perceptions of the cloud assessment learning environment, teacher-student interpersonal behaviour, changes in student conceptual understanding of the environment, student attitudes toward the subject, computing confidence levels, and achievement.

Participant observations are known as an essential component of ethnographic research (Bogdan & Biklen, 2003; Cohen et al., 2000). The role of the participant observer is to enter the natural environment of a group and become familiar with the individual members, their attitudes, beliefs and practices. Often, one of the main barriers to participant observations is the need for the participant observer become or exists as a natural part of the observed group (Bogdan & Biklen, 2003; Cohen et al., 2000). Fortunately in this study, the researcher was the lecturer of the research sample, and therefore already existed as a natural and accepted member the group.

The notes taken by the researcher were all recorded out of direct sight of the research sample in order to reduce reactivity amongst the observed students. This usually took the form of intensive note taking sessions immediately after timetabled classes, or other direct interactions with members of the research sample. Some notes were also taken during timetabled class while students were engaged in independent learning activities. This covert approach to note taking was done in order to maintain the natural environment of the group as the literature shows that overt participant observations can restrict the research by causing group members to put on an artificial socially constructed front, this is also known as the Hawthorne effect (Cohen et al., 2000). The research sample had been aware of the study as a whole since the

beginning of the semester which technically made the entire study overt in nature. Nevertheless, it was felt covert note taking would be more conducive to the natural group environment than overt note taking (i.e. pausing to take notes while engaging with students). The participant observation notes covered all aspects of face-to-face interactions with and observations of the research sample, this included but was not limited to: class discussions, individual student discussions, student questions, late arriving students, early leaving students, body language, observable attitudes, off topic work and discussions, in class peer interactions, teacher-student interactions, technical and non-technical problems experienced by students, non-verbal body language and cues and many other observable phenomena.

Interestingly, the participant observations existed as an over-arching data collection process that encompassed all other data collection activities throughout the entire study. Accordingly, the results of the participant observations have been used to help address each of the research questions in this study as they have provided insight into teacher-student interpersonal behaviour, student perceptions of the cloud assessment learning environment (including changes over time), student attitudes toward the subject, computing confidence, and achievement levels. Accordingly, the participant observations have also been used for comparative analysis with the other data sources and have provided yet another avenue to support the validity and reliability of the data collected in this study.

3.5.8 Virtual Participant Observations

Virtual participant observations were made by the researcher by monitoring student online activity. Observations were mainly based on Google Docs activity during the assessment period, but also covered Moodle activity throughout the semester. Technically, the virtual participant observation could have been included within the wider participant observations data, however it was decided that making a distinction between face-to-face and online observations would been advantageous from a data presentation and discussion perspective.

In contrast to traditional participant observations, virtual participant observations consisted entirely of phenomena observed electronically. This included, but was not limited to, the following observations: email discussions, Google Docs chat discussions, Google Docs comment dialogues, student 'note to self' comments within assignments, and Moodle usage. The researcher recorded the virtual observations in written form in a similar way to the traditional observations. However, additional electronic copies of

observed phenomena were also kept where possible (i.e. daily copies of student assignments and emails).

As with the participant observations, the virtual participant observations were used to help address various aspects of the research by providing qualitative insight into student use of the cloud assessment learning environment, attitude toward subject, computing confidence, conceptual change in understanding and teacher-student interpersonal behaviour. Further detail regarding the virtual participant observations will be provided in the following chapters.

3.5.9 Online Activity Statistics

Online activity statistics were also collected throughout the semester in which this study occurred. Unlike the qualitative virtual participant observations, the online activity statistics consisted solely of quantitative data. These statistics mainly covered Google Docs activity and Moodle activity, but also include email exchange statistics.

One significant piece of data collected that specifically related to the cloud assessment learning environment was the progressive assignment word count (collected via Google Docs). The word count of each student's assignment was recorded manually on a daily basis throughout the four week assessment. This data was collected in order to provide a quantitative measure of student progress during the assessment. Interestingly, this is to the researcher's best knowledge, the first time progressive assignment word count data has been collected on a daily basis for any type of research (this will be discussed in greater detail in the following chapters). The collected data has provided a quantitative insight into the way students approach written assignments. The progressive word count data is also individually presented and discussed in the following chapters.

Moodle activity statistics were downloaded from the Moodle learning management system at the conclusion of the semester. The statistics included page and resource view counts specifically related to the IT Project Management Paper in which this research was conducted. Brief statistics that describe email interactions between the researcher and the students were also recorded. These statistics essentially describe the number and frequency of email interactions between the researcher and the research sample.

The above mentioned online activity statistics have been used as to help address various research questions by providing a quantitative measure of students interaction

with the cloud assessment learning environment, the online resources related to the paper, and email communications with the researcher. Accordingly, this data relates to a number of the key research variables including: student perceptions of the cloud assessment learning environment (via usage statistics), teacher-student interpersonal behaviour (via communication statistics), and aspects of student attitude toward the subject and computing confidence (via activity and usage statistics), each of which will be discussed in greater detail in the following chapters.

3.5.10 Attendance Records

Student attendance throughout the entire semester was also recorded. The attendance records cover all timetabled lecture and lab classes as well as controlled assessments delivered during the 16 week semester. Attendance was collected as a quantitative measure of student engagement. Although attendance and engagement were not key variables of the study it has been suggested that a relationship can be seen to exist between attendance and student attitude towards a subject and also student achievement (Handelsman, Briggs, Sullivan, & Towler, 2005; Klem & Connell, 2004). Accordingly, the attendance records have been primarily used to help address the fifth and sixth research questions which include achievement level and attitude towards subject as key variables. It was also felt that the attendance records would provide a reliable measure that could potentially produce interesting findings as a result of statistical correlation analysis. The attendance records are presented in the following chapters and are discussed inasmuch as they relate to the various research questions.

3.5.11 Achievement Levels

Final grades for the project management plan (PMP) assignment were collected at the conclusion of the assessment, and were stored as a percentage. The final grade for the assessment was a simple yet significant piece of data that existed as an obvious indicator of achievement. For similar reasons, students overall achievement levels for the I202 IT Project Management paper were also collected at the conclusion of the semester. Beyond this, student academic history was also analysed and summarised. This summary took the form of a grade point average (GPA) measurement which represented the mean of student achievement levels from previous studies. These three achievement variables (PMP Grade, I202 Paper Grade, and GPA) were collected in order to help address the fifth research questions which ask whether or not student perceptions of the cloud assessment learning environment are related to their level of achievement. Accordingly, these achievement variables and their correlation with

other variables within this study as they relate to research questions are presented and discussed in the following chapters.

3.6 Ethical Considerations

A number of ethical considerations were made that related to the data collection activities undertaken throughout this study. The first consideration focused on the issue of participant anonymity with regards to data collection. It was understood that an entirely anonymous research sample can be advantageous as it enables participants to express opinions without fear of reciprocation. Conversely, anonymity of participants was also known to be a potential disadvantage (relating to validity of collected data) due to what the field of psychology refers to as deindividuation, a phenomena which can result in antinormative behaviour of anonymous group members (Gackenbach, 2006; McKenna & Bargh, 2000). Nevertheless, it was obvious from an early stage that a completely anonymous research sample would not be possible within the context of this study due to the obvious constraint posed by the researcher's role within the cloud assessment learning environment (not to mention the research's role as a participant observer). The option of conducting a semi-anonymous study (e.g. anonymous LIQ's, CAQ's, and concept maps) was also ruled out due to analysis and triangulation requirements of the study. The study essentially necessitated the comparative analysis of results from the various data sources on a student by student basis. In order to achieve this, there needed to exist a way of identifying each unique student across the different data sets. Again, with the researcher's participant observations existing as one of the data sets in question, it was infeasible to try and attempt to implement anonymity or even semi-anonymity through coding in this study. As a result, for each of the data collection methods that directly involved students (e.g. the LIQ's, CAQ's and concept maps) students were asked to include their student ID number as a means of identification for use in data analysis. The research participants were also informed that they would not be identifiable in any consequential research outputs and that the formal analysis phase of the study would not commence until after the conclusion of the semester once final marks for the paper had been finalised. These steps were taken to further ensure students felt comfortable in expressing honest opinions throughout the study. As has been mentioned, 100% of the IT Project Management class elected to participate in the study indicating that students were comfortable with the implications of the study and were satisfied that their individual confidentiality would be ensured.

The second ethical consideration revolved around the timing of the post-assessment data collection, this involved the second class interview, the second CAQ, the second concept map, and the focus group interviews. The timing of these data collection activities was significant due to two potential biases. It was identified that if students knew their assignments had not been marked prior to the data collection, it was conceivable that some could falsely assume that expressing negative opinions in the data collection could result in the researcher, their lecturer, reducing their assignment grades out of spite. This situation could then result in an artificially positive bias in the data. However, it was also determined that collecting the data after the student assignments had been marked and returned could also introduce an equally as possible negative bias. This negative bias would be due to what the field of psychology refers to as the self-serving bias whereby blame of personal failure is shifted to entities external to the individual (Sedikides, Campbell, Reeder, & Elliot, 1998). If this were to occur, it would also be conceivable that students who achieved a lower than expected grade in the assessment could express overly negative opinions in the data collection. Therefore, it was decided that the data collection would occur after the assignments had been marked, but prior to the results being released to the students. Before the post assessment data collection commenced, students were reassured that their assignments had already been marked and that the views they expressed in the data collection would in no way impact their grades. This reassurance was also coupled with an electronic version of each of the students marking schedules which included an electronic time stamp that would confirm that marks had been decided prior to the data collection and were not subsequently altered.

It is also worth noting that in considering the ethics for this study, that ethics clearance was sought for the period of the study by Curtin University, as well as by UCOL, the data collection site. In both instances the study was given full ethical clearance for the duration of the study.

3.7 Data Collection Overview

Earlier in this chapter (see Section 3.5) a detailed description of each of the data collection activities used for this study was given. Table 3.3 provides a summary overview of each of the methods in relation to the 16 week semester. This program and scheduled approach enabled the management of data collection fatigue in the student group, but also helped to ensure that data was collected in a way that did not interfere with regular class activity or assessments. This was an important consideration to ensure that to the best abilities of the researcher and in the time

available, the study was able to collect a diverse and comprehensive data set from this sample in a limited time.

Table 3.3 Data Collection Summary Overview

Data Collection Method	Occurrence	Quantitative	Qualitative
LIQ	Week 4 & 8	Yes	No
CAQ	Week 6 & 10	Yes	Yes
Concept Maps	Week 6 & 10	No	Yes
Class Interviews	Week 6 & 10	No	Yes
Focus Group Interviews	Week 10	No	Yes
Lecturer Descriptions	Week 10	No	Yes
Participant Observations	Weeks 1-16	No	Yes
Virtual Participant Observations	Weeks 1-16	No	Yes
Online Activity Statistics	Weeks 1-16	Yes	Yes
Attendance Records	Weeks 1-16	Yes	Yes
Achievement Levels	Weeks 4, 9, 12 & 16	Yes	Yes

3.8 Data Analysis

SPSS a statistical data analysis software package (IBM, 2012) was used to analyse the quantitative data collected via the various data collection methods throughout the study. The quantitative data was first analysed with respect to internal validity with Cronbach alpha reliability coefficients (Santos, 1999) being calculated for each of the LIQ and CAQ scales. Subsequently, the data was analysed using paired sample t-tests (Coakes & Steed, 2009) in order to ascertain changes between student perceptions pre and post engagement with the cloud assessment learning environment. Bivariate correlations (Coakes & Steed, 2009) were also calculated between each of the scales and also other quantitative data collected in the study (e.g. attendance, grades, etc.) to determine if any relationships existed within the data from a statistical stand point. Interestingly, the paired sample t-tests and bivariate correlation analysis produced some interesting statistical results which will be presented and discussed in the following chapters.

The qualitative data collected throughout this study was manually analysed over a number of months by the researcher. During this analysis the researcher focused on the central themes that emerged from data as they related to each of the research questions, as well as notable exceptions to these themes. This analysis involved

intensive comparative analysis of multiple data sources, coding of qualitative results into emergent categories, and identification of central themes relating to each of the research variables and research questions.

Initial analysis of the CAQ qualitative data involved coding the student responses into appropriate categories. The coding process required the researcher to first read all of the student responses for a particular item. Based on this initial review of the responses, categories that naturally emerged from the data were then listed. The student responses were then revisited and coded according to the developed list of categories. Once all responses were coded, the responses from each category were read collectively to ensure consistency within the category and to ensure the category name was representative of the responses that it encompassed. Within this process of coding, categories were revised, removed, combined and adjusted where necessary. Likewise, responses were also shifted and re-categorised until suitably placed. This process of iteration and reiteration is a worthwhile practice from a research perspective as it can help to ensure consistency of the coding (Cohen et al., 2000). The concept map data was also coded and categorised in a similar manner whereby the concepts developed by the students were allocated into specific categories. Finally, the class interviews, focus group interviews, participant observations, and virtual participant observations were also analysed in light of the coding categories that had resulted from the CAQ and concept map data.

During the analysis of the data, emerging ideas and themes were cross examined against each of the other data sets, both quantitatively and qualitatively. It is worth emphasising that although each of the data sets were initially analysed in isolation, they were also often revisited in light of themes that emerged from other sources. A final stage of the data analysis also involved the researcher examining the entire data set (i.e. all data sets combined) as a single data source in order to ensure all aspects of the data had been adequately considered with the overall context of the study. This approach to the data analysis proved extremely useful as the cross examination removed the need for conjecture about specific results from individual data sources. This process of triangulation produced overall results that were both robust from a qualitative standpoint and supported statistically by the quantitative data. The results from the data analysis phase of this study are presented in chapter four before being further discussed in chapter five, and concluded upon in chapter six.

3.9 Method Summary

This chapter has detailed the research methodology used for this study, and has explained the rationale behind using a multi-method ethnographic case study approach which has utilised both quantitative and qualitative data sources. The research questions have been reiterated and each of the data collection methods utilised by this study have been described. Details relating to each research method used in this study have been given, this has included: justification for the inclusion of each method, detail of how and when each data collection activity was used throughout the study, and a mapping showing how each method has been used to address the various research questions. Finally, major ethical considerations made during the research design were discussed and a summary of the data analysis process was given. The following chapter will present the results of the study by providing both the quantitative and qualitative results from the data collection methods detailed in this chapter.

Chapter 4 Results

This chapter will present the results of the data collection phase of the study. The results will be presented in a similar order to the data collections methods covered in the previous chapter. The first section will present the validity and reliability findings of each of the quantitative instruments used in this study. This will be followed by the presentation of the findings (including qualitative validation) from each of the data collection methods. As will be shown, the validity and reliability of the qualitative data is strongly evidenced through the consistency of results that will be shown to emerge across the multiple data sources (a topic discussed in the following chapter).

4.1 Quantitative Instrument Validation

As mentioned in the previous sections the LIQ instrument that was used in this study is an adaptation of the QTI. The literature has shown that the QTI is a valid and reliable instrument with numerous studies reporting statistical acceptable Cronbach alpha reliability coefficients, i.e. .60 or greater (Nunnally, Bernstein, & Berge, 1967), for each of the instruments eight scales as a quantitative indicator of internal consistency. In order to remain consistent with previous QTI studies, the LIQ has been statistically validated using the same approach.

The cloud assessment section of the CAQ instrument included unique scales developed specifically for this study. Consequently the results are not directly comparable with previous studies in terms of statistical validity. Nevertheless, Cronbach alpha reliability coefficients have been calculated for each of the CAQ scales (including the attitude and computing confidence scales) in order to show internal consistency, remain consistent with the literature, and to also provide comparative data for future studies into cloud assessment learning environments. However, it is worth noting that the student attitude toward subject and computing confidence scales included within the CAQ were adapted from existing scales and therefore have previous findings that have been used for comparative purposes.

4.1.1 LIQ Validity

The LIQ was administered twice during this study. The first LIQ was conducted in week four of the semester, two weeks prior to students engaging with the cloud assessment learning environment. The second LIQ was conducted in week eight of the semester, four weeks after the first LIQ and two weeks after students began engaging with the cloud assessment learning environment. Of the 50 research participants, 49 completed the first LIQ, while 45 completed the second LIQ. Table 4.1 shows the

Cronbach alpha reliability coefficients (i.e. the internal consistency) for each of the scales in the LIQ for students' ideal lecturer and current lecturer for both the pre engagement LIQ (LIQ1) and the post engagement LIQ (LIQ2).

The reliability for the different scales over the course of the two administrations of the instrument ranged from .68 to .93, all of which are acceptable values from a statistical perspective, i.e. above .60 (Nunnally et al., 1967) and are also on par with internal consistency findings from previous studies (Maulana et al., 2011; NeSmith, 2005; Rickards, 1998; Stolarchuk & Fisher, 2001; Telli et al., 2007).

Table 4.1 Internal Consistency of the LIQ Scales

Scale	Alpha Reliability			
	LIQ1 Student Ideal Lecturer	LIQ1 Student Current Lecturer	LIQ2 Student Ideal Lecturer	LIQ2 Student Current Lecturer
Leadership	.68	.81	.83	.86
Helping & Friendly	.77	.84	.85	.84
Understanding	.82	.76	.86	.85
Responsibility & Freedom	.86	.91	.93	.90
Uncertain	.86	.88	.86	.89
Dissatisfied	.83	.82	.84	.92
Impatience	.68	.69	.69	.83
Strict	.73	.85	.88	.88

n = 49 for LIQ1, n = 45 for LIQ2

It is interesting to note the variation of the Cronbach alpha reliability coefficient in the Leadership and Impatience scales. The leadership scale for student's ideal lecturer in the first LIQ is noticeably lower than the other values for the scales sitting at .68. This is particularly interesting as the exact same questionnaire when administered four weeks later resulted in a jump to .83 for the coefficient for the exact same scale. Additionally the exact same leadership scale when applied to student's current lecturer also resulted in higher coefficients of .81 and .86. The Impatience scale shows an equally as interesting variant with the scale including a noticeably higher value for the second LIQ current lecturer scale. This will be discussed further in chapter five. Finally, it is worth noting the consistently high Cronbach alpha reliability coefficient values for the Responsibility & Freedom scale (.86 - .93) due to the fact that the literature revealed that this scale in particular has often produced the lowest reliability values out of all of the scales. This change may be attributed to the slight modification

to the Responsibility & Freedom scale items during the adaptation for this study. However, once again this will be further discussed in chapter five. It is also worth noting that the LIQ was also completed by the researcher from a lecturer's perspective at times corresponding to the student data collection. However, as the lecturer existed as sample of one, Cronbach alpha reliability coefficients could not be calculated.

4.1.2 CAQ Validity

The CAQ was also administered twice during this study. The first CAQ was conducted in week six of the semester, on the first day of the four week assignment directly prior to students engaging with the cloud assessment learning environment. The second CAQ was conducted in week ten of the semester, four weeks after the first CAQ and immediately after students had finished engaging with the cloud assessment learning environment. Of the 50 research participants, 48 completed the first CAQ, while 40 completed the second CAQ. Table 4.2 shows the internal consistency (i.e. the Cronbach alpha reliability coefficient) for each of the cloud assessment learning environment scales from each of the CAQ's. As shown in the table, each scale achieved an acceptable level of reliability with values ranging from .71 to .97.

Table 4.2 Internal Consistency of the CAQ Scales

	Alpha Reliability	
Scale	CAQ1	CAQ2
Monitoring	.85	.85
Google Docs	.72	.71
Feedback	.91	.97
Cloud Storage	.78	.83
Preference	.78	.77

n = 48 for CAQ1, n = 40 for CAQ2

Within each CAQ, scales to measure student attitude towards subject and computing confidence were also included. The internal consistencies for these two scales from each CAQ are given below. Again, as shown in the table, both scales produced acceptable levels of reliability with values ranging from .85 to .87 which are also on part with previous studies (Ketelhut et al., 2007; Newby, 1998; Newby et al., 2001; Okan, 2008; Pyatt & Sims, 2012).

Table 4.3 Internal Consistency of the Attitude and Computing Confidence Scales

	Alpha Reliability	
Scale	CAQ1	CAQ2
Attitude Toward Subject	.85	.87
Computing Confidence	.85	.85

n = 48 for CAQ1, n = 40 for CAQ2

4.1.3 Validity Summary

The previous sections have shown the statistical validity and reliability of the LIQ instrument and the quantitative sections of the CAQ instrument. The remaining data collection for use in this study was not quantitative to the degree that statistical validity and reliability could be calculated. Consequently, the validity and reliability of the remaining data collection methods used in this study will be shown and supported through the triangulation of results as each data set is presented in the following sections.

4.2 LIQ Results

The previous section presented the statistical validity of the LIQ instrument. This section will now proceed by presenting the findings from the two LIQ data collections. The results have been divided into two main sections, the first presents the results in a way where initial student perceptions are contrast final student perceptions of both their ideal and current lecturer. The second section presents a comparison of ideal versus current both before and after engagement with the cloud assessment learning environment.

4.2.1 Student Perceptions Pre and Post Engagement

The LIQ instrument included sections relating to student perceptions of their ideal lecturer and their current lecturer and was administered twice during the study. This section presents a comparison of these two collected data sets. To begin, Table 4.4 presents the raw scale means and difference for both LIQ's (significance values are given in the subsequent t-test result tables). It is worth reiterating that the first LIQ was completed by 49 students, while the second LIQ was only completed by 45 students. Due to the size of the sample, direct comparison of means could be slightly misleading (due to a slightly different student make-up for each LIQ).

Table 4.4 LIQ Raw Scales Differences for Ideal and Current Lecturers

Scale	Ideal Lecturer			Current Lecturer		
	LIQ1	LIQ2	Difference	LIQ1	LIQ2	Difference
Leadership	4.49	4.65	.16	4.43	4.51	.08
Helping & Friendly	4.48	4.60	.12	4.51	4.67	.16
Understanding	4.45	4.59	.14	4.45	4.49	.04
Responsibility & Freedom	3.03	3.26	.23	3.23	3.36	.13
Uncertain	1.34	1.30	-.04	1.27	1.36	.09
Dissatisfied	1.23	1.20	-.03	1.21	1.24	.03
Impatience	1.31	1.24	-.07	1.14	1.18	.04
Strict	3.37	3.17	-.20	3.05	3.09	.04

n = 49 for LIQ1, n = 45 for LIQ2

Accordingly, the following tables show the results of paired samples t-tests which presents a more direct comparison of the data as it also only takes into consideration those students who completed both LIQ's. The t-tests also show the statistical significance of the changes to the scale means between the two LIQ's. It is interesting to note that the largest change in scale means between the first and second LIQ's occurs in the Helping & Friendly scale relating to student perceptions of their current lecturer. The t-test shows that students perception of their current lecturers level of helping and friendless increased by .19. The t-test also shows that this is statistically significant at the .01 level.

Table 4.5 Ideal Lecturer t-test (LIQ1 vs. LIQ2)

Scale	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Leadership	-.17	.44	.07	-.30	-.04	-2.56	44	.01
Helping & Friendly	-.14	.50	.07	-.29	-.11	-1.86	44	.07
Understanding	-.15	.48	.07	-.30	-.01	-2.09	44	.04
Responsibility & Freedom	.06	.70	.10	-.39	-.03	-1.75	44	.09
Uncertain	.03	.42	.06	-.07	.18	.89	44	.38
Dissatisfied	.06	.29	.04	-.06	.11	.61	44	.54
Impatience	.16	.37	.06	-.05	.17	1.09	44	.28
Strict	-.11	.66	.10	-.03	.36	1.68	44	.10

n = 45

Table 4.6 Current Lecturer t-test (LIQ1 vs. LIQ2)

Scale	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Leadership	-.11	.31	.05	-.20	-.01	-2.32	43	.03
Helping & Friendly	-.19	.48	.07	-.34	-.04	-2.61	43	.01
Understanding	-.08	.38	.06	-.20	.03	-1.44	43	.16
Responsibility & Freedom	-.07	.72	.11	-.29	.15	-.62	43	.54
Uncertain	-.06	.53	.08	-.25	.98	-.80	43	.43
Dissatisfied	.02	.34	.05	-.09	.12	3.15	43	.75
Impatience	-.03	.34	.05	-.14	.08	-.53	43	.60
Strict	-.04	.40	.06	-.16	.08	-.68	43	.50

n = 44

By way of reminder, students had not engaged with the cloud assessment learning environment for the first LIQ, but were engaging with the environment at the time of the second LIQ. The qualitative data presented later in this chapter provides further insight into possible reasons why student perceptions of their current teachers level of Helping & Friendliness would increase within the context of the cloud assessment learning environment. Interestingly, this increase in Helping & Friendliness also emerges as a common theme throughout the rest of results presented in this chapter and will be discussion in greater detail in the following chapter. The following figures provide a graphical representation of the before and after LIQ scales scores for both current and ideal lecturers. It is worth noting that the radar plots shown in the following figures represent the LIQ results in a slightly different manner to the sector profiles used to describe the QTI dimensions. Whereas previous QTI studies have mapped each scale to one of the eight sectors of the chart, the radar plots map each of the scales to one of the eight axes on the diagram.

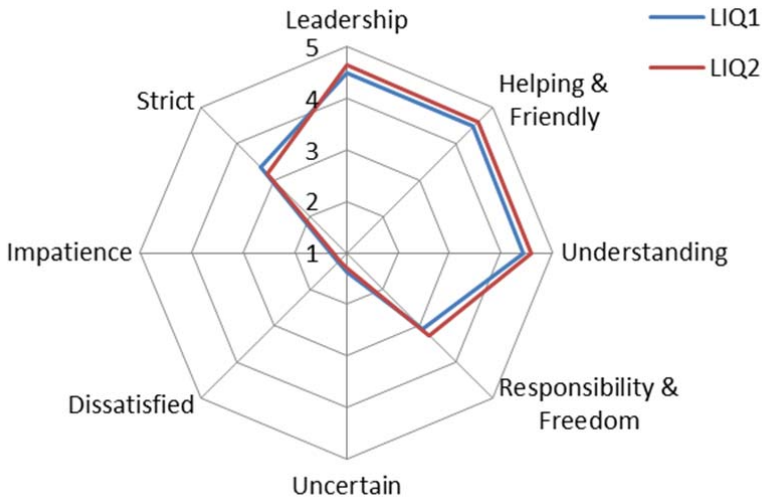

Figure 4.1 Student Ideal Lecturer Radar Chart (LIQ1 vs. LIQ2)

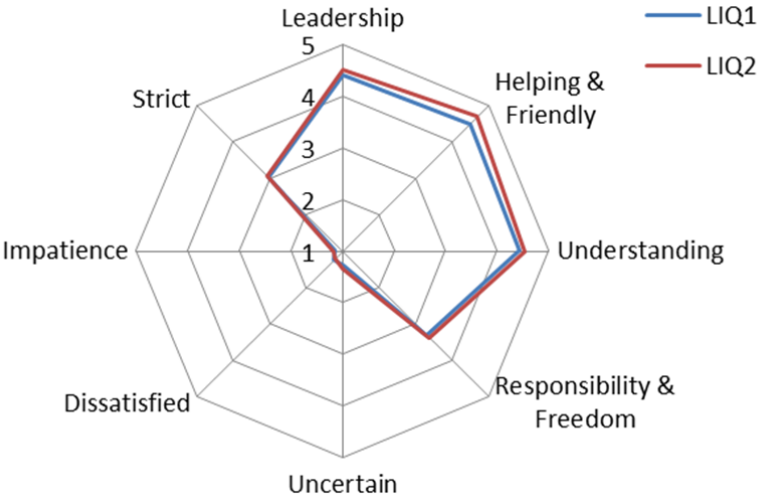

Figure 4.2 Student Current Lecturer Radar Chart (LIQ1 vs. LIQ2)

As mentioned, overall the LIQ data remains relatively consistent regarding student perceptions of both their ideal and current lecturers (in terms of interpersonal behaviour) both before and after engagement with the cloud assessment learning environment. Statistical analysis also revealed correlation statistics supportive of this notion of general consistency. Table 4.7 presents the scale correlations for the ideal lecturer (pre and post engagement) while Table 4.8 presents the scale correlations for the current lecturer (pre and post engagement). Note that the value for n changes from 45 to 44 due to a student only completing the ideal lecturer section of the questionnaire during the first data collection.

Table 4.7 Scale Correlations for Ideal Lecturer (LIQ1 vs. LIQ2)

Scale	r	p	n
Leadership	.43**	<.01	45
Helping & Friendly	.46**	<.01	45
Understanding	.48**	<.01	45
Responsibility & Freedom	.64**	<.001	45
Uncertain	.60**	<.001	45
Dissatisfied	.59**	<.001	45
Impatience	.45**	<.01	45
Strict	.57**	<.001	45

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table 4.8 Scale Correlations for Current Lecturer (LIQ1 vs. LIQ2)

Scale	r	p	n
Leadership	.75**	<.001	44
Helping & Friendly	.43**	<.01	44
Understanding	.63**	<.001	44
Responsibility & Freedom	.62**	<.001	44
Uncertain	.35**	.02	44
Dissatisfied	.50**	<.01	44
Impatience	.36*	.02	44
Strict	.84**	<.001	44

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

The correlation statistics suggest that there exists a moderate to strong significant positive relationship between student perceptions of both their ideal and current lecturer's teacher-student interpersonal behaviour both before and after engagement with the cloud assessment learning environment. These results will be discussed further in the following chapter.

4.2.2 Students Ideal and Current Lecturer

This section presents a comparison of student perceptions of their ideal lecturer with their current lecturer both before and after engagement with the cloud assessment

learning environment. Table 4.9 presents a raw comparison of scale means. Paired sample t-tests were also conducted in order to highlight the significance of differences between student perceptions of their ideal and current lecturers. Table 4.10 and Table 4.11 present the results of the t-tests for both LIQ1 and LIQ2.

Table 4.9 LIQ Raw Scales Means and Differences for LIQ1 and LIQ2 Results

Scale	LIQ1			LIQ2		
	Ideal	Current	Difference	Ideal	Current	Difference
Leadership	4.49	4.43	-.06	4.65	4.51	-.14
Helping & Friendly	4.48	4.51	.03	4.60	4.67	.07
Understanding	4.45	4.45	0	4.59	4.49	-.10
Responsibility & Freedom	3.03	3.23	.20	3.26	3.36	.10
Uncertain	1.34	1.27	-.07	1.30	1.36	.06
Dissatisfied	1.23	1.21	-.02	1.20	1.24	.04
Impatience	1.31	1.14	-.17	1.24	1.18	-.06
Strict	3.37	3.05	-.32	3.17	3.09	-.08

n = 49 for LIQ1, n = 45 for LIQ2

Table 4.10 LIQ1 t-test (Ideal vs. Current)

Scale	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Leadership	.07	.57	.08	-.09	.24	.89	47	.38
Helping & Friendly	-.03	.63	.09	-.21	.15	-.35	47	.73
Understanding	.02	.62	.09	-.16	.20	.21	47	.84
Responsibility & Freedom	-.22	.70	.10	-.42	-.01	-2.13	47	.04
Uncertain	.05	.42	.06	-.07	.18	.85	47	.40
Dissatisfied	.02	.38	.06	-.10	.13	.26	47	.80
Impatience	.17	.37	.05	.06	.28	3.16	47	<.01
Strict	.30	.72	.10	.09	.51	2.88	47	<.01

n = 48

Table 4.11 LIQ2 t-test (Ideal vs. Current)

Scale	Paired Differences					t	df	Sig (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Leadership	.14	.36	.05	.03	.24	2.56	44	.01
Helping & Friendly	-.08	.31	.05	-.17	.02	-1.61	44	.11
Understanding	.09	.45	.07	-.05	.23	1.32	44	.20
Responsibility & Freedom	-.10	.80	.12	-.34	.14	-.82	44	.42
Uncertain	-.06	.42	.06	-.18	.07	-.89	44	.38
Dissatisfied	-.04	.38	.06	-.15	.08	-.63	44	.53
Impatience	.06	.33	.05	-.04	.15	1.19	44	.24
Strict	.09	.68	.10	-.11	.30	.92	44	.37

n = 45

Scale correlations are presented in the following tables. It is interesting to note that the correlation between student perceptions of their ideal lecturer and their current lecturer vary in strength and significance for the first LIQ and yet are consistently strong for the second LIQ. These results will be discussed further in the following chapter.

Table 4.12 Scale Correlations for LIQ1 (Ideal vs. Current)

Scale	r	p	n
Leadership	.10	.51	48
Helping & Friendly	.15	.31	48
Understanding	.05	.74	48
Responsibility & Freedom	.62**	<.001	48
Uncertain	.53**	<.001	48
Dissatisfied	.30*	.04	48
Impatience	.37*	.01	48
Strict	.37**	.01	48

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table 4.13 Scales Correlations for LIQ2 (Ideal vs. Current)

Scale	r	p	n
Leadership	.64**	<.001	45
Helping & Friendly	.75**	<.001	45
Understanding	.52**	<.001	45
Responsibility & Freedom	.56**	<.001	45
Uncertain	.62**	<.001	45
Dissatisfied	.43**	.004	45
Impatience	.54**	<.001	45
Strict	.59**	<.001	45

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

4.2.3 Teacher Perceptions

As mentioned, the researcher also completed the LIQ instrument for both self and ideal lecturers at times corresponding to the student data collection. The researcher recognises the obvious limitations associated with working with such a small sample (i.e. one) particularly when the subject is the researcher. Nevertheless, the lecturers LIQ results have been included simply in the interest of completeness. Table 4.14 presents the pre and post engagement results of the researchers LIQ's for both self and ideal.

Table 4.14 Lecturer's LIQ Ideal and Self Perceptions

Scale	Ideal Lecturer			Self		
	LIQ1	LIQ2	Difference	LIQ1	LIQ2	Difference
Leadership	5.00	5.00	.00	4.30	4.30	.00
Helping & Friendly	4.80	4.80	.00	4.30	4.80	.50
Understanding	4.80	4.80	.00	4.30	4.30	.00
Responsibility & Freedom	3.00	3.20	.20	3.50	3.80	.30
Uncertain	1.00	1.00	.00	1.50	1.30	-.20
Dissatisfied	1.00	1.00	.00	1.00	1.20	.20
Impatience	1.00	1.20	.00	1.20	1.30	.10
Strict	3.30	3.30	.00	2.70	2.80	.10

n = 1

It is worth noting that the lecturer's perceptions of an ideal lecturer both before and after engagement with the cloud assessment learning environment were very similar to the perceptions expressed by the students. Correspondingly, the lecturer's own self

perceptions were also in line with those perceptions expressed by the student body. Interestingly, the lecturer also reported an increased level of helping and friendliness during the second LIQ data collection. These findings will be discussed further in the following chapters.

4.3 CAQ Results

As mentioned previously, the CAQ was developed as an instrument to measure student perceptions of the cloud assessment learning environment. The instrument also included sections that aimed to measure student attitudes towards subject and computing confidence. The instrument included a number of quantitative scales with each scale also being supported by an open ended short answer question. Accordingly, the quantitative results will first be presented, followed by the short answer response results, both of which will be discussed in greater detail in the following chapter.

4.3.1 Quantitative CAQ Results

A comparison of raw scale means between CAQ1 and CAQ2 are given in the following table, it is interesting to note the changes in the Monitoring and Google Docs scales. The changes in the monitoring scale seem to suggest that students' attitudes towards being monitored throughout the assessment process improved after having experienced the cloud assessment learning environment. Conversely, the changes in the Google Docs scale seem to suggest that student attitudes toward Google Docs as a tool became less favourable after using the tool for the assessment. Both of these changes will be discussed in further detail in the following chapter. It is also worth noting that the statistical significance of these changes is presented later in this section within the context of a paired sample t-test.

Table 4.15 CAQ Cloud Assessment Raw Scale Mean Comparison

Scale	CAQ1	CAQ2	Difference
Monitoring	3.67	3.98	.31
Google Docs	3.45	2.88	-.57
Feedback	4.43	4.40	-.03
Cloud Storage	4.30	4.13	-.17
Preference	3.11	2.96	-.15

n = 48 for CAQ1, n = 40 for CAQ2

A comparison of the scale means for the student attitude toward subject and computing confidence scales from each of the CAQ's are also given in the following table. Interestingly, neither the attitude toward subject nor the computing confidence scales

appear to display any considerable change between pre and post engagement with the cloud assessment learning environment.

Table 4.16 CAQ Attitude and Computing Confidence Raw Scale Means

Scale	CAQ1	CAQ2	Difference
Attitude Toward Subject	3.63	3.63	.00
Computing Confidence	4.19	4.21	.03

n = 48 for CAQ1, n = 40 for CAQ2

Similarly to the LIQ results, direct comparison of raw scale means may not be an accurate reflection of changes in student perceptions of the cloud assessment learning environment. This is due to the sample size and the fact that 48 students completed the first CAQ while only 40 students completed the second CAQ. Therefore the same data is presented below based on the results of a paired sample t-test which only takes into consideration those students who completed both CAQ instruments. The considerable changes in the Monitoring and Google Docs scales, as noted in the raw mean comparisons, are still apparent in the paired sample t-test results and are also shown to be statistically significant.

Table 4.17 CAQ Cloud Assessment Scale Mean Comparison

Scale	CAQ1	CAQ2	Difference
Monitoring	3.57	3.98	.42*
Google Docs	3.36	2.88	-.48*
Feedback	4.38	4.40	.02
Cloud Storage	4.27	4.13	-.14
Preference	3.02	2.96	-.06

* Change is significant at the 0.05 level, n = 40

Table 4.18 Cloud Assessment Scales t-test (CAQ1 vs. CAQ2)

	Paired Differences							
				95% Confidence Interval of the Difference				
Scale	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	df	Sig (2-tailed)
Monitoring	-.42	1.23	.19	-.81	-.02	-2.15	39	.04
Google Docs	.48	1.16	.18	.11	.85	2.65	39	.01
Feedback	-.02	.80	.13	-.28	.23	-.20	39	.84
Cloud Storage	.14	.99	.16	-.18	.46	.90	39	.37
Preference	.06	.90	.14	-.23	.35	.41	39	.68

n = 40

A comparison of the scale means for the student attitude toward subject and computing confidence scales based on a paired sample t-test of each of the CAQ's are also given below. Again, no significant change is apparent from a quantitative perspective.

Table 4.19 Attitude and Computing Confidence Scales (t-test)

Scale	CAQ1	CAQ2	Difference	Sig (2-tailed)
Attitude Toward Subject	3.58	3.63	.05	.61
Computing Confidence	4.18	4.21	.03	.65

n = 40

Correlations were also calculated relating the attitude toward subject scale and the computing confidence scale to other quantitative variables and scales within this study. Significant correlations are presented in the following tables. Variables tagged with (1) or (2) indicate either the first or second CAQ. The following correlations will also be discussed in greater detail in the following chapter.

Table 4.20 Attitude Scale Correlations

Scale	Correlated Scale	r	p	n
Attitude (1)	Attitude (2)	.70**	<.001	40
Attitude (1)	Monitoring (1)	.29*	.05	48
Attitude (1)	Google Docs (2)	.32*	.05	40
Attitude (2)	PMP Grade	.34*	.03	40
Attitude (2)	I202 Grade	.39*	.01	40
Attitude (2)	Monitoring (2)	.34*	.04	40
Attitude (2)	Feedback (2)	.46**	<.01	40
Attitude (2)	Cloud Storage (2)	.51**	<.01	40
Attitude (2)	Benefits Outweigh	.33*	.04	40

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table 4.21 Computing Confidence Scale Correlations

Scale	Correlated Scale	r	p	n
Confidence (1)	Confidence (2)	.80**	<.001	40
Confidence (1)	Feedback (1)	.35*	.02	48
Confidence (2)	Feedback (1)	.39*	.01	40
Confidence (2)	Cloud Storage (2)	.33*	.04	40

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

The second CAQ included an additional section with three items. The items focused on information relating to students prior use of Google Docs as well as whether or not they felt the benefits of cloud assessment learning environment outweighed the negatives. The first item asked if students had used Google Docs prior to the assessment, students were able to circle either Yes or No. Of the 40 students who completed the second CAQ 16 (40%) had used Google Docs before and 24 (60%) had not. The second item was qualitative and will be covered in the next section. The third and final item was a five point Likert scale statement "The benefits of using Google Docs for assessment outweigh the negatives", students could either Disagree (1), Agree (5) or select a value in between (2, 3, or 4). The response distribution relating to this item is given in the following table.

Table 4.22 Benefits Outweigh Negatives Response Distribution

	Score					Class Mean
	1	2	3	4	5	
Frequency	4	6	10	9	11	3.43

n = 40

Interestingly, the statistics reveal that 50% of the class felt the benefits outweighed the negatives (4's and 5's), 25% felt they were even (3's), and 25% felt the negatives outweighed the positives (2's and 1's).

As mentioned, scale correlation was calculated between each scale from both the first and second CAQ data sets (correlation with attendance and grade was also included). In the interest of completeness, the overall correlation results are shown in Table 4.24 which also includes insignificant correlations results that have not previously been mentioned, many of these results will be revisited later in this section and will be discussed further in the following chapter.

Acronym titles have been used to represent each of the scales and quantitative variables used in the correlation matrix (described in Table 4.23). N values are also given for each of the scales and variables.

Table 4.23 Correlation Matrix Acronym Descriptions

Acronym	Scale/Variable	n
AT	Attendance	50
PG	PMP Assignment Grade	50
IG	I202 IT Project Management Overall Paper Grade	50
GPA	Historical Grade Point Average	50
WC	PMP Assignment Word Count	50
A1	Attitude Toward Subject Scale (CAQ1)	48
A2	Attitude Toward Subject Scale (CAQ2)	40
C1	Computing Confidence Scale(CAQ1)	48
C2	Computing Confidence Scale (CAQ2)	40
M1	Monitoring Scale (CAQ1)	48
G1	Google Docs Scale (CAQ1)	48
F1	Feedback Scale (CAQ1)	48
O1	Cloud (Online) Storage Scale (CAQ1)	48
P1	Preference Scale (CAQ1)	48
M2	Monitoring Scale (CAQ2)	40
G2	Google Docs Scale (CAQ2)	40
F2	Feedback Scale (CAQ2)	40
O2	Cloud (Online) Storage Scale (CAQ2)	40
P2	Preference Scale (CAQ2)	40
BO	Benefits Outweigh Negatives Item (CAQ2)	40

Table 4.24 CAQ1 and CAQ2 Correlation Matrix

	AT	PG	IG	GPA	WC	A1	A2	C1	C2	M1	G1	F1	O1	P1	M2	G2	F2	O2	P2	BO
AT	-	.32*	.43**	.30*	.18	-.19	.23	-.14	-.24	-1.47	-.06	-.10	-.22	-.08	.37*	-.14	.36*	.05	.15	-.05
PG		-	.85**	.60**	.81**	.10	.34*	.14	.05	-.05	-.11	-.05	-.18	-.16	.16	-.17	.33*	.19	.02	.13
IG			-	.66**	.69**	.15	.39*	.07	-.03	-.07	-.18	-.07	-.20	-.26	.26	-.14	.43**	.18	.02	.08
GPA				-	.38**	-.06	-.08	.19	.22	-.16	-.27	-.04	-.36*	-.40**	.11	-.15	.10	-.10	-.14	-.14
WC					-	.13	.26	.09	-.01	-.11	-.10	-.07	-.11	-.14	.03	-.25	.11	.17	-.04	-.06
A1						-	.70**	.12	-.03	.29*	.15	.23	.22	.20	.07	.32*	.22	.30	-.12	.22
A2							-	.05	-.02	.16	.19	.19	.16	.18	.34*	.27	.46**	.51**	.16	.33
C1								-	.80**	.03	.04	.35*	.19	.18	.25	.18	.25	.30	.07	.14
C2									-	-.02	-.13	.39*	.13	-.07	.17	.07	.21	.33*	-.06	.03
M1										-	.30*	.42*	.44**	.57**	.22	.14	.11	.08	.17	.37*
G1											-	.29*	.42**	.68**	.13	.28	-.03	.24	.36*	.28
F1												-	.39**	.41**	.58**	.36*	.47**	.53**	.28	.43**
O1													-	.64**	.11	.24	.06	.55**	.27	.44**
P1														-	.28	.38*	.10	.32*	.55**	.56**
M2															-	.51**	.73**	.52**	.69**	.53**
G2																-	.45**	.43**	.66**	.71**
F2																	-	.59**	.45**	.51**
O2																		-	.39*	.56**
P2																			-	.69**
BO																				-

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

4.3.2 Qualitative Cloud Assessment CAQ Results

The CAQ also included open ended questions which students could write answers for which corresponded to each of the quantitative scales. The first section of the CAQ focused primarily on the student perceptions of various aspects of the cloud assessment learning environment. Six written short answer questions were included in this section, the first five related to each of the five cloud assessment scales (i.e. Monitoring, Google Docs, Feedback, Online Storage, and Preference). The sixth and final item was an overarching question allowing students to express any additional comments relating to the cloud assessment learning environment. The actual questions asked were as follows:

1. What do you think about your lecturer being able to see your assignment document for the duration of the assessment?
2. What do you think about using Google Docs (an online/web based document editor) for this assignment?
3. What do you think about your lecturer being able to give you assignment feedback before the due date?
4. What do you think about having your assignment stored online and automatically submitted on the due date?
5. What do you think about using an online word processor (Google Docs) for this assessment instead of a traditional desktop word processor (Microsoft Word)?
6. Any other comments about using Google Docs for this assessment?

The results from each of the short answer questions are presented in the following sections, beginning with the initial set of responses collected from the first CAQ. The initial responses are then compared to the second set of responses collected from the second CAQ. For the purposes of analysis, the written responses were organised into six possible categories: positive, mixed, neutral, concerned, negative, and no response. These categories were found to emerge naturally from the data. The *positive* category relates to positive themed responses. The *mixed* category relates to responses with positive, concerned and/or negative comments. The *neutral* category relates to comments that are neither positive nor negative and are usually supported by middle of the road responses to the related quantitative scale questions. The *concerned* category relates to comments that express concern about an aspect of the cloud assessment learning environment. The *negative* category relates to negative themed comments. In instances where a response could be interpreted as either concerned or negative, the related quantitative scale responses were used to inform the

categorisation. Finally, the *no response* category was used for students who did not elect to provide a written response to the qualitative question. Table 4.25 provides an overview of the described categories.

Table 4.25 Qualitative Response Categories

Category	Description
Positive	Positive themed responses
Mixed	Responses with a mixture of themes from positive to negative
Neutral	Responses that are neither positive or negative
Concerned	Responses that express concern
Negative	Negative themed responses
No Response	Response sections left blank

Monitoring

In response to the first qualitative question (relating to the Monitoring scale) 46 out of 48 students elected to provide a written response during the first administration of the CAQ. The two students who did not provide a written response also did not provide written responses for any of the other qualitative questions in the CAQ instrument. The remaining 46 responses fell into five main categories: positive, mixed, neutral, concerned, and negative. Table 4.26 shows the distribution of the qualitative responses to the first question.

Table 4.26 Monitoring Response Distribution (CAQ1)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
Count	29	4	2	9	2	2
Percentage	60.4%	8.3%	4.2%	18.8%	4.2%	4.2%

n = 48

As can be seen, the large group of responses 29 (60.4%) fell into the first category which can be described as students who provided positive comments relating to the question and expressed an interest or curiosity towards the learning environment. A selection of these comments follows:

"It's a good idea"

"This is a good idea as it will help students stay on track throughout the assignment"

"I think it will be helpful to make sure I'm on the right track"

"It's good, allows feedback on current progress"

"It's a neat idea, may encourage me to get it done early"

"Good idea, motivation to not leave it to the last minute"

"Great idea, very helpful towards my learning"

"Very good, they know the work is yours and can put you back on track if you get a bit off track"

Overall, the positive comments varied from short positive statements (e.g. 'good idea', 'great idea') through to longer comments that focused on particular aspects of the learning environment (e.g. feedback, motivation, helpfulness, etc.). As would be expected, the positive responses were also reflected in positive quantitative responses to the Monitoring scale questions. The four mixed responses included both positive and negative perceptions of the cloud assessment learning environment, for example some typical comments were:

"It will be good for incremental feedback, but feel uncomfortable as feel as if under constant scrutiny"

"I think it's good in the way of getting comments before due date but feel like I can't just part write things and just draft stuff because lecturer might think I don't know what I'm doing"

The two neutral responses simply expressed short neutral opinions, for example:

"Quite impartial (don't really care) =D"

The nine concerned responses fitted into two main subgroups, the first expressed concern about how the lecturer would use the monitoring ability, for example:

"It depends on the lecturer in question, and the nature of the feedback"

"Only concern is are all lecturers consistent in dealing with students. This method leaves room for influencing results"

The second subgroup expressed concern about how the cloud assessment learning environment could result in students altering their approach to assignment writing, for example:

"Makes me feel compelled to start earlier that I would normally"

"Makes me think that I will have to adjust my time management on my assignment"

The final two responses that fell into the negative category included a short negative statement without any obvious reason, and a longer response relating to progress. Both of the qualitatively negative responses also corresponded to quantitatively negative responses to the Monitoring scale questions. The two negative responses from participants were:

"Not good"

"Not happy being able to see my progress or lack thereof"

A breakdown of the responses to the same question when collected four weeks later as part of the second CAQ are presented in the following table, also included are the original results from the first CAQ for comparative purposes. It should be noted that 40 students completed the second CAQ as opposed to 48 who completed the first CAQ.

Table 4.27 Raw Monitoring Response Distribution (CAQ1 and CAQ2)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	29	4	2	9	2	2
CAQ1 Percentage	60.4%	8.3%	4.2%	18.8%	4.2%	4.2%
CAQ2 Count	28	2	1	3	1	5
CAQ2 Percentage	70.0%	5.0%	2.5%	7.5%	2.5%	12.5%

n = 48 for CAQ1, n = 40 for CAQ2

The following table shows the same statistics however it only takes into consideration those students who complete both CAQ questionnaires. Of the eight students who completed the first CAQ and not the second, six were positive, one was neutral and one had no response. It is very interesting to note the strong increase in positive responses (an increase of 12.5%) and the reduction of responses that fell into the concerned category (a reduction of 15%). Both of these statistics suggest that student perceptions regarding the monitoring aspect of the cloud assessment learning environment became more positive post engagement.

Table 4.28 Monitoring Response Distribution (Paired Samples)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	29	4	2	9	2	2
CAQ1 Percentage	60.4%	8.3%	4.2%	18.8%	4.2%	4.2%
CAQ2 Count	28	2	1	3	1	5
CAQ2 Percentage	70.0%	5.0%	2.5%	7.5%	2.5%	12.5%

n = 40

The majority of the responses to the second administration of the CAQ corresponded to those that emerged from the first collection. One main positive themes related to motivation, responses included:

"Helped me be more motivated"

"Motivates me to complete the assignment"

"Motivates you to get started faster and finish earlier"

Another prominent positive theme related to feedback, responses included:

"It was good, he was able to see my assignment progress so he could give me advice on my work"

"I like the idea that my lecturer was able to see my progress and to offer advice"

"It was good to get continuous feedback throughout"

One response also provided a clear example of a change in a student's perception of the cloud assessment learning environment, it was:

"Wasn't keen to start with, but now I think it's a good thing"

The results of the first short answer question relating to the lecturer's ability to monitor student progress throughout the assessment process suggested a number of common perceptions. The majority of students were positive about having their assignment progress monitored, some students initially had concerns about this aspect of the cloud assessment learning environment but the majority of these concerns were alleviated after having gone through the assessment process. This ultimately resulted in an increase in positive student perceptions relating to the monitoring aspect of the cloud assessment learning environment. The improvement in positive perceptions also coincides with a quantitative increase in the corresponding Monitoring scale, as well as

similar results from other data sources within this study (to be presented later in this chapter). Accordingly, the consistency of results between the quantitative and qualitative items adds support to the validity and the reliability of the instrument with regarding the monitoring aspect of the cloud assessment learning environment. The implications of these results will also be discussed in greater detail in the following chapter.

Google Docs

In response to the second short answer question (relating to the Google Docs scale) 46 out of 48 students elected to provide a written response during the first administration of the CAQ. To reiterate, the question was *"What do you think about using Google Docs (an online/web based document editor) for this assignment?"* The responses again fell into five categories: positive, mixed, neutral, concerned, and negative. The following table shows the distribution of responses.

Table 4.29 Google Docs Response Distribution (CAQ1)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
Count	22	8	6	5	5	2
Percentage	45.8%	16.7%	12.5%	10.4%	10.4%	4.2%

n = 48 for CAQ1

The most prominent group of responses 22 (45.8%) belonged to the first category which can be described as students who provided positive comments regarding the use of Google Docs for assignment writing. Typical positive responses included:

"I haven't used Google Docs before but it sounds cool"

"Nice to be able to edit from any computer"

"Sounds good"

"Easy to use"

"I hope to enjoy it, and I like to be able to use it from anywhere"

"Will be better than Openoffice"

"It is good because do not need to download software"

"Expecting it to be good, but have never used it before"

"I've heard good things but I'm yet to use it"

A common theme to emerge from the initial positive responses to this question was a positive expectation despite having not used Google Docs before. Other positive comments related to features of the tool with students citing convenience, reliability, and ease of use as positive aspects of Google Docs.

The eight mixed responses to the second question involved both positive and negative statements relating to the use of Google Docs for assignment writing. The mixed responses were also reflected by mixed and/or middle of the road responses to the quantitative scale items. A selection of the mixed responses follows:

"The idea is great, however there can be some accessibility problems"

"Google Docs is good as it allows sharing and is easy to use; however, it is only available online and I prefer to have my own copies of docs"

"I like the idea a lot, I just think it's not as easy to format and that it should have all the features of MS Word"

"Has good potential, however there is always the matter of the document being lost or tampered with within a cloud environment"

The six neutral responses simply included short statements indicating a lack of opinion due to inexperience with the tool. Again, these neutral responses were reflected by middle of the road responses to the related quantitative questions. Responses in this category included:

"To judge without experience leaves a higher chance to err"

"I don't know anything about Google Docs yet"

"I haven't used it before so am willing to give it a go before judging it"

The five concerned responses were comprised of statements relating to perceived potential shortcomings of Google Docs. The concerned responses were also reflected by mixed and/or middle of the road responses to the quantitative questions.

"Could make progress more slower than other students because of internet speeds"

"I have not used it before so am unsure about ease of use and formatting"

"Unsure as I have never used it, will probably try keep a local copy as well – in case something went wrong"

The five negative responses focused on the perceived superiority of other systems, mainly Microsoft Word. Accordingly, the negative responses also corresponded to negative quantitative responses. A selection of the qualitative responses follows:

"Not happy, prefer to use MS Word as it is the industry standard app"

"Preference is for using Microsoft Word offline"

Overall, the responses to the second short answer question relating to student views on having to use Google Docs for assignment writing revealed a number of common themes. Although a number of students had not used Google Docs before the majority of students seemed to have a positive expectation regarding its use for assignment writing with a number citing unique features of the tool as positives. However, this positive expectation was also coupled with a number of concerns relating to perceived shortcomings of the tool and individual preference for the more familiar Microsoft Word.

A breakdown of responses to the same question four weeks later after students had engaged with cloud assessment learning environment (and consequently Google Docs) is given in the following table. Also included are the results from the first collection for comparative purposes.

Table 4.30 Raw Google Docs Response Distribution (CAQ1 and CAQ2)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	22	8	6	5	5	2
CAQ1 Percentage	45.8%	16.7%	12.5%	10.4%	10.4%	4.2%
CAQ2 Count	9	6	1	10	10	4
CAQ2 Percentage	22.5%	15.0%	2.5%	25.0%	25.0%	10.0%

n = 48 for CAQ1, n = 40 for CAQ2

Again, the same statistics are given below with only those students who completed both CAQ's included. The students removed from the first data set included five positive, one mixed, one negative, and one student who did not give a response.

Table 4.31 Google Docs Response Distribution (Paired Samples)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	17	7	6	5	4	1
CAQ1 Percentage	42.5%	17.5%	15%	12.5%	10.0%	2.5%
CAQ2 Count	9	6	1	10	10	4
CAQ2 Percentage	22.5%	15.0%	2.5%	25.0%	25.0%	10.0%

n = 40

It is interesting to note the significant reduction in positive responses as well as the increase in both concerned and negative responses. These changes also correspond to the drop post engagement in the Google Docs quantitative scale results. A selection of the mixed responses follows:

> *"I think it was okay, not opposed to the notion at all so long as the user is aware of the limitations"*
>
> *"It's decent and does the job. However, it does lack some features that most modern word processors possess. Always requiring an internet connection can be a disadvantage."*

The negative responses ranged from short unimpressed comments through to passionately negative statements. The negative responses also corresponded to negative responses to the quantitative scale items. A number of the negative responses follow:

> *"Very restricting"*
>
> *"Google Docs was an unreliable piece of s#@&"*
>
> *"Formatting options non-existent, copy/paste function too buggy for regular use, crashes often/unstable"*
>
> *"I don't like Google Docs. There is a lack of formatting and there were numerous errors that occurred"*

Despite the increased negativity expressed towards Google Docs during the second administration of the CAQ a considerable number of positive responses remained, these included statements like:

> *"Excellent"*

"It is good; I can work on my assignment everywhere with the internet"

"Excellent for document formatting and inserting diagrams was a breeze"

In reviewing the responses to the second question relating to the use of Google Docs for assignment writing a number of common themes appeared to emerge. Students began with a relatively optimistic view of using Google Docs for the assignment despite many having not used it before (as evidenced by the results to the *"Had you used Google Docs before this assignment?"* item covered in the previous section). The notion of being able to use a free, online, Google product was appealing for many. However, a number of students had reservations regarding perceived limitations of the web based word processing tool. After engaging with the tool (Google Docs) for the assessment, overall student perceptions underwent a noticeable shift. Many students drew attention to the problems and issues they had with the tool during the assessment process and indicated that the tool did not live up to their expectations. Interestingly, the change in qualitative results is also reflected in a reduction of positivity in the corresponding quantitative scale which again adds support for the validity and reliability due to the consistency of results. It is also worth noting that despite the limitations of the tool, a number of students still expressed a positive attitude towards Google Docs. Again, these results are also reflected in a number of the other data sources from this study which will be presented later in this chapter.

Feedback

In response to the third short answer question (relating to the Feedback scale) 46 out of 48 students provided written responses during the first administration of the CAQ. To reiterate, the question was *"What do you think about your lecturer being able to give feedback before the assignment due date?"* The responses were categorised into two groups, positive and mixed (it also worth noting the negative responses in this section). The following table shows the distribution of responses.

Table 4.32 Feedback Response Distribution (CAQ1)

	Category		
	Positive	Mixed	No Response
Count	38	8	2
Percentage	79.2%	16.7%	4.2%

n = 48

The overwhelming majority of responses to the question were positive. The positive responses also corresponded to positive quantitative responses to the feedback scale

items. Students saw the feedback mechanism as a safety net that would help them to stay on task and also as a means for improving their eventual grade for the paper. The responses ranged from short positive statements through to longer reasoned comments. Some typical examples of the positives comments were:

> *"It will be good to maintain a stream of communication. Similar to old style teaching but implementing with modern technology"*
>
> *"Providing feedback in this manner is productive as it does not take up class time to answer questions and everyone has a fair opportunity"*
>
> *"It will be good to assess how I'm doing"*
>
> *"I think it's good because I might be able to get a better mark"*
>
> *"It will encourage students to work consistently"*
>
> *"Good idea if I get stuck on something"*
>
> *"Awesome idea. Helps students to stay on the right track"*
>
> *"Good, as I can correct errors or write more information so my grade improves at the end, and I learn more about the topic"*

The mixed responses also included positives comments about feedback but also included some concerns relating to the potential misuse or incompatibility of the mechanism. A sample of these responses follows:

> *"Could be beneficial to others however it may not be compatible with my style of assignment writing"*
>
> *"Feedback is great, if it's requested. An email gets this done"*
>
> *"Sounds great but might make everything far too easy"*
>
> *"I generally think it's good although there could be a line where too much feedback and direction is given and the work is compromised"*

Although there were far more positive responses to the feedback related question, it is worth noting the key themes that emerge from the mixed responses. Some students appear to like the idea of early feedback, but prefer to be in control of when it is given. Secondly, some students express concern that too much feedback could essentially

defeat the purpose of the assessment. Both of these perceptions will be discussed in greater detail in the next chapter.

After the second administration of the CAQ, 33 out of 40 students elected to provide a response to the third qualitative question relating to feedback. The responses fell into three categories: positive, mixed, and neutral. The following table shows the distribution of responses, the results from the first CAQ are also included for comparative purposes.

Table 4.33 Raw Feedback Response Distribution (CAQ1 and CAQ2)

	Category			
	Positive	Mixed	Neutral	No Response
CAQ1 Count	38	8	0	2
CAQ1 Percentage	79.2%	16.7%	0.0%	4.2%
CAQ2 Count	30	2	1	7
CAQ2 Percentage	75.0%	5.0%	2.5%	17.5%

n = 48 for CAQ1, n = 40 for CAQ2

Again, the following table shows the same breakdown of responses, however only those students who completed both CAQ's are included.

Table 4.34 Feedback Response Distribution (Paired Samples)

	Category			
	Positive	Mixed	Neutral	No Response
CAQ1 Count	30	8	0	2
CAQ1 Percentage	75.0%	20.0%	0.0%	5.0%
CAQ2 Count	30	2	1	7
CAQ2 Percentage	75.0%	5.0%	2.5%	17.5%

n = 40

Regarding the responses to the feedback related question, it is worth highlighting that not a single negative response was given either before or after engaging with the cloud assessment learning environment. The post assessment responses remained consistent with the pre assessment responses with the majority of comments being positive in nature. Interestingly, there was an increase in the number of students who elected not to provide a written response to the question during the second administration of the CAQ, however the quantitative scale question reveal these students as having predominantly positive views. A sample of the responses from the post assessment CAQ follows:

"Very helpful and motivating"

"Great, I can do my work better"

"A good idea, some students are too shy to approach in person"

"Was definitely helpful and would be great to have in future assignments"

"Very helpful. Convenient also know that I could leave questions knowing they would be answered"

Unique themes to emerge from the second set of responses included: increased motivation, desire for future use, and convenience of communication. As has been seen with the previous two sections CAQ results relating to feedback have revealed consistent themes (quantitatively and qualitatively) which have also emerged from other data sources within in this study.

Cloud Storage

The fourth question focused on the online cloud storage aspect of the cloud assessment learning environment. To reiterate the question was *"what do you think about having your assignment stored online and automatically submitted on the due date?"* 46 out of 48 students elected to provide a written response to the question for the first administration of the CAQ. The responses fell into five categories: positive, mixed, neutral, concerned and negative. The following table shows the distribution of responses.

Table 4.35 Cloud Storage Response Distribution (CAQ1)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
Count	29	9	2	3	3	2
Percentage	60.4%	18.8%	4.2%	6.3%	6.3%	4.2%

n = 48

The majority of responses to the cloud storage related question fell into the positive category. As expected, the positive responses also corresponded to positive responses to the associated quantitative scale. The positive responses tended to focus on a perceived reduction in workload as well as perceived improvement regarding assignment file safety. A selection of the positive responses follows:

"Good and easy"

"It means I have one less thing to worry about"

"Sounds like less work. Alright"

"Yay, it would save the hassle of late submitted finished work you may forget to submit of time"

"Good I can't hand it in late"

"A lot less worry about losing your file or pen drive"

"Prevents last minute mishaps submitting"

"It's good for me because I won't miss the due date!"

"Great, save a lot of hassle (I hate with some assignments I've done, I've submitted them to three different areas)"

The mixed responses highlighted both positive and negative perceptions of the online storage aspect of the cloud assessment learning environment. The qualitative mixed responses included:

"That's cool. But who else sees it, who 'owns' it. Does Google keep it in cache? Can it come back to haunt me?"

"Stored online is good, submitted on due date is a good theory, but could be bad if need an extra day to finish and take the late penalty"

"Great, although if you forget your password..."

"I would rather submit it myself, but if I forget it would be handy for it to do it automatically"

The two neutral responses were:

"I don't know yet, I can tell after using Google Docs"

"Not bothered"

The concerned responses included:

"If something goes wrong an incorrect doc could be submitted and/or other reasons could prevent me from doing the assignment"

"It damn well better automatically save!"

The negative responses included:

> *"I prefer self-management of these issues"*
>
> *"'Can't lose it' is marketing. There's just as much risk (if not more) in online storage as there is with local storage"*

In summarising the initial responses to the cloud storage question students were mostly positive and perceived a benefit from having their assignments stored online. However, a few students did express concern regarding a number of aspects related to cloud storage including: ownership, reliability, and freedom. These concerns also emerged during the initial class interview which will be presented later in this chapter.

The response distribution to the cloud storage question from the second administration of the CAQ is provided below. The distribution of the responses from the first CAQ has also been provided for comparative purposes.

Table 4.36 Cloud Storage Response Distribution (CAQ1 and CAQ2)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	29	9	2	3	3	2
CAQ1 Percentage	60.4%	18.8%	4.2%	6.3%	6.3%	4.2%
CAQ2 Count	17	11	0	4	1	7
CAQ2 Percentage	42.5%	27.5%	0.0%	10.0%	2.5%	17.5%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are also shown in the following table, however only those students who completed both CAQ's have been included.

Table 4.37 Cloud Storage Response Distribution (Paired Samples)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	24	8	1	3	3	1
CAQ1 Percentage	60.0%	20.0%	2.5%	6.3%	6.3%	4.2%
CAQ2 Count	17	11	0	4	1	7
CAQ2 Percentage	42.5%	27.5%	0.0%	10.0%	2.5%	17.5%

n = 40

The most significant change between the pre and post assessment responses to the fourth short answer question relating to cloud storage can be seen in the reduction of

positive responses and the slight increase in mixed responses. The number of students who elected not to provide a written response also increased. The positive responses given in the post assessment administration of the CAQ tended to correspond closely to those given during the pre-assessment CAQ, for example:

"Made me more inclined to finish on time"

"A good way of keeping on task/subject"

"I am strongly for the concept"

"Simply fantastic"

"There was no panic towards having to upload the document at the last minute"

"I couldn't lose it or get a late submission which is good"

"Stops you from worrying about losing it/not handing it on time"

The mixed responses involved both positive and negative comments relating to cloud storage and included statements like:

"50/50 not sure if I trust it yet as I lost some work due to Google not saving"

"It's good but some concern still exists"

"Excellent. But there was error messages at times and you had to reload - risk of losing work?"

"I think it was very good though automatic submission robs you of overtime"

"I didn't lose any work, but I did hear from others who did. I don't trust Google Docs and backed up my work to a local drive"

"'Saved seconds ago' is not something I can trust. I want to have control over saving, or for it to be precise. Automatic saving was good, however I never felt it was submitted and done"

The concerned responses were similar in nature to many of the points raised amongst the mixed responses, for example:

"Auto submission was freaky"

"Stored online was a bit average, network problems caused not saving/lose of info"

The negative response was:

"I'd rather self-manage using Word as I DID lose my assignment"

The responses to the fourth question relating to online storage and automatic submission of assignment work reveal a number of key perceptions shared throughout the student group. Generally, students appear to see online storage as positive, however a number of students seem to express initial mistrust with regards to the technology. This mistrust was later compounded by reported reliability problems with Google Docs. The students also appear to be divided concerning automatic submission, many saw the aspect as a motivating positive, while others felt the feature restricted their ability to complete last minute work and submit the assignment late. Interestingly, a number of students preferred being able to submit their work manually as opposed to waiting for automatic submission. Again, many of these themes also emerged from the other data sources including the concept maps and interviews.

Preference

The fifth question focused on student preference of word processing systems. To reiterate the question was *"What do you think about using an online word processor (Google Docs) for this assessment instead of a traditional word processor (Microsoft Word)?"* 46 out of 48 students elected to provide a written response to the question for the first administration of the CAQ. The responses fell into five categories: positive, mixed, neutral, concerned and negative. The positive category represented responses that indicated a preference for the cloud assessment learning environment, whereas negative responses indicated a preference for a traditional assessment environment. The following table shows the distribution of responses.

Table 4.38 Preference Response Distribution (CAQ1)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
Count	13	9	9	7	4	6
Percentage	27.1%	18.8%	18.8%	14.6%	8.3%	12.5%

n = 48

Interestingly, the responses to the preference question were spread relatively evenly across the various categories with the positive responses having only a slightly higher total. The positive responses include statements like:

> *"I think it is better, more fun to use and would make me work on it hard. Gives me motivation as lecturer is seeing it"*
>
> *"Without using Google Docs before, my assumption is it will be better than word simply because of its online capabilities"*
>
> *"It would be more convenient to use rather than Microsoft Word processor"*
>
> *"It's a better way, nice I can access the document from anywhere"*
>
> *"I like that it's available on any machine regardless of OS"*

The mixed responses included:

> *"I think it will make it easier to access my work when I'm at home but I think it has disadvantages as a word processor"*
>
> *"Google Docs is good to be online all the time. Microsoft Word is good that you have more flexibility"*
>
> *"Slower but good being stored on the internet"*

The neutral responses mainly consisted of 'wait and see' statements, for example:

> *"I've never used Google Docs before"*
>
> *"I don't know at this stage until I've tried using it"*
>
> *"I can't tell yet"*
>
> *"Chrome has crashed, MS Word has crashed - really not much difference"*

The concerned responses included statements such as:

> *"Requires an internet connection so not good for people without"*
>
> *"I know Google Docs isn't the same calibre as MS Word. I am sceptical about what features I can apply on Google Docs"*
>
> *"Might be a little slow, I noticed this before when I was using it"*
>
> *"It might lack features that I find useful"*

The negative responses included:

> *"Not happy. Now I have to learn another word processor. I should be concentrating on learning the subject material"*
>
> *"Word is a lot better as it has page breaks and formatting"*
>
> *"I would rather use MS Word as I am familiar with this"*
>
> *"Traditional desktop word processors have more features"*

Overall student preference varied regarding the use of an online word processor as opposed to a traditional desktop word processor. Although many indicated a preference for Google Docs, a large number also noted a perceived lack of features. Also, a notable number of students also indicated a preference for a traditional word processor often citing familiarity and better features as the reasons.

The distribution of responses to the same question collected during the second administration of the CAQ are presented in the following table, the distribution from the first CAQ are also included for comparative reasons.

Table 4.39 Preference Response Distribution (CAQ1 and CAQ2)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	13	9	9	7	4	6
CAQ1 Percentage	27.1%	18.8%	18.8%	14.6%	8.3%	12.5%
CAQ2 Count	7	13	2	5	8	5
CAQ2 Percentage	17.5%	32.5%	5.0%	12.5%	20.0%	12.5%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are presented in the following table, however only those students who completed both CAQ's have been included.

Table 4.40 Preference Response Distribution (Paired Samples)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	11	7	7	6	4	6
CAQ1 Percentage	27.5%	17.5%	17.5%	15.0%	10.0%	12.5%
CAQ2 Count	7	13	2	5	8	5
CAQ2 Percentage	17.5%	32.5%	5.0%	12.5%	20.0%	12.5%

n = 40

The most notable differences between the pre and post assessment responses regarding word processor preference can be seen in the reduction of positive and neutral responses and the increase in the mixed and negative responses. The positive responses remained consistent with those expressed during the pre-assessment CAQ, they included:

> *"It worked as well as Word would have, and it had other advantages"*
>
> *"I could access it anywhere"*
>
> *"MS Word is picky and has a tendency to mess up formatting etc."*
>
> *"There are no real excuses to not being able to access your assignment, everything is online"*

The mixed responses included statements such as:

> *"It was better in some cases and worse in others"*
>
> *"Both good and bad. Good as you don't need to upload to hand it in. Bad for presentation/formatting"*
>
> *"Each has its advantages and disadvantages. Perhaps a synchronous system with client and server could work better?*
>
> *"The idea of Google Docs is good, but the implementation really sucked"*
>
> *"Google Docs is awful, the reasons for using it are good, but Google Docs is unreliable and useless"*
>
> *"Word is a lot more developed and therefore has a lot more diversity, however Google Docs has a lot of potential"*

The two neutral responses were:

> *"Good, easy either way, I mean I don't mind which. No preference"*
>
> *"I can't say anything yet"*

The concerned responses included:

> *"My finished product doesn't look as good as it would have using Word"*
>
> *"Wasn't able to format doc as would have liked"*

"Not too great for formatting"

The negative responses were coupled with negative quantitative scale responses and included comments like:

"Don't like it"

"I would like to use MS Word"

"I would prefer to use Microsoft Word due to the problems experienced with Google Docs"

"I would rather use Word as I know how to use it better"

"Due to limited formatting and having to be online to use, would choose desktop word processor over Google Docs any day"

Regarding preference, the short answer responses reveal that students have mixed views which largely varied depending on their individual experiences. Some students appear to have had a positive experience with Google Docs and value the online tool over traditional desktop solutions. Students also noted that the concept behind Google Docs for assessment was essentially 'good', however they felt let down by the actual implementation. Other students reported a mixture of positive and negative experiences with many focusing primarily on aspects they found frustrating, in particular, the lack of familiar formatting features emerged as common concern. Finally, a number of students clearly indicated their preference for Microsoft Word.

General Comments

A final area for short answer comments was included at the end of the cloud assessment section of each of the CAQ's. The general comments section was preceded by the statement "Any other comments about using Google Docs for this assessment". 16 out of 48 students elected to provide additional comments during the first administration of the CAQ. The responses were distributed as follows.

Table 4.41 General Comments Response Distribution (CAQ1)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
Count	7	2	1	5	1	32
Percentage	14.6%	4.2%	2.1%	10.4%	2.1%	66.7%

n = 48

The positive responses included:

> *"Friggin awesome idea"*
>
> *"Impressive, very impressive"*
>
> *"It's exciting to see cloud apps being used in education. Lecturers should embrace new technologies, especially when that is what they are teaching us"*
>
> *"I really like the concept and I think everyone should adopt it"*
>
> *"Excellent idea, should be used for more assignments! Reports in Word are boring!"*

The mixed responses included:

> *"As someone who usually leaves their work to the last minute, having this cloud based assessment may have me re-evaluate my time management in this assessment, although have a document accessible on line would be great, having a local copy in necessary too I believe"*

The neutral response was:

> *"I haven't used it before but have heard plenty about it"*

The concerned responses included:

> *"We should have the option to use it or not"*
>
> *"Concerned about: ownership, privacy, functionality, and learning curve"*
>
> *"How does it work in non-broadband (dial up) environments? Not every student has broadband at home; and some parts of the country cannot get this. Will this slow them down?"*

The negative response was:

> *"Can be horrible to use, slower loading, crappy font, no page breaking, tabs"*

In response to the same section of the CAQ during the second administration, 14 out of 40 students elected to provide additional general comments. The responses were distributed as follows (the distribution from the first CAQ is also shown).

Table 4.42 General Comments Response Distribution (CAQ1 and CAQ2)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	7	2	1	5	1	32
CAQ1 Percentage	14.6%	4.2%	2.1%	10.4%	2.1%	66.7%
CAQ2 Count	3	3	0	5	3	26
CAQ2 Percentage	7.5%	7.5%	0.0%	12.5%	7.5%	65.0%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are also provided in the following table, however only those students who completed both CAQ's are shown.

Table 4.43 General Comments Response Distribution (Paired Samples)

	Category					
	Positive	Mixed	Neutral	Concerned	Negative	No Response
CAQ1 Count	4	2	1	5	1	32
CAQ1 Percentage	10.0%	5.0%	2.5%	12.5%	2.5%	67.5%
CAQ2 Count	3	3	0	5	3	26
CAQ2 Percentage	7.5%	7.5%	0.0%	12.5%	7.5%	65.0%

n = 40

Interestingly, the positive responses included the following statement:

> *"Have changed my thoughts on it, and actually this it is quite good"*

A similar comment also appeared within the mixed responses:

> *"Overall positive experience. Have changed my view since we started. But not 100% sold yet until it proves itself to be reliable."*

The concerned responses included:

> *"Sometimes the internet connection is slow and Google Docs is slow"*
>
> *"Small screen display because in browser, no button to see formatting"*
>
> *"When Google Docs goes down for maintenance it means I could not work on assignment when I wanted. When I'm in the middle of working on assignment and SlingShot ISP fails for 4 hours at night it gets a little frustrating"*

The negative responses included:

"FAULTY"

"Don't like it. Didn't always save. Don't like it anyway"

"Terrible tools for formatting, inconsistent browser view between IE and chrome"

Compared to the other short answer questions, the general comments section received a noticeably lower response rate. This is likely due to students having already expressed their opinions throughout the previous questions. The responses to general comments section that were tended to reiterate the perceptions made throughout the previous qualitative questions. Interestingly, two students clearly mentioned that their views had changed as a result of engaging with the cloud assessment learning environment. Interestingly, the lack of additional themes to emerge from the general comments section can be seen as validation of the five cloud assessment sections included within the instrument. For example, if numerous students made the similar types of comments in the general section on an additional variable that was not covered by any of the previous sections this could indicate that the instrument was not providing a comprehensive measurement of the environment.

Previous Usage and Value

As mentioned in the quantitative section, an additional section was included in the second CAQ that focused on collecting information relating to students prior use of Google Docs as well as whether or not they felt the benefits of cloud assessment learning environment outweighed the negatives. The section included three items of which the first and third items were quantitative and have been covered in the previous section. The first item asked if students had used Google Docs previously to which 16 out of 40 students responded yes. The second item then asked "if so, what did you use it for?" The responses included:

"Group assignment"

"Group project assignment"

"List"

"Sharing Docs and files"

"Nothing, just playing with it"

"Opening simple spreadsheet made by other people"

Interestingly, a number of students had used Google Docs for previous group based assessments (this will be discussed further in the following chapters).

4.3.3 Qualitative Attitude Toward Subject CAQ Results

The CAQ also included a section focused on determining student attitudes toward the subject in which the cloud assessment learning environment was being implemented. The section included as single short answer question which asked *"What do you think about this paper as subject?"* 35 out of 48 students elected to provide a written response to this question during the first CAQ. These responses were coded into categories which naturally emerged from the data, they were: Enjoyable, Necessary, Unsure, Disliked, and No Response. The distribution of responses follows.

Table 4.44 Attitude Response Distribution (CAQ1)

	Category				
	Enjoyable	Necessary	Unsure	Disliked	No Response
Count	16	17	1	1	13
Percentage	33.3%	35.4%	2.1%	2.1%	27.1%

n = 48

The responses to the attitude toward subject question revealed that about one third of the class enjoyed the subject. The responses were also reflected by positive responses to the quantitative scale questions from the same section. The responses categorised as Enjoyable included the following comments:

"Definitely an area I feel comfortable with and enjoy"

"Very interesting, and very relevant"

"It's pretty good"

"I enjoy it"

"Like it, learning new stuff"

A second group of students, again approximately one third, responded in a way which indicated that they felt the subject was necessary for what they were studying, however perhaps not a preferred subject. The responses corresponded to a range of middle of the road to positive responses to the associated Likert scale items. The responses included statements like:

"Necessary, but not what I would choose to learn"

"I understand that is generally necessary, but I don't have to like it"

"Boring but important"

"It will teach me the skills I need for my 3rd year papers"

"I could still make use of this paper in the distant future, however I have little interest at this stage and time"

The unsure response was:

"I will be able to tell at the end of semester, I have just started"

The response that fell into the disliked category was:

"Waste of time"

The distribution of responses to the attitude toward subject question collected during the second administration of the CAQ are presented in the following table, the distribution of responses from the first CAQ are also shown for comparative reasons.

Table 4.45 Attitude Response Distribution (CAQ1 and CAQ2)

	Category				
	Enjoyable	Necessary	Unsure	Disliked	No Response
CAQ1 Count	16	17	1	1	13
CAQ1 Percentage	33.3%	35.4%	2.1%	2.1%	27.1%
CAQ2 Count	14	12	0	4	10
CAQ2 Percentage	35.0%	30.0%	0.0%	10.0%	25.0%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are also given below, however only those students who completed both CAQ's are shown.

Table 4.46 Attitude Response Distribution (Paired Samples)

	Category				
	Enjoyable	Necessary	Unsure	Disliked	No Response
CAQ1 Count	12	16	1	1	10
CAQ1 Percentage	30.0%	40.0%	2.5%	2.5%	25.0%
CAQ2 Count	14	12	0	4	10
CAQ2 Percentage	35.0%	30.0%	0.0%	10.0%	25.0%

n = 40

There were a number of slight changes to student responses regarding their attitude towards the subject. Those students who found the paper enjoyable increased slightly, those who felt the paper was necessary decreased slightly, and those who disliked the paper also increased. The responses from those students who found the paper enjoyable included:

"Fun to learn about how to plan for a project. The task in it is fun"

"Very worthwhile as give an overall plan outline to work with"

"Really good and enjoyable"

"Enjoyable, good skills to learn"

The necessary responses included:

"A necessary evil"

"Good skills to learn and helpful for the third year"

"Necessary, but I'd rather do something else"

"Average, pretty boring but seems handy"

The responses categorised as disliked included:

"Disinteresting"

"I don't see the point of it"

"I find it boring to be honest, I don't really like it"

The students who did not respond to the qualitative question provided middle of the road to positive responses to the quantitative scale questions.

Overall the qualitative responses suggest that many of the students enjoyed the subject, however an equal number saw the subject as a 'necessary evil'. A percentage of the students also appeared to dislike the subject (however they constituted a relatively small minority). Again, these results were consistent with those obtained from other data sources from the study.

4.3.4 Qualitative Computing Confidence CAQ Results

The computing confidence section of the CAQ included three short answer questions relating to students self-perceived level of computing confidence. The first question

asked *"How do you think your computing skills compare to others?"* The responses to this question were organised into four categories: High, Good, Average and Unknown. The *High* category represents students who felt their computing skill level was much higher than others. The *Good* category represents students who felt their computing skill level was above average. The *Average* category represents students who expressed an average computing skill level. The *Unknown* category represents student who were unsure how they compared to others. 38 out of 48 students provided a written response to the question, the distribution of responses was as follows.

Table 4.47 Computing Skills Response Distribution (CAQ1)

	Category				
	High	Good	Average	Unknown	No Response
Count	15	15	5	3	10
Percentage	31.3%	31.3%	10.4%	6.3%	20.8%

n = 48

The majority of respondents indicated that they felt their computing skill level was higher than most other people. These responses also coincided with higher responses to the associated Likert scale items. High computing confidence responses included:

"Very high confidence and technical ability"

"Excellent"

"Much higher than the average person"

"Compared to others in my class I'm above average, but we're all geeks so we know more than most people"

"Highly skilled in most areas of computing"

The good responses included:

"They are reasonable"

"Better than some courses, worse in BICT, but ok"

"Depends on what area, I guess I know more than some in some areas"

"Above average"

The average responses included:

"Pretty average (I have only just recently owned my first computer, so I am a bit behind the 8 ball in general computer skills)"

"Adequate"

"I can work my way around them, but I don't like to have a big head about these things"

The unsure responses included:

"I can't tell until I get a good job in IT field and use my skills to produce something"

"I don't know and don't particularly care"

"I am not sure"

For the second CAQ, 29 out of 40 students responded to the first computing confidence question. The distribution of responses are provided below, the initial response distribution has also been included for comparative reasons.

Table 4.48 Computing Skills Response Distribution (CAQ1 and CAQ2)

	Category				
	High	Good	Average	Unknown	No Response
CAQ1 Count	15	15	5	3	10
CAQ1 Percentage	31.3%	31.3%	10.4%	6.3%	20.8%
CAQ2 Count	9	12	8	0	11
CAQ2 Percentage	22.5%	30.0%	20.0%	0.0%	25.0%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are also given below, however only those students who completed both CAQ's are shown.

Table 4.49 Computing Skills Response Distribution (Paired Samples)

	Category				
	High	Good	Average	Unknown	No Response
CAQ1 Count	13	13	4	3	7
CAQ1 Percentage	32.5%	32.5%	10.0%	7.5%	17.5%
CAQ2 Count	9	12	8	0	11
CAQ2 Percentage	22.5%	30.0%	20.0%	0.0%	25.0%

n = 40

It is interesting to note a slight drop in reported levels of high confidence, however the corresponding increase in students who did not provide a responses could also account

for this change. The types of responses for each of the categories were similar in nature to those uncovered during the first collection. The high confidence responses included:

"Advanced computing knowledge and usage"

"High"

"I'm not the best out there, but I'm confident I can say I'm very knowledgeable without sounding full of myself"

"I'm pretty amazing, very good"

The good confidence level responses included:

""Higher than average"

"Certainly above average, however I know I still have a lot to learn"

"I think I have good computing skills"

The average confidence level responses included:

"Average"

"I still need to improve a lot"

Based on the responses to the first computing confidence question, a large number of the research sample had a self-perceived above average computing skill level. Due to the fact the research sample consists of students studying towards an ICT qualification, this high level of confidence can be reasonably expected.

The second computing confidence question which asked *"How comfortable do you feel working with computers?"* The responses were organised into three categories: High, Good, and Average. The table below shows the distribution of responses.

Table 4.50 Computing Comfort Response Distribution (CAQ1)

	Category			
	High	Good	Average	No Response
Count	22	12	5	9
Percentage	45.8%	25.0%	10.4%	18.8%

n = 48

Responses that fell into the high category included:

"Very comfortable!"

"I always have been comfortable working with computers"

"I feel very comfortable working with computers"

"My keyboard and mouse are extensions of my hands"

"I feel happier using a computer than doing most things"

Responses from the good category included:

"I am comfortable if I know what to do on the computer"

"Depends on the program I'm using, some I'm very comfortable, others I'm not"

"I am comfortable"

The average category included responses like:

"I don't know all about computers, I am still learning and will be learning continuously."

"I work with them all the time. It isn't comfortable but not uncomfortable. Just normal nowadays"

"If I'm not 100% sure of myself with whatever I'm doing I do not feel comfortable. Knowledge is what makes me feel comfortable"

It is worth nothing that well over half of the class expressed a good to high level of comfort regarding working with computers. Based on the initial responses it appears the members of the research sample felt comfortable when working with computers, particularly when they were familiar with specific programs being used.

For the second administration of the CAQ, 32 out of 40 students provided written responses to the second computing confidence question. The response distribution is follows (the initial response distribution has also been included for comparison).

Table 4.51 Computing Comfort Response Distribution (CAQ1 and CAQ2)

	Category			
	High	Good	Average	No Response
CAQ1 Count	22	12	5	9
CAQ1 Percentage	45.8%	25.0%	10.4%	18.8%
CAQ2 Count	20	9	3	8
CAQ2 Percentage	50.0%	22.5%	7.5%	20.0%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are also given below, however only those students who completed both CAQ's are shown.

Table 4.52 Computing Comfort Response Distribution (Paired Samples)

	Category			
	High	Good	Average	No Response
CAQ1 Count	20	12	5	6
CAQ1 Percentage	50.0%	22.5%	12.5%	15.0%
CAQ2 Count	20	9	3	8
CAQ2 Percentage	50.0%	22.5%	7.5%	20.0%

n = 40

The results indicate that there was very little change regarding the second computing confidence question which focused on student comfort level when working with computers. The post assessment responses corresponded very closely with the pre assessment responses. Sample responses from the high category included:

"Very comfortable"

"Very, since I know a lot about them"

"Very comfortable, kinda why I'm in this class"

Responses from the good category included:

"More comfortable if I'm familiar with what I'm doing"

"I feel comfortable working with computers"

"Comfortable"

"Sometimes it's good if I know the things"

Responses from the average category included:

"Ok"

"I don't like them much anymore, I prefer to go outside and do activities such as camping"

41 out of 48 students responded to third computing confidence question during the first administration of the CAQ, the question asked *"How confident would you be to show someone else how to use computers?"* The responses were organised into two categories: confident and dependent. The confident category represents responses that expressed confidence whereas the dependent category represents responses that expressed some type of conditional statement. The response distribution is shown in the following table.

Table 4.53 Teaching Response Distribution (CAQ1)

	Category		
	Confident	Dependent	No Response
Count	28	13	7
Percentage	58.3%	27.1%	14.6%

n = 48

Sample responses from the confident category include:

"Very, I have patience to teach even beginners"

"I like teaching people computers things, I'm very comfortable"

"Very, I have helped the elderly use computers"

"I would feel confident teaching someone to use a computer because it is something I have done many times"

"Very confident"

Sample responses from the dependent category include:

"Pretty confident, so long as I have knowledge of the program"

"Depends what it is and their previous knowledge"

"That would depend on the someone"

30 out of 40 students provided written responses to the same question during the second administration of the CAQ. The response distribution is shown in following table (the initial response distribution has also been included for comparison).

Table 4.54 Teaching Response Distribution (CAQ1 and CAQ2)

	Category		
	Confident	Dependent	No Response
CAQ1 Count	28	13	7
CAQ1 Percentage	58.3%	27.1%	14.6%
CAQ2 Count	22	8	10
CAQ2 Percentage	55.0%	20.0%	25.0%

n = 48 for CAQ1, n = 40 for CAQ2

The same statistics are also given below, however only those students who completed both CAQ's are shown.

Table 4.55 Teaching Response Distribution (Paired Samples)

	Category		
	Confident	Dependent	No Response
CAQ1 Count	23	12	5
CAQ1 Percentage	58.3%	27.1%	14.6%
CAQ2 Count	22	8	10
CAQ2 Percentage	55.0%	20.0%	25.0%

n = 40

There appeared to be very little change in responses to the third computing confidence question that focused on student confidence to teach computers. The post assessment responses corresponded very closely with the pre assessment responses. Sample responses from the confident category included:

"I feel I could, and often do, easily"

"Very confident"

"I would be confident to show someone else how to use computers"

Sample responses from the dependent category include:

"Confident, provided they weren't very thick"

"Depends on how open they were to learning about them"

"If I know something I can teach someone confidently

"Depends if they are a fast learner or not"

Based on the results of the three short answer questions relating to computing confidence the majority of the class seemed to express a high level of computing confidence and comfort. A small number of students expressed a lack of confidence and or discomfort however this was usually expressed in association with the use of unfamiliar systems. Due to the research sample consisting of second year ICT students, a high level of computing confidence is consistent with what would typically be expected from such a group. The implications of this high level of computing confidence and its relationship to the cloud assessment learning environment will be discussed in greater detail in the following chapter.

4.4 Concept Maps

Students completed two concept maps focused on the cloud assessment learning environment during the course of the study. The first concept map was completed on the same day as the first CAQ, at the conclusion of the questionnaire, subsequent to the assessment being introduced, but before any work had been undertaken. For the concept maps, students were instructed to brainstorm or map out anything they understood or anything that came to mind when they thought about using Google Docs for assessment. Students were asked to begin each concept map with the phrase "Google Docs for Assessment" as the starting concept (a phrase understood by students that represented the cloud assessment learning environment). From this starting point, students proceed to develop as many associated concepts as they felt were important or related to Google Docs for assessment.

Of the 50 students in the research sample, 48 were present during the first concept map development session. Of the 48 students present, 24 developed concept maps (50%). The developed concept maps varied in size and complexity ranging from the addition of a single concept to multiple additional concepts with the largest map involving nine additional concepts. The average number of additional concepts was 3.58. Figure 4.3 presents the concept map size frequency statistics.

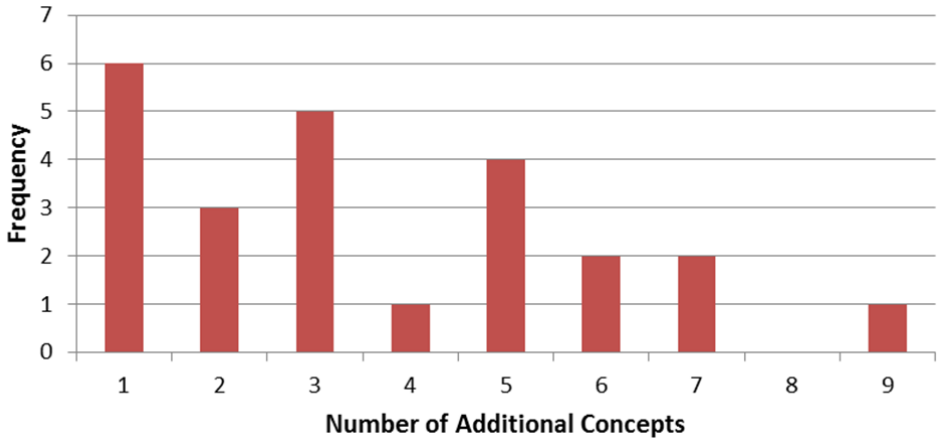

Figure 4.3 First Concept Maps Additional Concept Frequencies

In total, across the 24 concept maps 86 additional concepts were developed by students. Of the 86 concepts, 52 were positive, 17 were negative, 11 were questions, and 6 were statements that expressed a neutral or unsure perception.

Analysis of the 52 positive concepts revealed that 15 were general positive associations (e.g. "Great idea", "Exciting and new", "Good concept, cloud is the future", etc.), 11 related to feedback from the lecturer as a positive, six were positive comments relating to online storage and automatic saving, six related to ease of access, three related to automatic submission, three related to ease of use, and eight were miscellaneous positive comments relating to specific aspects of the cloud assessment learning environment (e.g. "No need to print (saves paper)", "Easier marking for the lecturer", etc.). Analysis of the 17 negative comes revealed that seven focused on internet connection reliability, five were concerned with the limited feature set, and five related to various aspects of the cloud assessment learning environment that were perceived as negatives (e.g. "There is a size limit", "Marketing hype", etc.). The 11 questions consisted of four which related to privacy and security concerns, four related to ease of use and features, two related to cost, and one was concerned with how the monitoring and feedback process would work. The six unsure/neutral concepts included statements like: "Unsure", "I'm still new to Google Docs", and "I am unaware of what Google Docs has to offer in terms of a word app". Figure 4.4 shows a pie chart summary based on the responses collected during the first concept map session (count and percentage shown).

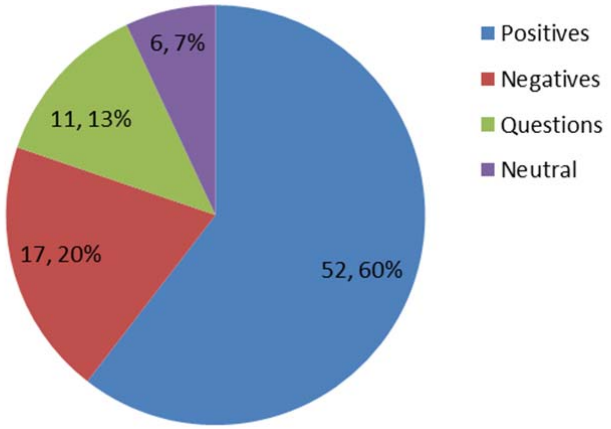

Figure 4.4 First Concept Maps Response Summary

The second concept map development session occurred on the same day as the administration of the second CAQ. Of the 50 students in the research sample, 40 students attended the session. During this session, concept maps were developed by 33 students (82.5%), this is a significant increase in number when compared to the first concept map session, both in terms of relative percentage and total number of concept maps completed. The concept maps again ranged from single additional concepts through to larger concept maps with multiple additional concepts, twelve being the largest. The average number of additional concepts per map was 5.18, again this is a significant increase when compared to the first concept maps session. Figure 4.5 presents the second concept map size frequency statistics.

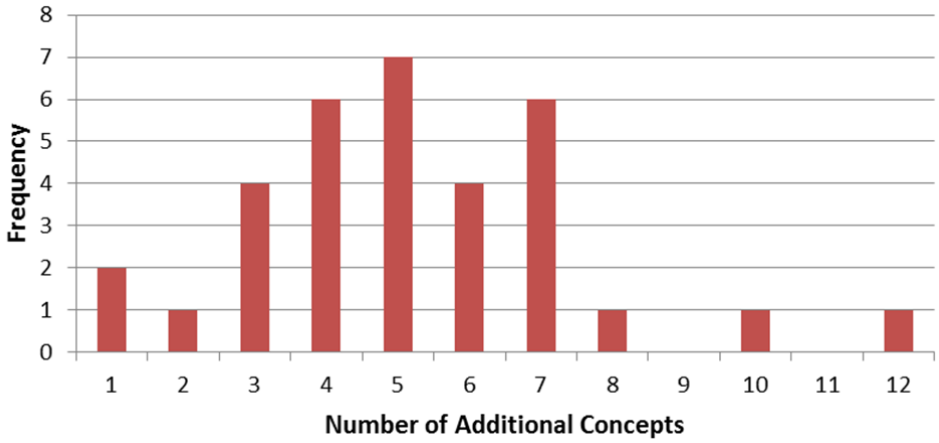

Figure 4.5 Second Concept Maps Additional Concept Frequencies

The 33 concept maps developed during the second session included a total of 171 additional concepts. Of the 171 concepts, 85 were positive, 83 were negative, 1 was a

question, and 2 were neutral statements. Interestingly, the second concept map session produced more than double the total number of additional concepts than the first concept map session. Another interesting observation is the fact that there were increases in both the positive and negative concepts associated with use of Google Docs for assessment, with the increase in negative concepts being the more significant of the two. These increases suggest an increase in student conceptual understanding of the cloud assessment learning environment and will be discussed in more detail in the following chapter.

Analysis of the 85 positive concepts revealed that 18 related to the feedback process, 14 related the accessibility of the cloud environment as a positive, 13 regarded the usability of Google Docs as a positive, 12 related to online storage and automatic saving, 10 considered Google Docs better than alternatives, nine viewed auto submission as a positive, five were general positive statements, and four were miscellaneous specific positive comments about the cloud assessment learning environment. Analysis of the 83 negative concepts revealed that 29 related to the limited feature set of Google Docs, 27 related to bugs experienced by the students, nine related to saving unreliability due to internet connection, eight were miscellaneous negatives that related to specific aspect of the assessment experience, five regarded the requirement of an internet connection as a negative, and five were general negative statements about using Google Docs for assessment (e.g. "Annoying", "Don't like it", etc.). Figure 4.6 shows a pie chart summary based on the responses collected during the second concept map session (count and percentage shown).

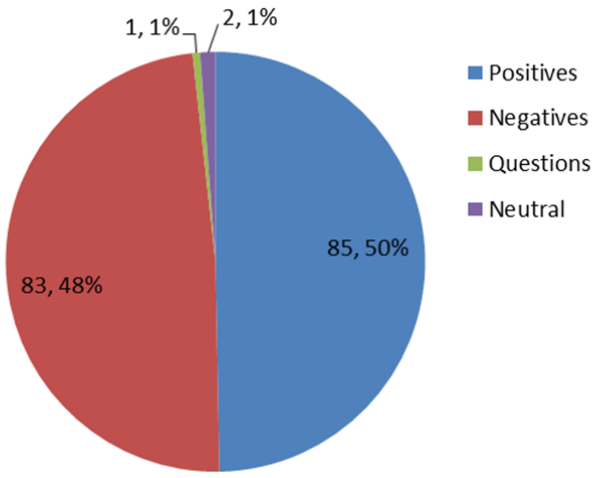

Figure 4.6 Second Concept Maps Response Summary

Figure 4.7 provides a comparison of additional concepts produced by students prior to (Pre-test concept maps) and after engagement (Post-test Concept Maps) with the cloud assessment learning environment.

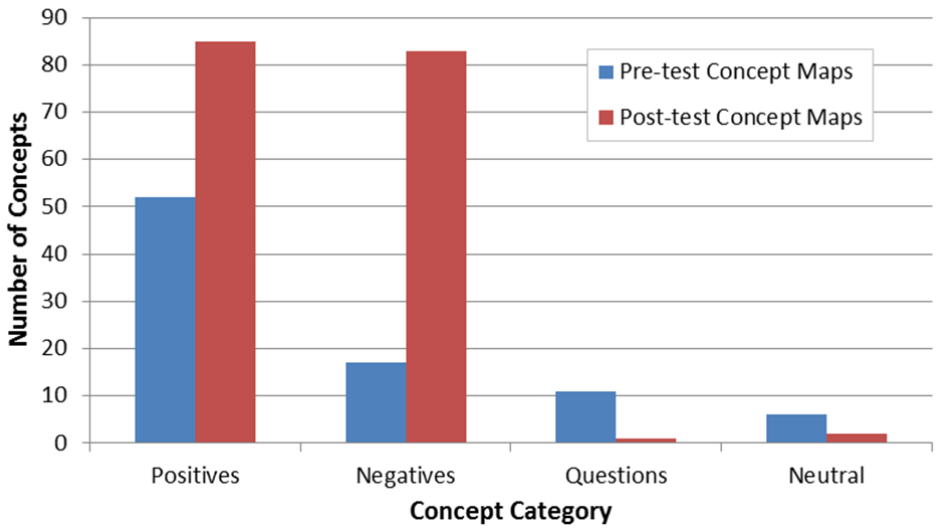

Figure 4.7 Pre-test Post-test Concept Map Comparison

One of the most striking changes between the first and second concept maps is the increase in negative concepts associated with using Google Docs for assessment. Another noteworthy change is the fact that while there was a reduction in the number of general positive concepts, there was at the same time an increase to the overall number of positive concepts. As mentioned earlier, the notable changes between the first and second concept map results suggest that engaging with the cloud assessment learning environment results in a change in conceptual understanding of the environment. These changes will be discussed in greater detail in the following chapter. The following table shows a detailed comparative breakdown of concepts from both concept map sessions.

Table 4.56 Pre-test Post-test Concept Map Comparative Breakdown

	Pre-test	Post-test
Total Concept Maps Developed	24	33
Total Additional Concepts	86	171
Positives	52	85
General Positive	15	5
Feedback	11	18
Miscellaneous Positives	8	4
Online Storage	6	12
Accessibility	6	14
Auto Submission	3	9
Usability	0	13
Better than Alternatives	0	10
Negatives	17	83
Internet Reliability	7	5
Limited Features	5	29
Miscellaneous Negatives	5	8
Bugs	0	27
Unreliability	0	9
General Negatives	0	5
Questions	11	1
Privacy & Security	4	0
Usability	4	1
Cost	2	0
Feedback	1	0
Neutral	6	2

Interestingly, the concept map results correspond closely with the findings from the other data sources whereby students express an initial positivity towards the cloud assessment learning environment and then post engagement, express a more balanced perception that includes a positive appreciation of the feedback mechanism and a negative perception of the limitations and bugs experienced through the use of Google Docs. Furthermore, the concept map data collection activity produced results that are consistent with those produced by the other data sources in this study which supports the validity and reliability of the concept map data.

4.5 Class Interviews

Whole class interviews occurred twice throughout the study. The first class interview was scheduled to coincide with the first CAQ and first concept map data collections, that is, the same day that the assessment was explained, but before students had directly engaged with the cloud assessment learning environment. Accordingly, the second class interview also coincided with the second CAQ and second concept map data collections. The results from each of the class interviews will be presented in the following sections.

4.5.1 Pre Assessment Class Interview

The first class interview consisted of a number of broad questions directed at the class as a whole. Each question led into short informal discussions relating to various perceptions students had regarding the assessment. It is worth noting that although discussion occurred during the first class interview, the discussions were often quite brief and did not explore any of the concepts discussed to any significant depth. Nevertheless, the following sections will detail each of the key themes that emerged during the first class interview.

One of the first themes to emerge was a curious excitement regarding the use of the cloud assessment learning environment. Even though many students had not used Google Docs before, the students who engaged in conversation expressed an expectant positive view towards the assessment with statements like:

> *"Sounds awesome"*
>
> *"I think it'll be a fun way to do an assessment"*
>
> *"Hopefully it'll be as good as it sounds"*
>
> *"It should be cool to use something different for a change"*

Building on the previous theme, the discussion became more specific with a number of students voicing a positive view specifically towards the monitoring and feedback aspect of the cloud assessment learning environment. During this phase of the discussion further explanation was given regarding the level and frequency of the feedback that would be provided in order to leave students with a common expectation regarding this aspect of the cloud assessment learning environment. Although the comments made by students were limited, the class as a whole could be seen to show

support for each of the positive statements. The discussion included positive statements and questions like:

"The feedback thing sounds pretty useful"

"How often will you be giving feedback?"

"Getting feedback comments before its due will be really helpful"

A technical discussion relating to Google Docs as a tool also occurred. This sub discussion focused on the capabilities of Google Docs with students asking brief questions relating to cost, storage capacity, privacy, collaboration, and accessibility. During this part of the discussion initial queries from students were answered, the included questions like:

"Does it cost anything to use?"

"What's the storage limit?"

"How many documents can I have?"

"Who will be able to see my work?"

"How does the collaboration work?"

"Do you need to install anything?"

"Does it work across different browsers?"

Finally, a few remarks were expressed by a couple of students relating to their typical approach to written assessment. These remarks included statements like:

"Does this mean I can't leave it until the last minute?"

"Looks like I'll have to start this one early..."

Based on the first class interview, the students collectively seemed to have a curious or nervous excitement coupled with a hopeful expectation regarding the assessment. The early feedback feature of the cloud assessment learning environment was also singled out as a particularly beneficial aspect. Although a number of questions existed regarding how exactly the assessment would work, once the questions were answered the class seemed content with the new assessment approach. Again, these initial pre-

engagement results are consistent with the findings from the other data sources within this study.

4.5.2 Post Assessment Class Interview

The second class interview also consisted of a number of broad questions directed at the class as a whole. Each question resulted in, at times, extensive informal discussions relating to various perceptions students had regarding the assessment. In contrast to the first class interview, the discussions during the second class interview were often a lot longer, involved more students, and expressed a number of opinions based on their recent experience. Accordingly, the following sections will detail each of the key themes that emerged during the second class interview.

Interestingly, the second class interview began with what could be called a brief venting session. A handful of students, when given the opportunity, quickly expressed some complaints relating to the assessment, specifically focusing on limitations of Google Docs and some bugs that were experienced with the use of the tool. The remarks included statements like:

"It was crap"

"It didn't work in IE, mind you nothing works in IE"

"Lag, can be very slow when working on documents original imported from Word"

"Cursor can get lost. Need to click somewhere else to edit. WYSIWYG fails."

"It has limited features"

Once the initial venting had subsided, the conversation turned to focus on a number of positive and constructive comments regarding the assessment. It was particularly interesting to note that some of the positive comments were expressed by many of the students who had engaged with the initial venting of negative comments. The general feeling regarding the use of Google Docs for assessment was that the tool (Google Docs) had some issues but it also had the potential to be a really useful and powerful tool for assessment. The positive statements included:

"Its simplicity is its strength"

"Chat and comments were really good"

"I really liked the feedback"

"I would definitely use it again"

"Benefits outweigh its weaknesses"

"If it had all the features of Word, which it will probably eventually get, it will be much better than MS Word"

"I like it" (reiterated numerous times)

Based on the discussions that occurred during the second class interview it appeared that the students had found through the assessment experience that Google Docs had a number of limitations that had frustrated their assignment progress. However, the class also communicated that once they learnt to live with the limitations, the advantages offered by the cloud assessment learning environment were highly appreciated. In particular, the feedback feature was cited as a significant advantage over traditional assessment methods. Interestingly, as students mentioned various limitations experience with Google Docs, the discussion would often turn to workarounds that students had used to resolve the various issues. Overall, the majority of the students tended to agree that although Google Docs had some issues, the advantages outweighed the disadvantages, and ultimately it was a good approach to assessment. Again, these results were consistent with the results that have emerged from the other data sources within this study and will be discussed further in the following chapter.

4.6 Focus Group Interviews

Focus group interviews were conducted with two separate groups of students after the completion of the assessment in the hours after the second CAQ and concept map data collection activities. The interviews were semi-structured and included a number of key questions to direct the discussion towards specific aspects of the cloud assessment learning environment, student attitudes toward subject and student computing confidence levels. During both interviews, the researcher acted as the interviewer.

4.6.1 Focus Group One

The first focus group consisted of seven students, five female and two male. The interview ran for 30 minutes and consisted of a round table discussion of various aspects of the cloud assessment learning environment. For the purposes of reporting, each student has been given an alternative name in order maintain participant anonymity while still retaining individual identity. The interview began with an initial

focus of problems that students had experienced using Google Docs for the assessment, the first statement made was:

> *"I didn't like Google Docs, yeah it was buggy" - Mike*

Upon asking for further details the following explanation was provided:

> *"Yeah it would just come up with random error messages, and you couldn't edit your document, and this was even in Chrome" - Mike*

From this, a few of the other students shared related experiences:

> *"...it came up with that error message you were talking about... ...I found I mainly only had problems outside of the lab, once I was in the lab it was fine..." - Juan*

> *"Yeah I didn't have the crashing issue but it was just stuff like the spell checker would highlight a space where there wasn't anything and I would click and the cursor would go somewhere other than where I'd click and I would be typing and the cursor would just move around." - Walter*

> *"The document would freeze, you couldn't edit it" - Mike*

> *"Like the saved second ago thing, it didn't" - Walter*

> *"That editor is below average" - Damon*

> *"There were a couple of lagging issues and stuff but nothing major for me" - Steve*

> *"Time lag, a lot of the issues I've had." - Damon*

Interestingly, another student who had had other issues quickly remarked:

> *"Yeah I didn't have any lag" – Walter*

Damon went on to state:

> *"As your Doc gets bigger, and as you have a couple of problems they sort of merge and becomes impossible to work with, if you start using images, it also compounds the problem" - Damon*

It is worth noting that a clear division was made between the limited features set offered by Google Docs and the bugs present in the system. The students seemed reasonably content with the features however it was the existence of bugs that was found frustrating, for example:

"I made my peace with the lack formatting pretty quickly, yeah but there was still formatting issues, it'd just do weird strange things" - Mike

"They have done a good job boiling it down to the features you need, but yeah they just need to fix those errors." - Walter

"If they got rid of the bugs, I would use it again for sure" - Juan

Interestingly, the student who began the discussion with a negative statement also made the following remark later in the interview, to which two other students (Walter and Susie) agreed:

"I did find it motivating that you were able to see our work as we went, so it was sort of like a motivation as you want to have something for you to see" - Mike

A number of the other students, including those who had expressed negative views, also began to share positives experiences, for example:

"As a collaborative tool I was blown away, I didn't know stuff like that existed... ...as a collaborative tool it's great" - Steve

"I liked it, as I said, I liked it as in what you're trying to put across, document sharing and that... …it had a positive doing it Google Docs" - Damon

"At home it was fine, I didn't have a great deal of problems with it" - Juan

"My experience is a bit different from these other guys, and maybe I was just lucky. When you first put out the survey I was really quite anti using Google... ...but I found the whole thing really positive!" - Steve

"I didn't have any issues with it, no error message or nothing, it was good" - Jill

"I found the features appropriate for a program that's being delivered over broadband. Because sometimes these programs like Word can get so bloated you need a degree just to operate them whereas this was intuitive it did all that I needed it to do, a nice professional looking document, it didn't need fancy word art." - Steve

The discussion also turned to focus specifically on the monitoring and feedback process that was present within the cloud assessment learning environment. A number of students expressed positive views with relation to this aspect of the assessment to which all the students agreed, for example:

"I liked the comments, I found them quite helpful" - Mike

"That was the main benefit of Google Docs for me, the comments were the cool part, it is Google Docs, but I get comments so it's okay" - Walter

"I was happy you didn't go overboard with the feedback, I still felt like I was doing the assignment... ...it was good to know you were actually reading it, making sure I wasn't doing anything too off track" - Walter

Regarding the automatic submission, all of the students found the feature a positive however some interesting feedback was given relating to a feeling of incompleteness, for example:

"I would have liked a confirmation email, or something where I could log into Google Docs and know you had downloaded it" - Mike

"Yeah like when you submit something you get that feeling of 'it's done, I don't need to do anything'. It was all automatic I didn't get that feeling 'I'm done now', literally 5 minutes before the deadline I was think "what if there's something I need to change", because I hadn't got it into my head 'I'm done'" - Walter

The discussion concluded by focusing on student levels of computing confidence and attitude toward the subject. The students all expressed a reasonably high level of computing confidence, although a couple of notable statements were made:

"It's not really general, like some things you're good at and some things you're not, it's not really a general question" - Susie

"Everyone in this course is going to circle 4 or 5 (referring to the Likert scale questions) because you'd have to be pretty stupid to be in the second year of this course and not" - Walter

Regarding attitude toward subject a number of the students expressed the view that the IT Project Management subject was only really useful because of the eventual third year industry project that they would be required to do the following year. Statements were made like:

"I think it's quite helpful you know, because it helps us with the industry project" - Mike

"I don't think you'd get as much out of it (the subject), if the degree didn't have a project" - Juan

"The industry project gives you a chance to apply what you learn here, so without the project this paper wouldn't be as useful because you'd only have theoretical knowledge" - Walter

However, a number of the other students felt the paper was useful beyond its immediate relevance to the third year project. For example, the following statements were made:

"I think the planning is important for life, understanding planning is core at any organisational level, so that gives you a background in planning, it relates to all the other subjects. It is a core topic." - Damon

"I do think it's still useful because it's a life skill that I've noticed a lot of people here don't have, some of the younger students especially" - Steve

Overall, based on the discussion with the first focus group a number of significant themes emerged. First, the majority of students from the focus group had experienced bugs when using Google Docs while others had not experienced any. Interestingly, although a lack of features was noted by the students, they seemed less concerned about this limitation and were more frustrated by the errors they had experienced. Notably, when the bugs caused students to lose work, a mistrust of the cloud environment resulted with students electing to make offline backups. Despite the bugs in the system, all of the students expressed a positive view of the monitoring and feedback aspect of the cloud assessment learning environment, recognising it as a major advantage over traditional assessment methods. Regarding automatic submission, the students again expressed a positive view. However the inability to perform a submission action left a number of students feeling like they hadn't properly completed the assessment. The majority of the focus group students also expressed a high level of computing confidence, however a view was also expressed where confidence was felt to be dependent on the technology being used. Finally, the IT Project Management paper was viewed by all as useful due to the eventual industry project that was to be undertaken during the following year. Some students expressed the view that without the third year project the IT Project Management paper would be less valuable, while others felt that it taught valuable life skills that would be applicable even beyond the third year industry project.

4.6.2 Focus Group Two

The second focus group consisted of four students, all four students were male. The interview ran for 24 minutes and consisted of a round table discussion of the cloud assessment learning environment and followed a similar format to the first focus group interview.

Interestingly, in response to the first question which asked if there was anything in particular that stood out to them about the assessment, the first response was:

> *"About the assignment? Or about Google Docs?" - Kasper*

This query was interesting in the sense that the student clearly differentiated between the assessment and the tool used to complete the assignment. The student went on to say:

> *"I actually have something to say about the assignment, I'm king of doing everything at the last minute, so it didn't really benefit me in any way" - Kasper*

The other three members of the focus group went on share positive views regarding the cloud assessment learning environment by making statements like:

> *"I did like the idea that we could do the report and you could actually look at it rather than us coming to you and saying 'can you have a look at this' whereas you could just look over things in your own time and make comments" - Tim*

> *"Or when we made a comment and it emailed you, we didn't have to go and find you or anything it was just a lot easier." - Chris*

> *"Yeah that itself (the comments) was quite helpful, it was a little bit daunting, but once I got going and you made a particular comment, that was good and I felt a lot better." - Adam*

However, in a similar fashion to the first focus group students, the students from the second focus group also expressed a number of negative views regarding bugs they had experienced while using Google Docs. These statements included:

> *"On Friday I tried to upload a picture and it took over an hour, it would let me upload it, it wouldn't let me select the thing, it wouldn't let me do anything really, but that may have just been UCOL wireless crapping out because eventually I just sat down at a wired computer and it worked a lot better, so it obviously needs a decent connection." - Chris*

"With the tables, because I pasted them in from Word, Google Docs still treated them as tables but I couldn't actually resize any of the columns or anything" - Kasper

"I had the problem with the connection at home... ..I think the problem was with the WiFi, because what was happening was I would be doing was putting the information on, but next time I would get on half the stuff would be gone." - Adam

An interesting observation was also made by one of the focus group members, to which the rest of the focus group agreed, the observation was:

"That seems to be a pretty common element where people have problems is where people were using wireless." - Tim

The focus group members went on to point out a number of other errors and limitations they had found with the system, comments included:

"The other bad thing about it as well was that you can't use it offline." - Chris

"Also the toolbars at the top were quite chunky so when I used my little 10 inch laptop I couldn't actually see that much of the actual document, although I can barely use Office on it as well" - Chris

"What I also found was that I would downsize the document size to 80% so I could have two documents side by side, and what that meant was the cursor would get out of synch with the words... ...it's just disconcerting if nothing else." - Adam

"You had to go in and tell it you wanted to use the New Zealand dictionary as well." - Tim

After discussing a number of bugs and limitations present within the system, the students then returned to some more positive comments regarding the idea behind the assessment, for example:

"I mean the idea is fantastic, but the actual using is not" - Chris

"The built in chat client was also good because getting everyone to have the same IM client is impossible. So with Google Docs you can just put it on there and there's no problem." - Kasper

"When you and I were communicating over the chat, that was helpful, we were obviously in the same place, and that was great." - Adam

"They (the comments) were helpful, like the one you left 'you're missing something here' that was quite good" - Chris

"Yeah I agree, the idea in principle is a good one, for the interaction between yourself and (us) that sort of thing, but it's the technology that lets it down." - Adam

When asked what they thought about the automatic submission, it was interesting to note that a similar comment was made to that communicated by members of the first focus group, although a contrasting comment was also made. The comments were:

"It's freaky (automatic submission), I was sitting there thinking is it submitted or not?" - Chris

"It didn't bother me, the way I see it, come 5 o'clock it's your problem" - Kasper

When asked about computing confidence three of the four focus group participants agreed that they all had a high level of computing confidence, with one student making the following statement in relation to one of the quantitative CAQ questions:

"It was the question that asked 'compared to other people at UCOL', it seemed a bit silly, we're all doing an IT course, why ask that question?" - Chris

However, the fourth student expressed a very different opinion by stating:

"I wouldn't put myself at that level at all" - Adam

When asked what they thought of IT Project Management as a subject, the views expressed by the students were divided. Two felt the paper was only necessary as a course requirement, while the other two felt the paper was interesting and valuable in and of itself. The comments made were:

"I wrote it on the thing, it's a necessary evil, I know I have to do it, but I don't necessarily need to enjoy it" - Kasper

"It's necessary to do, but it's not what I'd pick" - Chris

"I'd still take it, I mean that's kind of the focus of my papers, to take more of the management and development papers" - Tim

"Yeah this is one of the things I'd have more of an interest in, the management." - Adam

Finally, in reflecting on the assessment a couple of interesting comments were made, they were:

> *"I would have made more effort sooner so I would get more feedback from you" - Tim*

> *"I would have liked a smaller class so we could get more feedback, because of course you've had to spread out to 50 students so if there were only 20 students we would essentially get double the feedback, provided we could actually be fed back that much." - Chris*

Based on the discussion with the second focus group, a number of significant themes emerged which were very similar to those expressed by the first focus group. The students recognised the difference between the cloud assessment learning environment and the tool used to implement the environment with one student noting its perceived redundancy for students who leave their assignment work to the last minute. Nevertheless, the monitoring and feedback aspects of the assessment were viewed in a positive light with some emphasis being placed on the convenience and perceived ease of getting feedback. In reflecting, the students also expressed the view that starting earlier and having a smaller class size would both prove beneficial regarding this type of assessment. The students also had experienced a number of issues with Google Docs citing bugs relating formatting and cursor location. Interestingly, the focus group members deduced that the use of wireless internet connections appeared to be a common factor to many of the issues experienced. Ultimately, the students felt that the idea behind the assessment was good; however they felt somewhat let down by the implementation (i.e. Google Docs). The students also expressed similar sentiments regarding automatic submission as the first focus group, noting a feeling of uncertainty about the submission (i.e. is it submitted or not?). Three of the four students also felt they had a high level of computing confidence, with one student having a much lower self-perceived level of confidence. Finally, the students were mixed regarding attitude towards subject with two feeling it was a 'necessary evil', while the other two expressing a fondness and preference for the subject.

4.7 Lecturer Descriptions

The eleven focus group students were also given the opportunity to write anonymous descriptions of both their ideal lecturer and their current lecturer, this was done in order to provide qualitative data to complement the LIQ results. Analysis of the eleven

written descriptions revealed a generally consistent view of the attributes possessed by both an ideal lecturer and the students' current lecturer. The following sections will present a summary of the descriptions given by the focus group students.

4.7.1 Ideal Lecturer

Although the students each provided unique descriptions of their perceived ideal lecturer, a number of characteristics appeared consistently throughout the descriptions. In total fifteen unique characteristics were attributed to an ideal lecturer. Table 4.57 shows a breakdown of the characteristics and their frequencies amongst the descriptions.

Table 4.57 Ideal Lecturer Description Summary

Characteristic	Description	Frequency
Knowledgeable	Knowledgeable of subject area	10
Communicative	Good communicator of subject matter	7
Approachable	Approachable regarding the subject and assessments	7
Helpful	Helpful to students	4
Prepared	Prepared for lessons	3
Understanding	Understanding of student needs	3
Strict	Strict when required	3
Relevant	Provides relevant information	3
Humorous	Has a sense of humour	2
Flexible	Gives students freedom and flexibility with study	2
Fair	Provides fair assessments	1
Patient	Patient with students	1
Tidy	Tidy and well presented	1
Respectful	Respectful to students	1
Nice	Nice	1

According to the students written descriptions, an ideal lecturer is someone who is above all knowledgeable of the subject that they are teaching. They are a good communicator of subject matter and students feel that they are approachable. An ideal lecturer should also be helpful to students, prepared for lessons, understanding of student needs, and be able to manage a class well.

4.7.2 Current Lecturer

Again, a generally consistent perception was revealed through the analysis of the written descriptions of the students' current lecturer (i.e. the researcher). In total

sixteen unique characteristics were attributed to the students' current lecturer. Table 4.58 shows a breakdown of the characteristics and their frequencies amongst the descriptions.

Table 4.58 Current Lecturer Description Summary

Characteristic	Description	Frequency
Knowledgeable	Knowledgeable of subject area	10
Communicative	Good communicator of subject matter	7
Approachable	Approachable regarding the subject and assessments	5
Helpful	Helpful to students	3
Prepared	Prepared for lessons	2
Understanding	Understanding of student needs	4
Strict	Strict when required	3
Relevant	Provides relevant information	2
Humorous	Has a sense of humour	2
Flexible	Gives students freedom and flexibility with study	2
Fair	Provides fair assessments	1
Patient	Patient with students	1
Tidy	Tidy and well presented	1
Respectful	Respectful to students	1
Nice	Nice	1
Punctual	Punctual, on time to for lessons	1

According to the descriptions, the students' current lecturer was actually quite close to their ideal lecturer. Interestingly, a number of students elected to either repeat or refer to what they had written in the ideal lecturer section. This also coincides with the quantitative LIQ results which reveal that quantitatively students' perceptions of an ideal lecturer appear very similar to their perceptions of their current lecturer. These results will be discussed further in the following chapters.

4.8 Participant Observations

As the sole lecturer of the IT Project Management paper, within which this study took place, the researcher was in an ideal position to act as a participant observer. Accordingly, observation began from the beginning of the semester, four weeks before the first formal data collection, and six weeks before students began engaging with cloud assessment learning environment. These observations also extended beyond the end of the assessment, through to the end of the semester. Although the observations

were significantly focused on discovering student perceptions of the cloud assessment learning environment they also inherently double as a way for the researcher to develop their own perceptions of the environment as well as perceptions of teacher-student interpersonal behaviour that occurred throughout the duration of the study. The following sections will now present the observations made over the course of the semester as they related to various aspects of this study. It is also worth noting that the participant observations also encompassed all other data collection activities, consequently data explicitly presented in other sections of this chapter have not been included in this section. Finally, the participant observations are presented in the form of a chronological narrative of the semester in which the study occurred. This has been done in order to give context to the study, to show the cloud assessment learning environments place within the overall IT Project Management paper, and to also show the development of and change in perceptions and behaviours over the course of the semester (Lieblich, Tuval-Mashiach, & Zilber, 1998).

4.8.1 Pre Assessment

This section will present the observations made during the initial six weeks of the semester, before students began engaging with the cloud assessment learning environment. During this six week period students were introduced to the paper, this included an overview of topic as well as a summary of the coming assessments. The first assessment for the paper was a Project Brief test which carried a 10% weighting, this assessment was also conducted during this initial time period.

Each week students had a one hour lecture and a two hour lab session timetabled back to back. Although attendance was not compulsory for the I202 IT Project Management paper, a reasonable level of attendance is generally accepted as necessary for the successful completion of a given paper within the BICT degree. From day one of the paper, students seemed stand offish. Although the first few weeks of classes seemed reasonably well attended, overall students did not appear overly excited about the course content. However, it should be noted that a small minority of students did appear to be showing an early interest in the paper, with many of these students tending to be some of the more mature members of the class. Nevertheless, very few questions were asked by students during the lecture sessions and students also appeared to do only as much as was required during the lab sessions and would occasionally be seen to move on to other work before the end of the timetabled lab sessions. This contrasted strongly when compared to how the same students would behave and had behaved in other papers for which the researcher was or had been a

lecturer. In other more 'interesting' papers, students would often be more inquisitive, ask numerous questions during lectures, be seen to spend longer experimenting during lab sessions, and also would engage in subject related discussions outside of class times. As mentioned, this was not the case during the first few weeks for the majority of the class. From the researchers perspective this was not an uncommon attitude to be expressed by students toward the subject. The majority of students had previously taken between eight and twelve BICT degree papers, many of which involved hands on practical work in areas such as software development, web design, and networking. Conversely, the IT Project Management paper was more of a theory based 'reading and writing' paper that tended not to capture students in the same way as the more practical papers.

In an attempt to combat the inherent dryness of the IT Project Management paper, the lab sessions were structured and run as interactive group activity lessons. During these labs sessions, students would work together on project management related problems. The lab sessions tended to result in students engaging more than what they would during the lecture classes. However, this increased level of engagement was likely also impacted by the change in environment and delivery mode (i.e. 50 person lectures versus small group activities). The majority of students who attended the lab sessions tended to engage well during the group activities, however as a result of group dynamics, certain group members were found to take a backseat during various activities. During this early stage of the semester was when a number of students started to demonstrate varied attendance with some attending the lecture session and not attending the following labs session, or vice versa.

Student interest began to increase slightly as the reality of the first assessment, a Project Brief test, approached. The project scenario used as the basis for the first assessment was decided by the class as a result of a series of group activities where students formulated and presented potential IT and technology related projects. The project proposals were then voted on by the class members to decide on a winning project to be used for the coming assessments. This approach had been adopted in order to keep the IT Project Management content fresh each semester and also in order to involve the students with the assessment creation process. The underlying intention was to increase student involvement with the paper as a whole. Interestingly, the winning project scenario was titled the 'Alcoholic Beverage and Condiment Dispenser (ABCD) Project'. The project aim was to develop a vending machine for use in licensed premises that would dispense both alcoholic beverages and condiments to patrons.

From the researcher's perspective, this was not most appealing project that was presented, however due to the democratic system of class voting, it was elected as the most favoured scenario by the members of the class. During this process the perceived interest and engagement levels of students seemed to increase. For example, the number of questions asked by students during class time increased, however it should be noted that the majority of questions essentially related to what would be in the coming Project Brief test.

On the week of the first assessment, the first formal LIQ data collection also occurred. Interestingly, when the LIQ survey (which asks student about their ideal lecturer and their current lecturer) three students remarked that the researcher would be the same as their ideal lecturer. Notes in the margins of some of the LIQ surveys also reflected this notion, e.g. the lecturers name written next to the ideal lecturer heading. The lecture session during this week was also used as a review session for the Project Brief test that was scheduled for the following day. Interestingly, even though the first assessment for the paper was occurring the following day, a number of students had elected not to review the IT Project Management content during the last lab session before the test, but instead decided to work on activities for another paper (Dynamic Web Solutions), a more 'interesting' web development paper.

After the Project Brief test student engagement appeared to return to the same level that it had been from the beginning of the semester, however this lull in engagement was short lived as the project management plan assignment, worth 30% of students final mark was to be handed out in week six, two weeks after the Project Brief test. This would also mark the beginning of students' engagement with the cloud assessment learning environment and would also coincide with the second formal data collection of the study. The participant observations made during this timeframe will be presented in the following section.

4.8.2 The Cloud Assessment Learning Environment

During week six of the semester the project management plan (PMP) assignment was given out to students. This included the first official introduction on the cloud assessment learning environment. The introduction covered details relating to the assignment and how the students would be using Google Docs to complete the assessment task over a four week period, as well as their lecturer's involvement during this period. There was an initial buzz from the class regarding the assessment which could be described as a hesitantly curious excitement. The details of this initial

discussion with the class are covered in more detail in the class interview section presented earlier in this chapter. The first CAQ and concept maps collection was also administered subsequent to the assignment introduction (again, presented earlier in this chapter). The following lab session focused on getting students set up with Google Docs, creating their assignment documents and sharing them with their lecturer. Interestingly, the process of signing up to Google Docs, and creating and sharing assignment documents did not appear to be a difficult task for any of the members of the class. This ease of use was exemplified by the fact that not a single question was asked by students regarding the sign up, creation or sharing processes. By the end of the session all students who had attended had successfully signed in, created and shared their assignment document. A number of students had also already begun experimenting with some of the more advanced features of the system including template formatting and image importing and manipulation. Those students who did not attend the lab session were followed by email later on that day informing them of the assessment process, consequently by the end of the first week all 50 students had signed up, created and shared their assignment documents.

At the end of the first week each assignment document was reviewed by the researcher and appropriate feedback relevant to the current state of each document was provided (more detail is given in the following virtual participant observations section). Based on the current progress that had been observed, general feedback was also given to the class at the beginning of the lecture the following week. This pattern also continued throughout the assessment process where the class as a whole would be given general feedback based on the collective class progress that had been observed over the previous week. Face-to-face assignment related queries were observed to increase over the four week assessment period. Accordingly, the face-to-face queries appeared to come from students with higher levels of attendance and engagement. The first two weeks consisted of approximately 25% of the total number of assignment related queries. Interestingly, these queries were made at logically convenient times (e.g. during and immediately after timetabled lectures and labs sessions). Not surprisingly, these early queries were made by students who had also made early progress on the assignment. The third week of the assessment process consisted of approximately another 25% of the total number of face-to-face assignment related queries. Again, the majority of these questions were asked during timetabled lessons. However the students asking the questions during the third week also included many students who had not previously been seeking help. The third formal data collection activity also occurred at the start of the lecture during the third week of the assessment. This data

collection involved the second administration of the LIQ which focused on perceptions of teacher-student interpersonal behaviour. At this point in time students had been engaging with the cloud assessment learning environment for approximately two weeks.

During the last week of the assessment, approximately 50% of the total number of assignment related queries were asked. It was interesting to observe that these questions were not only asked during the last available timetable lessons, but were also asked during other unscheduled times. This included during lab sessions for other papers where the researcher was available, and also during non-contact times where students came to the researchers office. The majority of the questions asked during the last week were also asked by students who had not previously been seeking help. It was interesting to note that although the timing of the queries varied across the four week period, the nature of the queries remained relatively consistent, i.e. the same or similar types of questions were asked by students over the course of the four week assessment. Consequently, the assistance provided to the early starting students was essentially the same as that given to students who worked on their assignments gradually, and also those students who left the majority of the assignment work to the last week. This pattern of increased questioning towards the end of the assessment process was also reflected in virtual participant observations of the Google Docs feedback/commenting system which will be described in the following section. It was also very interesting to note that by third and fourth week of the assessment many students were asking the researcher to "jump into my doc", "have a look at what I've done", and "answer the questions I've left in my doc", this indicated students had begun to embrace the early feedback features offered by the cloud assessment learning environment.

It should also be noted that particularly during the last week of assessment a noticeable amount of low level frustration was observed throughout the class relating to Google Docs as a tool. Numerous members of the class were found to be frustrated with various limitation and bugs that they had experienced with Google Docs. These included limitations relating to the formatting of table, formatting of fonts and styles, and uploading and manipulation of images. Bugs within the system were also reported, these included: browser related rendering problems (i.e. it wouldn't work correctly in Internet Explorer), the cursor would appear in the wrong area of the page, work would be lost due to connection errors, and an overall slowness of lag when using the system.

4.8.3 Post Assessment

After the conclusion of the PMP assignment students were no longer required to use Google Docs and consequently ceased engaging with the cloud assessment learning environment. The following week during the first lecture after the assignment had been submitted the fourth and final formal data collection occurred. This included a general class interview, the second administration of the CAQ, the second concept map collection, and two focus group interviews, all of which have been detailed earlier in this section. When contrasted with the same class four weeks earlier, when the assignment was introduced, the class at the end of the assessment process seemed far more opinionated. It was if the members of the class had become technologically battle hardened in the sense that through the engagement with the cloud assessment learning environment students had gained first hand experiences that they felt were worth sharing. Overall, students seemed to have mixed opinions of the assessment process, on the one hand expressing disappointment with aspects of Google Docs as a tool, but on the other hand praising the usefulness and helpfulness of the early feedback mechanism made possible by the same system. This mix of opinions has also been reflected in a number of the other data sources that are mentioned throughout this chapter.

One week after the end of the PMP assessment a two week mid-semester break occurred. During this time zero face-to-face interaction occurred between the researcher and the students. After the conclusion of the break, the regular timetabled classes resumed. The first week consisted of a review of the IT Project Management content that had been delivered over the previous ten weeks prior to the break. The review was done in preparation for the third summative assessment, a closed book theory test with a 30% weighting that was soon approaching. Students were observed to return to a level of engagement similar to that experienced directly prior to the first Project Brief test. That is, students were primarily focused on what would be in the test. The test occurred the following week as scheduled and was reasonably well attended (48 out of 50 students). The only students who did not attend the assessment had both been unsuccessful in the previous two summative assessments for the paper.

The remaining six weeks of the semester were entirely focused on the use of the Microsoft Project software package. The Microsoft Project content would form the basis of the final summative assessment, a 30% practical test using Microsoft Project. Interestingly, over the final weeks of the semester, class attendance and overall engagement underwent a noticeable drop (refer to the attendance section later in this

chapter). Reasons for this drop could be contributed to a number of factors which were observed and became apparent through discussion with various members of the class. Two of the most commonly observed factors will now be detailed. Students had now completed 70% of the summative assessments for the IT Project Management paper, and for many of the students, they had already passed the paper and had decided to focus their attention on other papers which still had significantly weighted outstanding assessments. Many students also felt extremely comfortable with the Microsoft Software package. When compared to other software packages used by the students on the BICT degree, Microsoft Project was viewed as simple office tool, and as a consequence students did not feel they would be disadvantaged by missing the Microsoft Project lessons. Although there were a decreased number of students in each class, the level of overall class engagement appeared to remain consistent to that which had been observed earlier in the semester. Interestingly, the students who retained their engagement levels included all of the students who had started their PMP assignments early, and also included all of the students who had expressed a greater interest in the paper overall. Nevertheless, despite the decreased level of attendance and engagement over the latter part of the semester, the final summative practical assessment was attended by the majority of the class (again 48 out of 50) including those students who had not engaged since the previous theory test. Furthermore, based on the results of the practical test, the lack of attendance did not appear to impact achievement levels. Upon completion of the practical assessments students had essentially completed the IT Project Management paper and as a consequence, participant observations relating to this study concluded.

This section has presented participant observations made by the lecturer in the form of a chronological narrative. The narrative has spanned the entire semester in which the study took place and has aimed to provide a coherent and compressive account of the researcher's experiences and observations throughout the study.

4.9 Virtual Participant Observations

While the previous section presented participant observations based on face-to-face interactions with the members of the research sample, this section presents the virtual participant observations made via email, Moodle (the LMS used for the IT Project Management paper), and through Google Docs (the cloud computing tool used to implement the cloud assessment learning environment). As with the participant observations, the virtual participations also enabled the researcher to develop their own unique perceptions of the environment and will also be presented in the form of a

chronological narrative. The virtual participant observations will also be divided in the same sections as the previously covered participant observations.

4.9.1 Pre Assessment

Prior to the start of the project management plan (PMP) assessment the research sample students were engaging with Moodle, the LMS used for both the IT Project Management paper and all other papers undertaken by the students. Students were also able to contact their lecturer via email. The students did not begin engaging with the cloud assessment learning environment (and consequently Google Docs) until the start of the project management plan assessment. Consequently, this section presents only those virtual participant observations that were made via either Moodle or email exchanges.

The main observation made during the first six weeks of the paper, prior to students engaging with the cloud assessment learning environment can be summed up as 'minimal engagement' or a 'lack of engagement'. Activity logs revealed that most of the resources that were made available to students via Moodle were only sparsely accessed by students during the first six weeks. This access typically happened only on the day of the IT Project Management lessons. Even though it seemed that the majority of students were only sparsely accessing the resources, there did appear to be a core group of students who were accessing the material more frequently. The only notable rise in Moodle activity occurred directly prior to the Project Brief test, the first summative assessment for the paper. In the days leading up to the test, a significant spike in Moodle usage occurred, this also coincided with an increase in face-to-face communications with students that was also observed during the same period (see participant observations section).

After the completion the first summative assessment, student Moodle activity was observed to return to a similar level as seen during the first few weeks of the semester. This level of activity appeared to remain unchanged until the beginning of the project management plan assessment where students also began engaging with the cloud assessment learning environment.

Email contact was also very low during this initial period, a total of six emails were received relating to the IT Project Management paper, five were regarding absence due to illness, and one was a query regarding when the results from the Project Brief would be available.

4.9.2 The Cloud Assessment Learning Environment

As students began engaging with the cloud assessment learning environment, possible virtual participant observations were no longer restricted to those possible via email and Moodle, but also included online observations of student use of Google Docs. Accordingly, this section will present the virtual observations made via both online environments as well as email.

Student use of Moodle was seen to increase during the first few days of the PMP assessment. Students were mainly accessing online resources relating specifically to the assignment, e.g. the assignment document, project scenario, and assignment template. A small number of students were also seen to access a number of previously released resources that related to the assignment content.

On the day that the PMP assignment was announced, a high level of Google Docs activity was observed. This was the direct result of lab session dedicated to the initial creation and sharing of student PMP assignment documents. However, even after the conclusion of lab session, a small number of students were also seen to be accessing and using Google Docs consistently over the remainder of the week (the shared view of the documents and revision history features enabled this observation). Interestingly, the majority of the class did not appear to do much work on their assignments during the first week. Many of the students did not make any changes beyond what was achieved during the initial set up lab session, whereas others only made one or two significant edits during this time. After the first week all of the students in the class had created and shared their PMP assignment document. A small number (around 10%) had made a strong start to the assignment. Approximately 40% of the class had made some progress by creating the title page, entering section titles and beginning the introduction section. Finally, about half of the class had done little more than putting filler text into the document and/or creating the title page. At the end of the first week the majority of feedback given to students via the Google Docs commenting system fell into the category of general motivational statements of encouragement, this was due to the limited amount of work completed. Interestingly, likely due to the default email notifications that are sent from Google Docs when a new comment has been added to a document, a number of students responded quickly (i.e. within 2-3 hours) to the initial feedback added to their assignment documents.

Over the course of the second and third week of the assignment, Moodle activity was observed to reduce from the initial spike that coincided with the beginning of the

assignment, however it did remain slightly higher than it had been prior to the assignment beginning. Again, during this period resources related to the assignment were regularly accessed by students.

Interestingly, during the same two week period (weeks two and three of the assignment), the initial small group who had made a strong start to the assignment continued to make significant progress to the point where activity actually appeared to taper off. This tapering off was also observed to coincide with the near completion of the assignment (well before the due date). During this period of time a reasonable amount of interaction occurred between the early starting students and the researcher via Google Docs. A number of clarification questions were asked and answered using the comments system, but overall very little guidance was requested (and consequently given) with the majority of interactions taking the form of confirmation of work, as opposed help with work. During the middle two week period of the assessment feedback comments were given to each student at least twice (once per week). Over this course of time, a number of students also began using the comments system to leave questions in their documents. Each question was responded to on a case-by-case basis and often clarified student understanding about a particular aspect of the assignment or directed them towards other related resources. Interestingly, common assignment related questions that were asked within Google Docs were also reiterated during class time as they often identified aspects of the course content that required clarification. Furthermore, it was noted that the students who showed increased engagement and attendance in class were also those students most actively involved in the cloud assessment learning environment during this period.

As the assessment progressed, student use of Moodle appeared to remain relatively consistent with resources being accessed slightly more frequently than they had been during the initial six weeks of the semester. Interestingly, a notable increase in Moodle activity was observed during the week leading up to the PMP assignment due date. This also coincided with the increase in face-to-face assignment related queries that was observed during the same timeframe.

In a corresponding fashion, during the last week of the assessment, the amount of activity observed via Google Docs increased dramatically. This increase involved the majority of students accessing and editing their assignment documents, increased queries were made using the Google Docs comment system, and an increased number of in document discussions relating to the assessment occurred. Although there was a

significant increase in student online activity over the last week of the assessment, it was interesting to observe that the student activity and queries were of the same nature as those made previously by the early starting students, however the activity and queries were being made by different students (those who still had work to do on their assignments).

Notably, during the last few days of the assessment, a number of students sent email queries asking for the lecturer to 'jump into' particular student's assignment documents to have a look. Once the student's document was opened, a discussion occurred using the Google Docs chat feature where the student would ask general pre submission questions, e.g. "does it look alright?" "Have I missed anything?" These discussions also often included clarification question about specific sections of the assignment document. In participating in these discussions the researcher was careful to exercise an appropriate level of guidance (this will discussed further in the following chapter).

The number of email queries also increase significantly during this assessment period, with 34 emails being received with questions relating specifically to the PMP assessment. An additional 211 emails were also received during this time period, however these emails were automatically generated and sent from Google Docs and reflected a new comment or response to a comment that had occurred in Google Docs. The majority of emails were also received during the latter part of the four week assessment.

4.9.3 Post Assessment

After completion of the PMP assignment, overall online activity subsided. Not surprisingly, as Google Docs was no longer required for assessment, student use of the system ended. Student use of Moodle also reduced to levels similar to that observed during the pre-assessment time period. After week ten of the semester, one week after the conclusion of the PMP assessment, a two week semester break occurred, this resulted in close to no Moodle activity by the students.

Online Moodle activity picked back up after the end of the mid-semester break. Two spikes in online activity levels occurred during the remained eight weeks of the semester. The first spike occurred directly before a summative theory test, and the second spike happened prior the final summative practical test of the semester. Other than these two spikes in activity levels where students accessed assessment related

materials, student Moodle activity levels remained consistent with those observed during the beginning of the semester (i.e. relatively low).

Interestingly, email activity dropped down to a similar level to that observed prior to the cloud assessment with only eight emails being received relating to the IT Project Management paper over remaining weeks of the semester.

Once students had completed the final summative assessment Moodle activity and email exchanges related to the IT Project Management ended. Consequently, virtual participant observations also concluded at this time.

The virtual participant observations made by the researcher via Moodle, email, and Google Docs have been presented in this section in the form of a chronological narrative. This section has aimed to present the researchers observations of student engagement, behaviour and perceptions of the cloud assessment learning environment from an online perspective.

4.10 Online Activity Statistics

This section presents the online activity statistics from both Moodle, the LMS used for the IT Project Management paper and Google Docs. As mentioned in the previous section, student use of Moodle varied throughout the semester, usually spiking in relation to assessments. Within the class two main groups emerged, those who appeared to be actively engaging online, and those who were less active. Although Moodle activity was unique for each student, the following figures are representative of the general usage observed within the system from members of each of the groups.

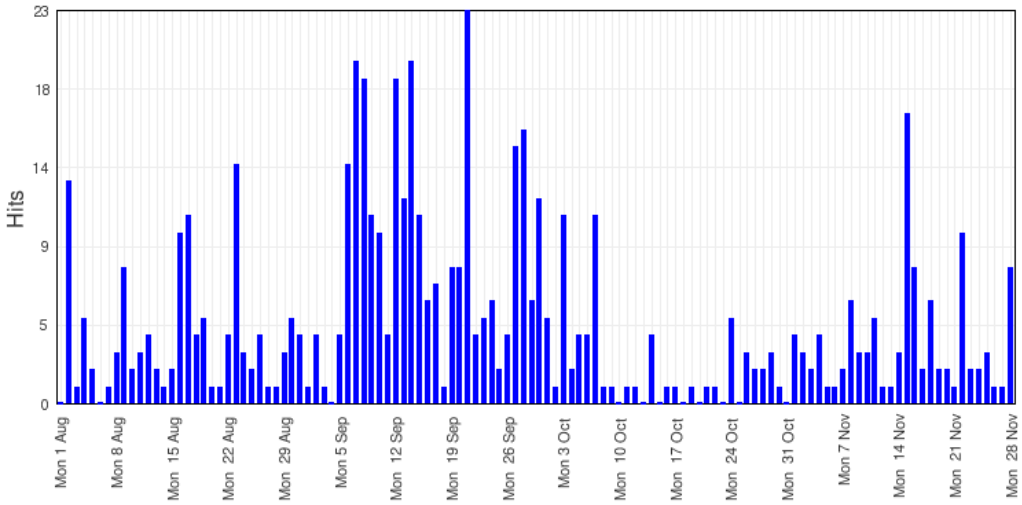

Figure 4.8 Sample Moodle Activity Log (Active)

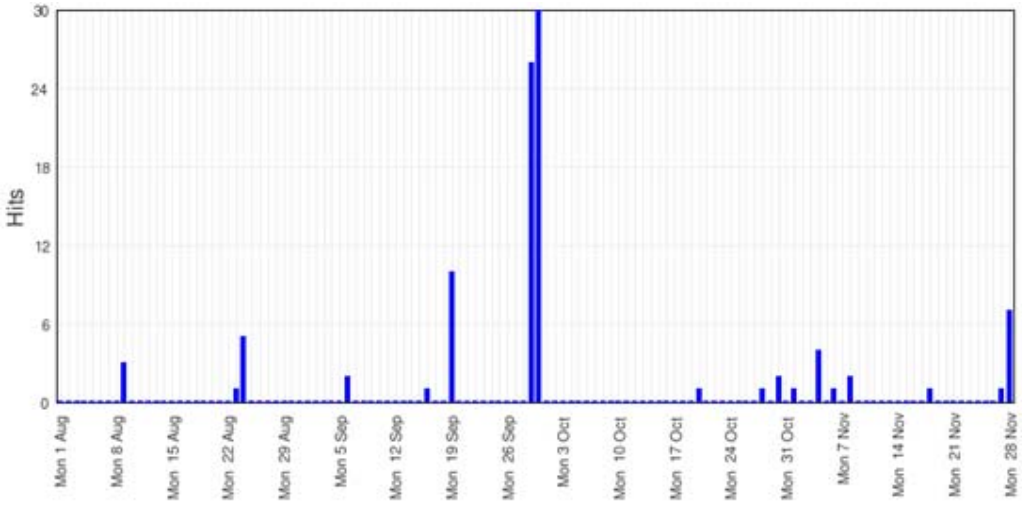

Figure 4.9 Sample Moodle Activity Log (Less Active)

Although the online Moodle activity logs can provide some interesting data, it is worth noting that the raw activity data is not a perfect representation of online engagement. A number of factors can skew the data and caution should be exercised when interpreting the results. For example, a student may access resources from Moodle and save them offline for future reference (i.e. to a USB pen drive), a practice which is relatively common amongst students. In this instance the student may be regularly accessing the resource however the activity would not be recorded within the Moodle activity logs due the resource being stored offline. Another limitation with online Moodle activity statistics relates to length of usage and intention, for example, a student who accidently accesses an online resource and then quickly closes it, will be recorded as having the same activity as a student who intentionally opens the same online resource and studies it in depth for an extended period of time. Nevertheless, the Moodle activity logs help by contributing some interesting data relating to online engagement and when combined with the other data within this study, help to develop a clearer picture of student online usage and activity.

The second major online activity statistics that will be presented relates to student usage of the cloud assessment learning environment. Throughout the four week assessment, the word count from each student assignment document was recorded on a daily basis. From this data four distinct groups emerged when overall word count over time was analysed. The figures following present the word count over time for each of these groups.

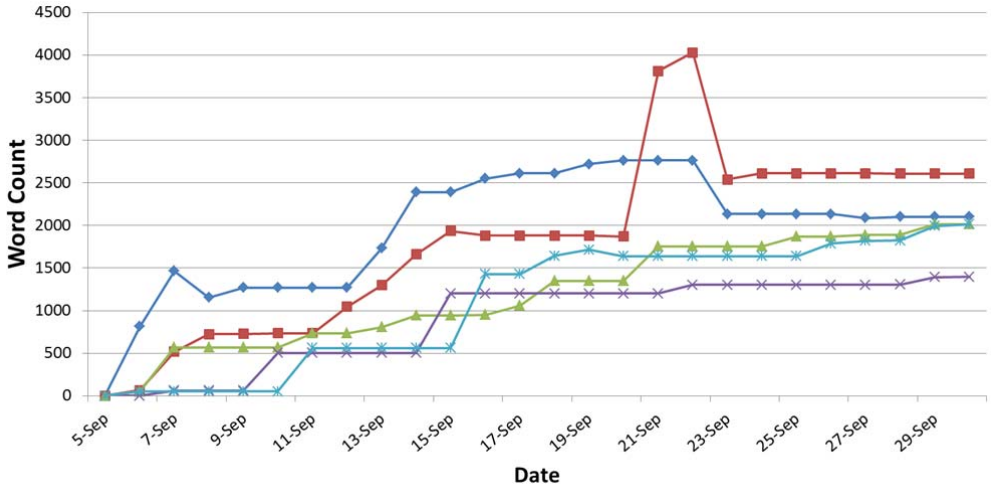

Figure 4.10 Early Starters Progressive Word Count

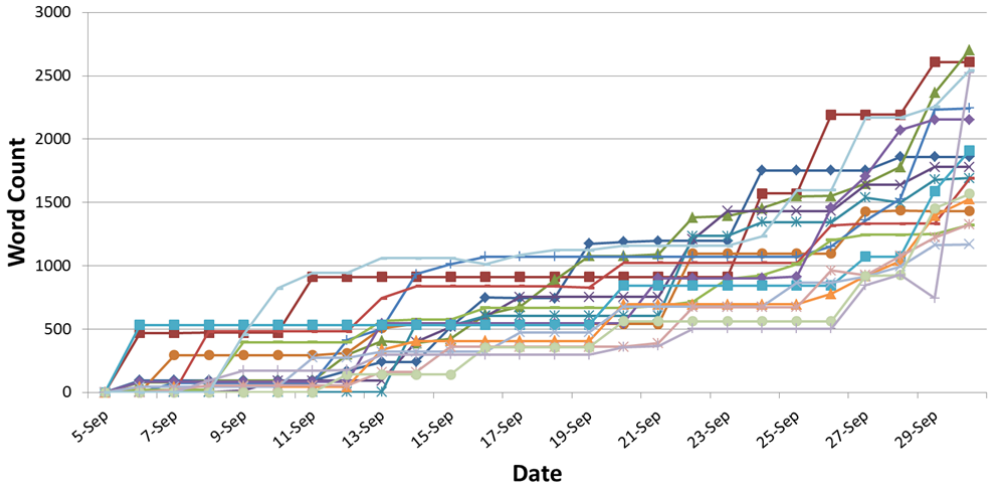

Figure 4.11 Gradual Workers Progressive Word Count

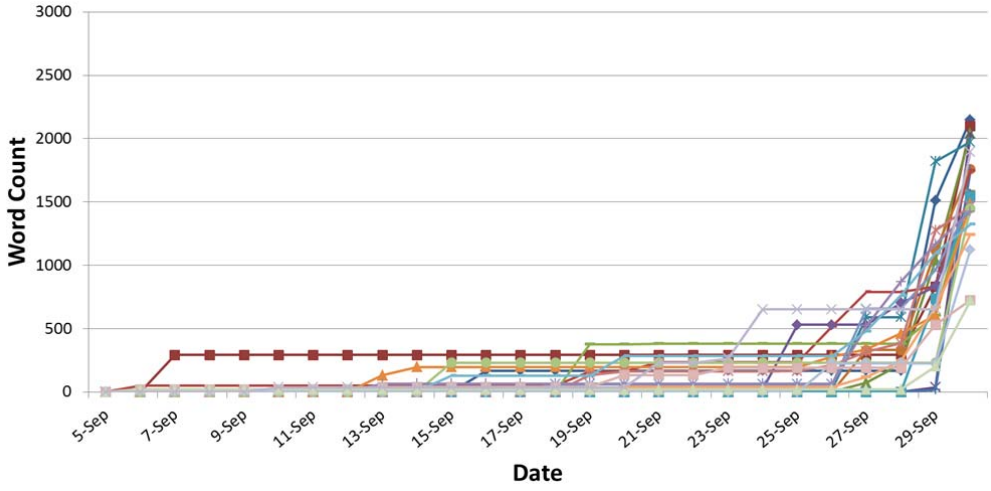

Figure 4.12 Late Workers Progressive Word Count

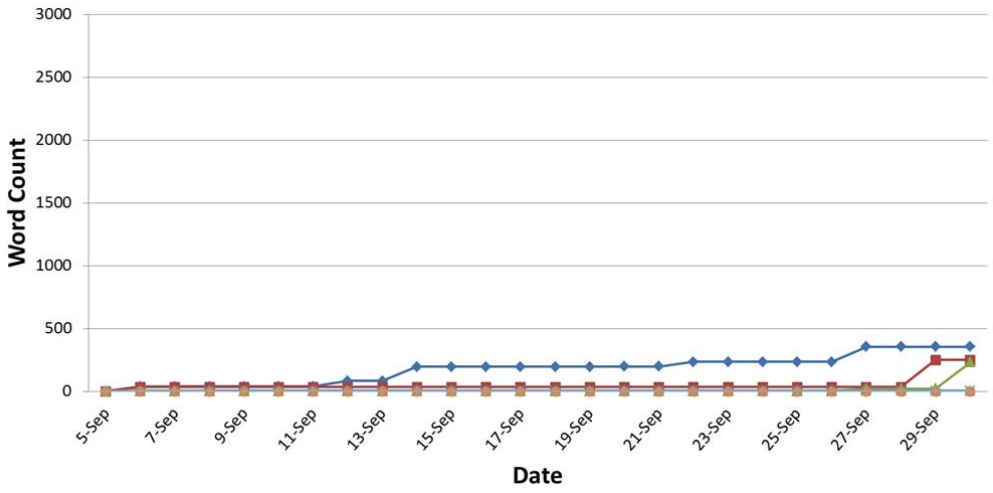

Figure 4.13 Incomplete Progressive Word Count

The first group consisted of five students, these were the students who started early and finished before the due date. The second group consisted of 17 students; these were students who gradually worked on the assessment over the four week period. The third group consisted of 23 students and were those students who left much of the assignment work until the end of the four week period. Finally the fourth group consisted of five students who did not complete the assignment. The following table provides summary statistics for the members from each group relating to final mean word count and the maximum, minimum and mean grades for each group.

Table 4.59 Word Count and Achievement Statistics

Group	Number of Students	Final Mean Word Count	Min Final Grade	Max Final Grade	Final Mean Grade
Early Starters	5 (10%)	2027	85.5%	95.5%	92.0%
Gradual Workers	17 (34%)	1886	63.0%	97.5%	80.0%
Late Workers	23 (43%)	1572	40.0%	89.5%	72.0%
Incompletes	5 (10%)	168	0.0%	33.0%	12.0%
Overall Class	50 (100%)	1554	0.0%	97.5%	70.0%

N = 50

Further statistical analysis also revealed that the final assignment word count was also correlated with the three main achievement variables: PMP assignment grade ($r = .808$, $p = <.001$, $n = 50$), overall I202 IT Project Management paper grade ($r = .691$, $p < .001$, $n = 50$), and student historical grade point average (GPA) ($r = .380$, $p = .007$, $n = 50$). These correlations will be reiterated in the achievement section and discussed in greater detail in the following chapter.

4.11 Attendance

Attendance records for all 50 members of the class were recorded for the entire semester. This included 16 lecture classes and 12 lab sessions which occurred before, during, and after students engaged with the cloud assessment learning environment. Overall student attendance for the semester ranged from 11% through to 100%. Table 4.60 presents a summary of the attendance statistics for the semester.

Table 4.60 Summary Class Attendance

Attendance Range	Lectures Only	Labs Only	Total
100%-75%	33	32	29
74%-50%	12	10	14
49%-25%	3	6	5
24%-0%	2	2	2

n = 50

The statistics reveal that the majority of students had reasonably high levels of attendance throughout the semester. Interestingly, when attendance is viewed over time a trend emerges which shows attendance levels varying throughout the semester in relation to the assessments. The following graph shows class attendance on a weekly basis over the course of the semester. Week four, twelve and sixteen involved in class summative assessments, while week six was the beginning of the PMP assignment.

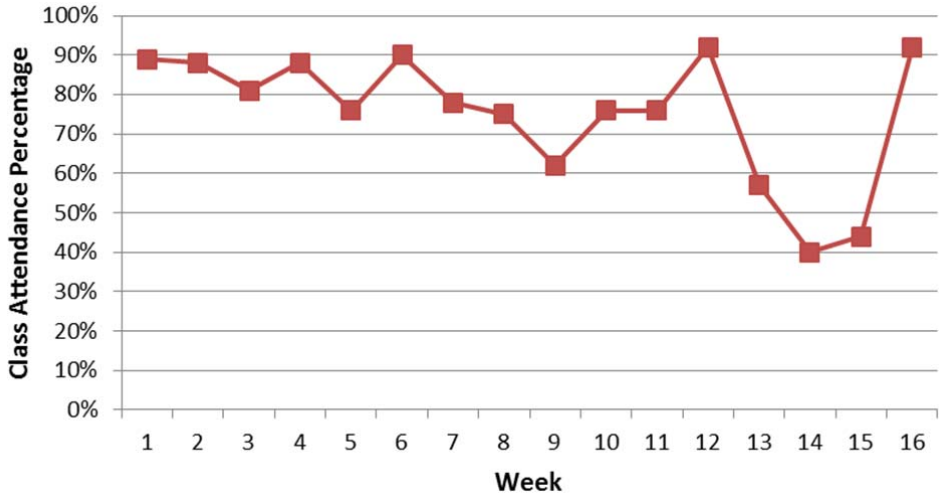

Figure 4.14 Weekly Class Attendance

The variance in attendance tends to suggest that a core group of students maintained high attendance throughout the semester, with a smaller group choosing only to attend

important, assessment related sessions. It is also interesting to note the significant drop in attendance during weeks 13-15. At this point in time students would have completed 70% of the summative assessments for the paper, with only a 30% Microsoft Project practical test remaining. The attendance trends may reflect a number of phenomena which will be discussed in greater detail in the following chapter, these include students attitude towards the subject, confidence towards achievement, as well as balancing workload amongst other enrolled papers.

Statistical analysis also revealed a number of weak significant positive correlations between attendance levels and some of the other quantitative data collected for this study. Variable tagged with (2) indicate scale results from the second administration of the CAQ. The implications of these correlations will be discussed in further detail in the following chapter.

Table 4.61 Attendance Correlation Statistics

Correlated Variable	r	p	n
PMP Grade	.316*	0.025	50
I202 Grade	.426**	0.002	50
GPA	.301*	0.034	50
Lecturer Monitoring (2)	.366*	0.020	40
Feedback (2)	.362*	0.022	40

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

4.12 Achievement

The spread of grades for the PMP assignment which was undertaken by the students in the cloud assessment learning environment are presented in Figure 4.15.

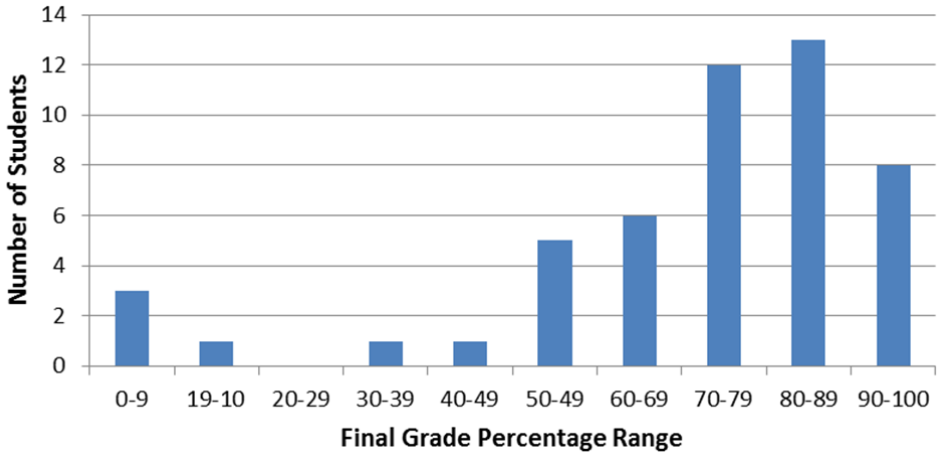

Figure 4.15 PMP Grade Distribution

Table 4.62 presents the final grades for the PMP assessment student by student, in addition the achievement levels for the other assessments in the paper, the overall final grade for the IT Project Management paper, and the academic history for each student has also been provided. The academic history has been condensed to show only students average final grade for all previous papers, i.e. the grade point average (GPA). Students have been numbered to maintain anonymity and have been ordered according to their PMP level of achievement.

Table 4.62 Academic Achievement Levels

Student	Summative Assessments				Overall I202 Paper Grade	GPA
	Project Brief Test	PMP Assignment	Theory Test	Practical Test		
Student 1	90.00%	97.50%	90.00%	100.00%	94.50%	97.74%
Student 2	80.00%	95.50%	94.50%	93.00%	93.50%	86.19%
Student 3	73.00%	94.50%	95.00%	99.00%	93.50%	90.87%
Student 4	67.00%	94.00%	91.50%	91.00%	89.50%	91.62%
Student 5	85.00%	94.00%	96.50%	97.00%	94.50%	95.49%
Student 6	53.00%	93.00%	77.50%	74.00%	79.00%	62.53%
Student 7	82.00%	92.50%	92.50%	97.00%	92.50%	90.59%
Student 8	57.00%	92.00%	80.00%	80.00%	81.50%	79.47%
Student 9	63.00%	89.50%	89.50%	81.00%	85.00%	91.01%
Student 10	62.00%	88.00%	79.00%	64.00%	77.00%	76.11%
Student 11	50.00%	88.00%	78.00%	93.00%	79.00%	69.95%
Student 12	75.00%	87.00%	89.50%	94.00%	88.00%	89.95%
Student 13	72.00%	85.50%	80.50%	84.00%	82.00%	85.10%
Student 14	65.00%	85.50%	78.00%	79.00%	79.00%	84.17%
Student 15	62.00%	84.00%	73.00%	70.00%	74.50%	72.05%
Student 16	68.00%	84.00%	80.00%	90.00%	82.00%	68.80%
Student 17	73.00%	83.00%	75.50%	71.00%	76.50%	76.97%
Student 18	80.00%	83.00%	70.00%	77.00%	76.50%	64.68%
Student 19	88.00%	82.50%	85.00%	94.00%	86.50%	82.61%
Student 20	52.00%	81.50%	52.50%	70.00%	64.50%	65.90%
Student 21	70.00%	81.50%	88.00%	89.00%	84.50%	77.81%
Student 22	75.00%	79.00%	75.00%	81.00%	77.50%	70.73%
Student 23	50.00%	79.00%	77.50%	77.00%	75.00%	69.79%
Student 24	53.00%	79.00%	77.50%	77.00%	75.50%	77.29%
Student 25	52.00%	78.50%	80.00%	79.00%	75.50%	80.04%
Student 26	75.00%	77.50%	63.00%	70.00%	70.00%	77.90%

Student 27	87.00%	77.00%	64.50%	94.00%	76.50%	81.14%
Student 28	43.00%	76.00%	59.50%	86.00%	68.00%	65.52%
Student 29	78.00%	75.50%	85.00%	96.00%	84.50%	70.21%
Student 30	65.00%	74.00%	82.50%	84.00%	78.50%	37.77%
Student 31	78.00%	73.50%	83.00%	87.00%	80.50%	72.61%
Student 32	23.00%	73.50%	79.00%	79.00%	72.00%	73.36%
Student 33	58.00%	71.50%	72.00%	0.00%	56.00%	74.04%
Student 34	42.00%	69.00%	63.00%	94.00%	69.00%	78.79%
Student 35	75.00%	68.00%	58.00%	69.00%	65.00%	51.04%
Student 36	63.00%	66.00%	75.00%	73.00%	70.50%	69.31%
Student 37	67.00%	65.50%	71.50%	97.00%	74.50%	71.29%
Student 38	73.00%	63.00%	75.00%	83.00%	73.00%	83.21%
Student 39	47.00%	62.00%	30.50%	40.00%	43.50%	46.65%
Student 40	57.00%	59.00%	72.00%	94.00%	71.00%	72.91%
Student 41	50.00%	59.00%	61.50%	69.00%	61.00%	74.39%
Student 42	55.00%	58.00%	67.00%	83.00%	66.50%	79.46%
Student 43	62.00%	56.00%	57.50%	77.00%	61.50%	63.34%
Student 44	62.00%	54.00%	67.00%	84.00%	66.00%	65.16%
Student 45	65.00%	40.00%	78.00%	93.00%	68.50%	62.85%
Student 46	45.00%	33.00%	0.00%	0.00%	14.40%	54.04%
Student 47	55.00%	18.00%	64.50%	81.00%	52.90%	52.27%
Student 48	70.00%	8.00%	57.00%	86.50%	50.00%	67.05%
Student 49	33.00%	0.00%	58.00%	0.00%	26.50%	37.47%
Student 50	40.00%	0.00%	22.50%	0.00%	13.00%	66.08%

Statistical analysis revealed a number of weak correlations that existed between student achievement levels and a selection of quantitative variables within the study. These correlations are presented in the following table and will be discussed in greater detail in the following chapter. Variables tagged with a (1) represent data collected from the first administration of the CAQ, accordingly, variables tagged with a (2) indicate scales from the second administration of the CAQ.

Table 4.63 Achievement Correlations Statistics

Achievement Variable	Correlated Variable	r	p	n
PMP Grade	Attendance	.32	.03	50
PMP Grade	I202 Grade	.85	<.001	50
PMP Grade	GPA	.60	<.001	50
PMP Grade	Attitude (2)	.34	.03	40
PMP Grade	Feedback (2)	.33	.04	40
PMP Grade	Word Count	.81	<.001	50
I202 Grade	Attendance	.43	<.01	50
I202 Grade	GPA	.66	<.001	50
I202 Grade	Attitude (2)	.39	.01	40
I202 Grade	Feedback (2)	.43	.01	40
I202 Grade	Word Count	.69	<.001	50
GPA	Attendance	.30	.03	50
GPA	Online Access (1)	-.36	.01	48
GPA	Preference (1)	-.40	.01	48
GPA	Word Count	.38	.01	50

4.13 Results Summary

This chapter has presented the results from eleven unique data sources: the LIQ and CAQ surveys, concept maps, class interviews, focus group interviews, lecturer descriptions, participant observations, virtual participant observations, online activity statistics, attendance, and achievement levels. When the eight scales from the LIQ (administered twice for both ideal and current lecturers), seven scales from the CAQ (administered twice), achievement variables, attendance records and other quantitative data from this study are considered, 55 unique quantitative variables are found to exist. Working with 55 unique variables allows for 1,485 possible analytical combinations, this is also without taking into consideration the researchers LIQ results or quantitative summations of the qualitative data sets (e.g. concept map concept counts, qualitative coding categorisation totals). Accordingly, an exhaustive analysis and presentation of all possible data combinations has not been conducted due to its inherent infeasibility. Instead, the results have been analysed, combined and presented in a way that was deemed appropriate to the study by the researcher. This appropriateness was guided by the relevance of the results to the research questions and significance of the results. As mentioned throughout the chapter, each of the data sources have provided consistent results relating to the various research variables in

this study. These consistent themes will form the basis of discussion in the following chapter.

It is also worth noting that additional data relating to the research sample was collected over the course of this study. This data included age, gender, and ethnicity. However, as these variables did not relate specifically to any of the key research questions, the data has not been presented in conjunction with the other results as it was deemed superfluous to the goals of this research. Furthermore, in the interest of completeness, the researcher did in fact involve these variables during the data analysis stage in case any notable trends emerged, in which case the findings would have been included. However, analysis did not reveal any significant or robust relationships between the presented data and the age, gender, or ethnicity variables.

Returning to the underlying research questions of this study, the results presented in this chapter have provided data relating to each of the variables present within the research questions. These variables included: instrument validity, perceptions of teacher-student interpersonal behaviour, perceptions of the cloud assessment learning environment, levels of achievement, computing confidence, and attitude towards subject. The first section of this chapter presented data relating to the first research question, that is, data relating to the validity of the LIQ and CAQ instruments used in this study. The LIQ results, lecturer descriptions, participant observations, as well as aspects of a number of the other data sources contributed data relating to the second research question which is focused on teacher-student interpersonal behaviour. The CAQ results, concept maps, class interviews, focus group interviews, participant observations, virtual participant observations, and online activity statistics have provided data relating to the third and fourth research questions (which are concerned with positive and negative aspects and changes in student understanding of the cloud assessment learning environment). In addition, the above mentioned results combined with attendance, assessment grade, and academic history contribute data specific to the fifth, sixth, and seventh research questions which are focused on the cloud assessment learning environments relationship with student achievement, attitude towards subject, and computing confidence.

In presenting the results, a number of common themes emerged from the various data sources. These included: an increase in lecturer helping and friendliness as perceived by students potentially caused by the cloud assessment learning environment, changing perceptions of the cloud assessment learning environment possibly caused by

intensive use and exposure to the environment, a difference in attitude towards the subject amongst the students, and an overall high level of computing confidence expressed by the majority of students in the research sample. As indicated throughout this chapter, these themes and the results in general will be discussed in further detail in the following chapter. These discussions will also further support the validity and reliability of the data through highlighting the consistent themes and results that have emerged across the different data sources.

Chapter 5 Discussion

The previous chapter presented the results from each of the data collection sources from within this study. This chapter will now present a discussion of the results in light of the research questions of this study. Particular attention will be paid to the common themes that emerged across the multiple data sources.

5.1 Validity

This section will discuss the results in terms of validity. Results deemed as significant will be compared and contrasted with those from previous studies (where possible) and also compared with similar findings from other data sources from within the study. The validity of the LIQ and CAQ as used within this study is an essential part of the first research question which asks if the instruments used in this study are valid and reliable when used with this research sample. Consequently, the validity of these instruments will now be discussed.

5.1.1 LIQ Scale Validity

One of the first results that stood out from the quantitative validity of the LIQ instrument was the Cronbach alpha reliability coefficients for each of the LIQ scales. As mentioned, the LIQ instrument was essentially a version of the QTI that had been adapted for the New Zealand tertiary environment. The adaptation involved the rephrasing of various items to make them more appropriate for New Zealand tertiary students. The Cronbach alpha reliability coefficients for each of the eight LIQ scales as reported in the previous chapter all fell within a statistically acceptable range (i.e. greater than .60). This result was found to be consistent with previous QTI studies and indicates that the LIQ is reasonable adaptation of the QTI and that it has retained an acceptable level of internal consistency commonly associated with the original instrument (Maulana et al., 2011; NeSmith, 2005; Stolarchuk & Fisher, 2001; Telli et al., 2007). Furthermore, of note was the coefficient for the Responsibility & Freedom scale which produced values ranging from .86 - .93. A number of previous studies that have utilised the QTI instrument have reported much lower corresponding coefficients, with the Responsibility & Freedom scale often producing the lowest Cronbach alpha reliability coefficient of all the scales. Coll, et al. (2002) reported a coefficient of .58, Telli, et al. (2007) reported a coefficient of .66, den Brok, et al. (2006) reported coefficients of .57, .58, and .61, Maulana, et al. (2011) reported a coefficient of .61, Stolarchuk and Fisher (2001) reported a coefficient of .59, and NeSmith (2005) reported a coefficient of .63. The .86 - .93 values achieved by the LIQ version of the Responsibility & Freedom scale suggest that the adapted version of the scale has

improved the internal consistency of the scale items. Table 5.1 shows the original Responsibility & Freedom items from the original Australian short form QTI instrument and the adapted items that were used in the LIQ in this study (items are taken from the Current Teacher/Lecturer version of the instrument).

Table 5.1 Responsibility & Freedom Scale Items (QTI vs. LIQ)

QTI Items	LIQ Items
1. We can decide some things in this teacher's class	1. We can decide some things in this lecturer's class
2. We can influence this teacher	2. We can negotiate with this lecturer
3. This teacher lets us decide when we will do the work in class	3. This lecturer lets students decide on what they do in class
4. This teacher lets us get away with a lot in class	4. This lecturer lets students decide when they work in class
5. This teacher gives us a lot of free time in class	5. This lecturer gives students a lot freedom in class
6. This teacher is lenient	6. This lecturer is flexible

As shown in the above figure, a number of items were not changed beyond using the term lecturer in place of teacher. However, the remaining items were changed to use slightly different language which was deemed more appropriate for the tertiary environment. Although the improved Cronbach alpha reliability coefficient for the scale suggests an improvement has been made to the internal consistency of the items within the Responsibility & Freedom scale, the researcher acknowledges that due to the size of the research sample used in this study it would be premature to conclude an absolute improvement to the scale has been achieved. Further testing of the adapted scale with a larger research sample would be required before such a generalisation could be justified (this will also be revisited in the final chapter).

Although some improvement was noted with the adapted version of the Responsibility & Freedom scale, the same cannot be said for the Impatience scale. The Impatience scale was originally titled the Admonishing scale in the QTI. Based on the results of this study, the Impatience scale achieved the lowest Cronbach alpha reliability coefficient values, ranging from .68 - .83, although these values are still statistically acceptable, on average they were not on par with the other scales within the instrument. Interestingly, of the six items within the scale, three were left unchanged (aside from replacing teacher with lecturer), two hard key terms replaced (e.g. mocking remarks

was replaced by insults), and one item was replaced. Nevertheless, the changes appear to have slightly lowered the internal consistency of the scale. However, as with the Responsibility & Freedom scale, further testing with a larger research sample would improve the reliability of this conclusion.

Overall, the internal consistency of each the scales within the LIQ were comparable with, and in some instances, were improvements over those values reported in previous studies. Although this study was limited from a statistical validity perspective by the size of the research sample, when combined with the results of previous studies, support is added to the notion that the LIQ instrument used in this study was valid and reliable in relation to its use within this study. Furthermore, as will be discussed in the following sections, the results from the LIQ's are also supported by findings from other data sources from within in this study. This correlation of findings across different data sources adds additional support to the validity and reliability of the LIQ instrument used in this study.

5.1.2 CAQ Quantitative Validity

Unlike the LIQ, the CAQ was not primarily adapted from an existing instrument. Specifically, the items relating to the cloud assessment learning environment (the main part of the instrument) were original. This was due to the uniqueness of the cloud assessment learning environment and the fact that no prior research had been conducted with this particular learning environment as the focus.

The Cronbach alpha reliability coefficients for each of the CAQ cloud assessment scales were all within a statistically acceptable range, i.e. above .60 (Nunnally et al., 1967). However, due to the fact this was the first time the instrument was used, these results cannot be compared to those reported on in previous studies. Fortunately, the results of each of the quantitative cloud assessment scales were also supported by short answer questions relating to the same scale. The combination of the Likert scale results and the short answer responses for each cloud assessment scales reveals student perceptions of each aspect of the cloud assessment learning environment were consistent from both quantitative and qualitative perspectives. This correlation adds support for the validity of the instrument as a whole. Furthermore, the perceptions that emerged from the CAQ results were again reiterated throughout the other data sources from within this study. These corresponding themes that emerged across the data sources add further support to the validity and reliability of the CAQ instrument and will be discussed in greater detail in the following sections of this chapter.

Although the cloud assessment section of the CAQ instrument was original, the quantitative Attitude Toward Subject and Computing Confidence scales included within the instrument were adapted from existing instruments. Consequently, the reliability coefficients for each of these scales can be compared to those reported in previous studies. The CAQ was administered twice and produced reliability coefficients of .85 and .87 for Attitude Toward Subject scale, these values are statistically acceptable and also compare with those reported in previous studies. For example, Ketelhut, et al. (2007) reported coefficients ranging from .80 to .93. The internal consistency results combined with the corresponding qualitative results add further supported to the validity and reliability of the CAQ instrument, and specific support to the Attitude Toward Subject scale.

Correspondingly, the Computing Confidence scale produced a coefficient of .85 for both administrations. Again, these values compare well with those reported in previous studies, for example, Newby (1998) reported a coefficient of .90, Okan (2008) reported a coefficient of .79, and Newby and Fisher (2000) reported a coefficient of .88. Again, these comparable results combined with corresponding qualitative results support the validity and reliability of the CAQ and specifically the Computing Confidence scale.

5.1.3 Validity Summary

The instruments used in this study have been shown to be valid and reliable from a statistical perspective as much as is possible given the limitation of this study. As mentioned, further validity will be provided through the triangulation of results across the other data sources from this study. Correspondingly, the validity and reliability of the data collected via the various methods used within this study will also be supported through this same process of triangulation and will be reiterated throughout this chapter.

5.2 LIQ

The LIQ results were the primary quantitative data source relating to teacher-student interpersonal behaviour which forms the basis of the second research question. The LIQ was administered to the research sample twice during the study, once prior and once after students had begun engaging with the cloud assessment learning environment.

5.2.1 The Student's Ideal Lecturer

Based on the results of the initial administration of the LIQ, prior to engaging with the cloud assessment learning environment, students described their ideal lecturer as

follows. An ideal lecturer is someone who is a good leader, helping and friendly, understanding, is not impatient, dissatisfied, or uncertain, and is moderately strict and gives students a moderate amount of responsibility and freedom. This description also reflected the lecturer's own view of an ideal lecturer (according to the lecturer's LIQ1 results).

Based on the results of the second administration of the LIQ, after students had been engaging with the cloud assessment learning environment, the collective student description of their ideal lecturer did not appear to change in any noticeably significant manner. The ideal lecturer was still a good leader, was helping and friendly, and understanding, was not impatient, dissatisfied, or uncertain, was moderately strict and gave students a moderate amount of responsibility and freedom. However, on an acute statistical level, scores for leadership, helping and friendly, understanding, and responsibility and freedom increased slightly, and the score for the strict scale decreased slightly. However, these changes were not found to be statistically significant. With reference to the lecturer's LIQ results, the same pattern emerged whereby the lecturer's perceptions of an ideal lecturer remained consistent with their initial perceptions (with only the responsibility and freedom scale experiencing a slight positive increase). Accordingly, due to the lack of any significant changes and the consistency of perceptions, the results suggest that the cloud assessment learning environment does not influence lecturer or student perceptions of their ideal lecturer and that in this instance, the lecturer and students had similar perceptions of the interpersonal behavioural characteristics of an ideal lecturer.

5.2.2 The Student's Current Lecturer

The results from the first administration of the LIQ provide a quantitative description of how the class perceived their current lecturer (i.e. the researcher). The research sample described their current lecturer as a good leader, helping and friendly, understanding, not impatient, dissatisfied, or uncertain, moderately strict and someone who gives students a moderate amount of responsibility and freedom. Interestingly, the initial results for students' ideal and current lecturers were very similar from a quantitative perspective. This indicates that initially, the researcher was reasonably close to what the students considered as an ideal lecturer.

Based on the result from the second administration of the LIQ, the quantitative description of how the class perceived their current lecturer remained consistent with the original description. Again, this also corresponded very closely to the results

relating to students ideal lecturer. A notable result was the consistently strong and significant correlation of scale means between final student perceptions of their ideal lecturer and their current lecturer. To reiterate, for the eight scales all correlated at the .01 level will all bar the Dissatisfied scale (p = .004) having a p < .001, this was also coupled with high values for r ranging from .43 for the Dissatisfied scale through to .75 for helping and friendly. These results suggest that at the time of the data collection, student perceptions of their current lecturer correlated closely to their perceptions of their ideal lecturer in terms of teacher-student interpersonal behaviour. This notion that the students current lecturer was very close to their ideal lecturer was also reflected in the qualitative lecturer descriptions collected from the focus group members (findings which will be discussed later in this chapter). Correspondingly, this theme also emerged from the participant observations where a number of students remarked that the researcher was their ideal lecturer. Again, this suggestion was also written by some of the students on the LIQ surveys. An obvious potential bias relating to this particular result should also be addressed. Due to the power relationship that existed between the researcher and the students (i.e. teacher student), it is conceivable that some students may have evaluated the researcher more favourably (i.e. they could feel uncomfortable communicating a negative opinion about the researcher to the researcher, as the researcher was also responsible for the grading of their assessments). However, based on experience, students at UCOL did not appear to be influenced by this bias, with students often comfortably voicing concerns regarding lecturer performance. Each semester, lecturer and programme evaluations occurred where students would often express areas where they perceived improvement was required. This freedom of student expression can also be seen as a reflection of the wider New Zealand tertiary environment culture. Nevertheless, to combat this potential bias within this study, the qualitative lecturer descriptions provided by the focus group members were entirely anonymous. Through this complete anonymity students were free to express opinions openly without any fear of reprisal, interestingly, the opinions shared through the lecturer descriptions did not deviate from the results produced by the other data sources, but in fact supported them. This suggests that the views expressed by students through each of the LIQ data collections were valid and reliable, and it is unlikely that they were influenced by the identified potential bias.

Although the LIQ results did not reveal any dramatic changes in student perceptions of their current lecturer pre and post engagement with the cloud assessment learning environment, a paired sample t-test revealed that there was a statistically significant

change in the perceived level of helping and friendliness. Of the eight scales, the helping and friendliness scale mean shifted the most by increasing by .19 during the second administration of the LIQ (i.e. after students began engaging with the cloud assessment learning environment they perceived their current lecturer as more helping and friendly) and was significant at the .05 level with p = .01. This significant change is particularly interesting when viewed in light of the literature, specifically Wubbles and Brekelmans (2005) review of two decades of research on teacher-student relationships in class where the authors state that "the QTI does not need to be administered more than once per year, since interpersonal style remains relatively consistent" (p. 11). This result suggests that the introduction of the cloud assessment learning environment may result in students perceiving their current lecturer as having a higher than normal level of helping and friendliness. Interestingly, this increased level of helping and friendliness can also be seen to emerge from a number of the other data sources within the study. From the researchers perspective this result was initially surprising, but after consideration and comparative analysis with the other results from this study, the result began to fit logically into the wider findings of the study for the following reasons. Due to the unique features of the cloud assessment learning environment the lecturer was able to provide more help during the assessment process, this help took the form of weekly general class feedback based on current progress as noted in the participant observations. The virtual participant observations also show that the lecturer was able to engage in a helping manner on an individual basis by providing in document feedback comments, and also by responding to in document questions posed by students. The CAQ results also show that students viewed the feedback and commenting features of the cloud assessment learning environment as positives, from both a quantitative and qualitative perspective (refer to the following section). Accordingly, in makes sense that while students are engaged in a cloud assessment learning environment they could potentially perceive their lecturer as having an increased level of helping and friendliness. However, it should be noted that the simple introduction of the environment will not increase perceived helping and friendliness, but more that the cloud assessment learning environment can enable lecturers to be more helping and friendly towards students if the environment is utilised effectively. This theme will re-touched throughout this chapter and concluded upon in chapter six.

5.2.3 The Lecturer's Perceptions

The study also involved the collection of the lecturer's (i.e. the researcher's) perceptions of teacher-student interpersonal behaviour both before and during

engagement with the cloud assessment learning environment. As was mentioned in the results chapter, the researcher is aware of the limitations imposed by using oneself as a data source. However, in the interest of completeness the data has been included, and through triangulation with the other data sources has been provided a level of validity.

It was interesting to note that the lecturer's self-perceptions with regards to teacher-student interpersonal behaviour were very similar to those produced by the students. That is, the lecturer perceived themselves as being a good leader, helping and friendly, understanding, not uncertain, dissatisfied, or impatient, mildly strict while providing students with a reasonable level of responsibility and freedom. This self-perception also remained relatively consistent throughout the study. However, it is interesting to note that the LIQ results suggest that the lecturer also felt a positive increase in their own level of helping and friendliness towards the students while engaging with the cloud assessment learning environment (an increase of .50 when compared to the pre engagement LIQ). In this sense, the lecturer's LIQ results are given a level of validity and reliability due to triangulation, as the results correspond well with the other data sources within the study (in particular the student LIQ results). Interestingly, the non-significant differences between the lecturer and student perceptions of the lecturer have been reported before in previous studies (Wubbels & Brekelmans, 2005). However, in their review of teacher-student relationships in class Wubbles and Brekelmans (2005) highlight that most studies show rather distinct differences in scale scores, with many teachers reporting higher ratings of their own leading, helpful and friendliness, and understanding behaviour than their students. In contrast, the lecturer in this study reported lower ratings in these same areas (excluding helping and friendliness during the second administration).

5.2.4 Teacher-Student Interpersonal Behaviour Summary

In terms of teacher-student interpersonal behaviour, the results suggest that the research samples perceptions of their current lecturer were very similar to their perceptions of their ideal lecturer. However, as this was consistent both before and after student engagement with the cloud assessment learning environment it appears that the introduction of the environment does not significantly impact student perceptions of their current lecturer in relation to their ideal lecturer. More interestingly, the results suggest that the cloud assessment learning environment does not significantly alter student perceptions of teacher-student interpersonal behaviour (beyond helping and friendliness) of either their ideal lecturer or their current lecturer. However, analysis of the slight changes in student perceptions of their current lecturer

based on the LIQ results suggest that while students are engaged with the cloud assessment learning environment they perceive their current lecturer as having an increased level of helping and friendliness. This was also reflected through the researchers own experiences as a participant observer where an increased level of interaction with students occurred during the cloud based assessment which was primarily facilitated by the cloud assessment learning environment. These results combined with data from other data sources suggest that the feedback and commenting features of the cloud assessment learning environment can enable lecturers to be more helpful to students in relation to the assessment.

5.3 CAQ

This section discusses the results from the *Cloud Assessment Questionnaire* (CAQ). The CAQ was administered twice, once prior and again after students had engaged with the cloud assessment learning environment. The results from the CAQ provide a depth of information relevant to the second, third, fourth, fifth, sixth and seventh research questions which all include the cloud assessment learning environment as key variable. The CAQ was a combined quantitative and qualitative instrument that focused on three main areas related to this study, the first and most significant (as mentioned) was the cloud assessment learning environment, however the CAQ also had sections focused on student attitude towards subject and computing confidence (variables specifically related to the sixth and seventh research questions). Accordingly, the results from these three parts of the instrument will be discussed in the following sections.

5.3.1 The Cloud Assessment Learning Environment

The results from the first CAQ provided insight into the research samples perceptions of the cloud assessment learning environment prior to engagement. Likewise, the results from the second CAQ provided insight into student perceptions after having engaged with cloud assessment learning environment. The CAQ included five sub sections relating to the cloud assessment learning environment and one section each for attitude toward subject and computing confidence. The pre and post engagement results will be now be discussed for each of these sections. Correlations between the cloud assessment scales and other variables within this study will be discussed later in this chapter in the respective sections of each of the correlated variables.

Monitoring

The quantitative results suggest that before engaging with the cloud assessment learning environment students viewed the feature of the environment that enabled

their lecturer to monitor their progress as slightly on the positive side of neutral. The short answer responses added depth to this statistic by revealing that the students had mixed opinions about this aspect of the environment with the majority of students expressing positive viewpoints which included non-specific positive remarks, and positive remarks with a specific focus, i.e. feedback, motivation, and helpfulness. However, a number of students also expressed concerns relating to this feature, these concerns included remarks relating to constant scrutiny, lecturer misunderstanding, lecturer inconsistency, and compulsion to change approach (i.e. start earlier than normal). Interestingly, this mix of opinions was also expressed through the initial class interview, the initial concept map collection, and participant observations of the research sample during the same time period. Overall, prior to engagement, students seemed positive regarding the monitoring features of the cloud assessment learning environment but also had some reservations relating to how it would be used in actuality.

After engaging with the cloud assessment learning environment the quantitative results reveal that the slightly positive view students had previously expressed, had significantly increased (from 3.57 to 3.98, $p = .04$). The short answer responses relating to this aspect of the environment also support this shift and reveal an increase in the number of positive written responses and a decrease in the number of concerned responses. The short answer responses appear to suggest that the majority of the concerns that were initially expressed had been alleviated through experience (i.e. initial fears did not become a reality and therefore were not expressed post engagement). Again, this increased acceptance of the monitoring aspect of the cloud assessment learning environment also emerged from a number of the other data sources including the second class interview, the second concept map collection, the focus group interviews, participant observations, and virtual participant observations. Overall, after having engaged with the cloud assessment learning environment students viewed the ability for their lecturer to monitor their progress as a positive.

When the first and second CAQ results are compared, a change in students understanding of the cloud assessment learning environment is suggested. Prior to engagement, students seemed curiously positive with some concerns relating to unknown elements of the environment. Through experience with the environment, the initial concerns appear to have been alleviated. Consequently, after having engaged with the environment students expressed less concerns and a more positive view of the

monitoring feature. As mentioned, this change was also expressed through other data sources which will be covered later in this chapter.

Google Docs

The Likert scale results from the first CAQ suggest that students initially viewed the use of Google Docs as an overall slightly positive aspect of the cloud assessment learning environment. The short answer results from the first CAQ support this slightly positive initial view. Interestingly, many of the positive responses appear to have come from students who had not used Google Docs before, but were expecting a positive experience. This initial positive expectation regarding Google Docs was also noted in a number of the other data sources including the initial concept maps, initial class interview, and participant observations.

In contrast to the quantitative scale results from the first CAQ, the results from the second CAQ suggest that students ended up viewing the use of Google Docs as an overall slightly negative aspect of the cloud assessment learning environment. A paired sample t-test revealed a statistically significant drop in the results relating to the quantitative Google Docs scale (from an initial score of 3.45 decreasing to 2.88, $p = .01$). This decrease of .57 was also the largest change out of the five cloud assessment scales. These results suggest that after engagement, student viewed the use of Google Docs more negatively than they had prior to engagement. The short answer responses also support this notion of increased negativity with the number of positive comments decreasing and the number of negative comments increasing (when compared to the results from the first CAQ). Although there still remained a comparable number of positive comments regarding the use of Google Docs post engagement, the contrast with the first CAQ results suggested the change represented an apparent shift in perceptions. One noticeable change in the short answer results was the obvious lack of expectantly positive comments. Having engaged with the cloud assessment learning environment, students were no longer in a position to express an opinion based on expectations, but instead were able to express opinions based on experience. Another noticeable change was the increased number of negative comments relating to the various limitations and bugs students had experience through their use of Google Docs. This overall change in perceptions regarding Google Docs was also reflected in other data sources including the concept maps, second class interview, focus group interviews, participant observations and virtual participant observations.

The change in student perceptions regarding the use of Google Docs within the cloud assessment learning environment is one of the most obvious changes observed in this study. This change in perceptions can be seen to stem from the difference that existed between student expectations and the eventual experience had by students. As mentioned, the first CAQ reported initial perceptions which were often based on the expectations of students who had not used Google Docs before, whereas the second CAQ reported perceptions based on first hand experiences that were still raw in the minds of students. The results suggest that many of the students initially had high expectations regarding Google Docs and unfortunately for many, it appears these expectations were not met.

Feedback

The early feedback mechanism made possible by the cloud assessment learning environment was viewed as a very positive aspect of the environment according to the scale results from the first CAQ. Based on the results from the first CAQ, the early feedback feature of the environment was viewed as the most positive out of the five cloud assessment sub scales. The short answer responses from the first CAQ also support this view with the overwhelming majority of comments being positive in nature, with only a few responses expressing a mixed view (e.g. conditionally positive so long as the feedback is appropriate). Interestingly, there were zero negative comments provided relating to this aspect of the cloud assessment learning environment.

The Likert scale results from the second CAQ were almost identical to the results from the first CAQ with regards to the early feedback aspect of the cloud assessment learning environment. Again, the results suggest that the early feedback mechanism was still perceived as very positive from a statistical standpoint (4.40 up from an initial 4.38). As with the first CAQ, the short answer responses from the second CAQ also support this positive view of the feedback mechanism. Interestingly, the early feedback mechanism within the cloud assessment learning environment is made possible by the collaborative features of Google Docs. In contrast to the results from the previous section, where through experience students perceptions of Google Docs became more negative, the results from this section indicate that student perceptions of this particular aspect of the cloud assessment learning environment are essentially unchanged and remain positive (despite the feedback aspect being a core feature of Google Docs). This unchanged positive view of the feedback mechanism of the cloud assessment learning environment is also expressed through a number of the other data

sources including the second class interview, the concept maps, focus group interviews, participant observations and the virtual participant observations. It is also worth noting that the feedback aspect was also the most commonly cited positive aspect of the cloud assessment learning environment.

When the first and second CAQ results are compared it becomes clear that the early feedback mechanism is viewed as a positive both before and after student engagement with the cloud assessment learning environment. In this instance, it appears the students had high expectations of the early feedback mechanism, and through experience felt those expectations were met.

Cloud Storage

The scale results of the first CAQ indicated that the online (cloud) storage and automatic submission aspect of the cloud assessment learning environment was also perceived as a positive by the research sample. The short answer responses also support this view with the majority of comments being positive in nature, many of which cite a perceived reduction in workload and reduced concern regarding the loss of work. The initial written responses also included a number of concerns regarding privacy and security factors related to the online cloud storage. This generally positive perception also emerged as a theme in many of the other data sources including the first class interview, first concept maps, and participant observations.

The results from the second CAQ were consistent with those from the first, and suggest that students continued to view the online storage aspect of the cloud assessment learning environment positively. However, it should be noted that there was a slight drop in the Likert scale results (4.30 down to 4.13), however this was not found to be statistically significant ($p = .37$). The written responses also remained consistent with those from the first CAQ however there was a slight drop in the number positive comments which was coupled with an increase in the number of students who elected not to provide a written response to the short answer cloud storage item in the second CAQ. It was interesting to note that a number of students expressed a degree of mistrust regarding the automatic saving feature of Google Docs. For this single aspect of the cloud assessment learning environment a number of differing themes emerged from the data, these included a positive view relating to the convenience and reliability of online storage, a mistrust regarding the automatic saving feature, and a generally positive view of the automatic submission feature. These themes can also been seen in

a number of the other data sources including the class interviews, concept maps, focus group interviews, participant observations, and virtual participant observations.

When the first and second CAQ results are compared with relation to the cloud storage aspect of the cloud assessment learning environment the results suggest that students had an overall positive view of this aspect, both before and after engaging with the environment. Although the reliability of the automatic saving feature was mistrusted by some students, the online storage and automatic submission features of the environment appeared to be viewed as a positive across the majority of the research sample.

Preference

The first CAQ revealed that from a statistical perspective, students did not have an overwhelming preference for the cloud assessment learning environment over a traditional approach. Interestingly, this seemingly neutral quantitative result becomes more complex when the short answer responses are considered. The written responses relating to preference indicate a mixed view was held by the members of the research sample with an almost even spread of positive, mixed neutral, concerned and negative responses. This mix of short answer responses also suggests that the quantitatively neutral result may have been caused by a levelling out of different opinions.

The Likert scale results from the second CAQ are slightly less favourable than the initial results, however they remain relatively consistent (2.96 down from 3.11). Again, when the scale results are viewed in light of the short answer responses, the same pattern emerges as was seen in with the results of the first CAQ. Interestingly, a slight change in qualitative responses was observed with the number of positive responses dropping slightly and the number of mixed and concerned responses increasing slightly. The main theme that emerged from the written responses was the notion that the idea behind the cloud assessment learning environment was good, however the implementation did not live up to expectations due to limitations and bugs experience within Google Docs.

Accordingly, when the results regarding preference from the first and second CAQ are considered it appears that students had varied views which seemed to ultimately depend on expectation versus experience. Those students who had experienced problems with Google Docs appeared to express a preference for a traditional approach

to assessment, whereas students who had had a good experience seemed to express a preference for the cloud assessment learning environment.

General Comments

The CAQ also included a short answer item that allowed students to express any other general comments about the cloud assessment learning environment. The majority of responses from both the first and second CAQ generally reflected the themes that have been discussed in the previous sections, often reiterating points previously made. However, a couple of noteworthy comments were in the second CAQ which involved two students specifically stating that their views had changed regarding the cloud assessment learning environment, changing from negative to positive. Interestingly, this change of perception was also expressed in a number of the other data sources including the focus group interviews, and participant observations.

Previous Usage and Value

As mentioned in the results chapter, the second CAQ also included a section that asked if students had used Google Docs before and if so what for, and also asked students if they felt the positives of using Google Docs for assessment outweighed the negatives. Interestingly, 16 out of the 40 respondents indicated that they had used Google Docs before. This highlights the fact that at least 24 members of the research sample had not used Google Docs before and therefore based their responses to the initial CAQ questions entirely on expectations. Likewise, at least 16 members of the research sample were able to draw on prior experience with Google Docs when responding to the first CAQ. Finally, the results relating to the benefits outweighing the negatives revealed that 50% of the respondents felt the benefits outweighed the negatives, 25% felt they were even, and 25% felt the negatives outweighed the benefits. These results when combined with the results previously discussed suggest that the cloud assessment learning environment was still considered a worthwhile approach to assessment despite the feature limitations and bugs experienced within Google Docs by many members of the research sample. Again, this theme of overall worthwhileness was also expressed through a number of the other data sources.

5.3.2 Attitude Toward Subject

The quantitative results from the first CAQ relating to student attitude towards the subject suggest that overall students had a slightly positive attitude towards the IT Project Management paper. The results from the second CAQ regarding student attitude towards subject were essentially the same as those from the first CAQ (3.63 in

both instances of the raw scale means and a variance of .05 with the paired sample t-test). Statistically, this suggests that engaging with the cloud assessment learning environment did not affect student attitudes towards the IT Project Management paper.

The scale correlation results (see Table 4.24) for both the first and second CAQ suggest that the initial attitude expressed by the students (as captured via the first CAQ attitude scale) did not show any significant signs of a strong correlation (positive or negative) with any of the cloud assessment scales. A weak correlation ($r = .29$, $p = .05$) was observed between the initial attitude results and students initial response to the lecturer monitoring scale. A moderate positive correlation ($r = .32$, $p = .05$) was also observed between the initial attitude results and the students final response to the Google Docs scale. Weak positive correlations were also observed between the final attitude expressed by the students (as captured via the second CAQ quantitative attitude scale) and the students final responses to the lecturer monitoring scale ($r = .34$, $p = .04$) and the benefits outweighing the negatives scale ($r = .33$, $p = .04$). Stronger more significant positive correlations were observed between the final attitude expressed by students and the students final responses to the feedback scale ($r = .46$, $p < .01$) and online access scale ($r = .51$, $p < .01$). These quantitative results suggest that a relationship could exist between final student attitudes toward the subject (post engagement with the cloud assessment learning environment) and their perceptions of the feedback and online access aspects of the environment. The correlation results also found a significant and strong positive correlation between students initial and final attitude towards subject results ($r = .70$, $p < .001$), this indicates that student attitudes towards the subject are closely related both before and after engagement with the cloud assessment learning environment.

The short answer responses reveal slightly more depth to the quantitative results by showing that the members of the research sample had two main views concerning the IT Project Management paper. 30% of respondents viewed the paper as enjoyable, something they would even elect to do if they paper had not been compulsory, while 40% of the respondents viewed the paper simply as necessary, and in some instance “a necessary evil”. These two main attitudes were also evident based on a number of the other data sources including the focus group interviews, participant observations, and were also alluded to by levels of student attendance and engagement. The qualitative results from the second CAQ were also consistent with those expressed in the initial CAQ which adds support to the notion that engagement with cloud assessment learning environment did not have an apparent impact on student attitudes toward the subject.

When the results relating to student attitudes toward the subject from the first and second CAQ are considered, it becomes apparent that two main attitudes existed amongst the members of the research sample, enjoyment and necessity. The results also reveal that these two distinct attitudes were consistent both before and after students engaged with cloud assessment learning environment suggesting that the environments introduction did not have an effect on student attitudes towards the subject (a suggestion than the scale results can also be interpreted to support). Finally, as mentioned this distinction of attitudes was also seen to emerge from a number of the other data sources.

5.3.3 Computing Confidence

The level of computing confidence expressed by students from the research sample was relatively high according to the scale results from the first CAQ. This overall high level of computing confidence was also expressed through the short answer responses relating to computing confidence. As mentioned previously, this was not unexpected as the research sample consisted of students from the second year of ICT degree. A number of the other data sources including the participant observations and virtual participant observations also provided data supporting this high level of computing confidence reported amongst the majority of the research sample.

The scale results from the second CAQ were consistent with those from the first CAQ with regards to students self-perceived level of computing confidence (4.18 and 4.21). The computing confidence scales from the first and second CAQ's were also found exhibit a strong, significant positive level of correlation ($r = .795$, $p < .001$, $n = 40$). Again, the short answer results remained consistent with the initial CAQ results and again supported the self-perceived high level of computing confidence expressed amongst the research sample. This theme of consistently high computing confidence also emerged from a number of the other data sources including the focus group interviews and participant observations. The consistently high level of computing confidence also suggests that engagement with the cloud assessment learning environment did not impact levels of computing confidence amongst the research sample.

In a similar fashion to the attitude towards subject results, the scale correlation results (see Table 4.24) for both the first and second CAQ suggest that student computing confidence levels did not show any notable signs of strong correlation (positive or negative) with any of the cloud assessment scales. The initial computing confidence

results showed a slight positive correlation with students responses to the first feedback scale (r = .35, *p* = .02). The final computing confidence results again showed a slight positive correlation with students responses to the first feedback scale (r = .39, *p* = .01) and student responses to the second online access scale (r = .33, *p* =.04). The correlation results also found a significant and strong positive correlation between students initial and final computing confidence levels (r = .80, *p* < .001), this indicates that student computing confidence levels are consistent both before and after engagement with the cloud assessment learning environment.

The short answer responses relating to computing confidence also supported the notion that the majority of the research sample had a high level of computing confidence both before and after engagement with the cloud assessment learning environment. Students felt that their computing skill level was generally higher than others (although some specified that it would depend on the area of computing in question), that they felt comfortable when working with computers, and would also feel comfortable teaching others how to use computers (although again, some specified that this would be area dependent). As with the scale results, the short answer results relating to computing confidence did not appear to change in any significant way as a result of the introduction of the cloud assessment learning environment.

Overall, that data indicates that a high level of computing confidence was held by the majority of the research sample both before and after engagement with the cloud assessment learning environment. This consistently high level of computing confidence as captured by the CAQ instrument suggests that for this research sample, engagement with cloud assessment learning environment did not impact on students self-perceived level of computing confidence.

5.4 Concept Maps

This section will discuss the results from the concept map data collections. The research sample members were given the opportunity to develop concept maps on two separate occasions. The first coincided with the first CAQ data collection, prior to student engagement with the cloud assessment learning environment, the second coincided with the second CAQ data collection, after students had finished engaging with the cloud assessment learning environment. Although the instructions and environment was consistent for both concept map data collections, the produced concepts maps varied quite noticeable between the first and second collections.

In total 24 out of 48 students elected to create concept maps during the first collection session. From the 24 concept maps a total of 86 concepts were produced with an average of approximately 3.5 concepts per map. The concept maps from the initial collection were overall positive in nature with 60% of the concepts being positive, 20% negative, 13% questions, and 7% neutral. The most common type of positive concept fell into the general positive category. These were non-specific positive concepts students associated with the cloud assessment learning environment (e.g. "Great idea", "Exciting and new", etc.) The second most common group of positive concepts were those related to the feedback mechanism. The two most common negative concept categories were internet reliability and limited features. It is worth noting the existence of concepts that fell into the 'questions' and 'neutral' categories, these concepts represented students who were either unsure about the environment or still had unanswered questions.

In contrast to the first concept map collection, 33 out of 40 students elected to create a concept map during the second collection session. It is interesting to note the significant increase regarding the response rate, 33 up from 24 or 82.5% up from 50%. This increase in the response rate suggests that after having engaged with the cloud assessment learning environment, members of the research sample had increased in their conceptual understanding of the environment. From the 33 concept maps a total of 171 concepts were produced with an average of about 5.2 concepts per map. Again, the increased average number of concepts per map also suggests that students had increased in their conceptual understanding of the environment. Interestingly, the literature indicates that missing concepts from a concept map often highlights a gap in the knowledge of the author (Dykstra et al., 1992), in this instance the lack of negative concepts in the initial concept maps is evidence of this knowledge gap. A noticeable shift in the distribution of responses was also observed during the analysis of the concepts from the second collection. Whereas the first set of concept maps were predominantly positive, the second set of concept maps were much more evenly balanced. The second set of concept maps included 50% positive concepts (down from 60%), 48.5% negative (up from 20%), 0.5% questions (down from 13%) and 1% neutral (down from 7%). Analysis of the positive responses revealed that student conceptual understanding of the positive aspects of the environment had become more specific. The first set of concept maps included a high proportion of non-specific general positive concepts. However, the second set of concepts maps included a much smaller proportion of non-specific positives, and a significant increase in the number of feature specific positives (e.g. feedback, accessibility, usability, online storage, etc.).

This increase in specificity suggests that after having engaged with the cloud assessment learning environment students had a clearer understanding of the specific aspects of the environment that they viewed as positives. Interestingly, in a loosely related study where concept maps were employed in a similar pre-test post-test design, student concept maps were also found to become larger and more specific post-test (Trent et al., 1998). It is also worth noting that even though there was an increase in the number of negative concepts, that the negative concepts were always included on concept maps which also included positives suggesting that students had mixed perceptions about various aspects of the environment. As noted, these themes also emerged in other data sources including the CAQ results, class and focus group interviews, and participant observations.

Another very noticeable change was the increase in negative concepts. The two most prominent negative categories were limited features and bugs. This increase suggests that after engaging with the cloud assessment learning environment students also had a clearer understanding of the specific aspects of the environment that they perceived as negatives. Finally, the significant drop in both the questions and neutral categories also suggest that through engagement with the cloud assessment learning environment students had had their questions answered and were no longer unsure how they felt about the environment. Again, these themes also emerged from other data sources including the CAQ results, interviews, and participant observations.

Based on a comparative analysis of the concept maps from both collection sessions a number of key themes have emerged surrounding student conceptual understanding of the cloud assessment learning environment. Initially, students were generally positive about the environment, however, there also existed some uncertainty and unanswered questions regarding the environment. After engaging with the cloud assessment learning environment the concept maps results suggests students conceptual understanding of the environment had changed. Post engagement, the initial uncertainty appears to have disappeared. Students had become more specific about what they perceived as positives within the environment. Likewise, students had also become aware of the limitations and the existence of bugs within Google Docs which they included as specific negative aspects of the cloud assessment learning environment. As mentioned, these themes are also reflected in a number of the other data sources from this study.

5.5 Class Interviews

Class interviews were conducted in conjunction with the CAQ and concept map data collections, i.e. prior to and post engagement with the cloud assessment learning environment. The results from the class interviews essentially reflect the key themes that also emerged from both the CAQ findings and the concept map results.

The first class interview was significantly shorter in duration than the second. This reflected the notion that initially students had a limited conceptual understanding regarding the cloud assessment learning environment. The comments that were raised during the first interview mainly consisted of general positives comments and questions about the environment. Again, this reflected the themes from the first CAQ and the first set of concepts maps, i.e. students were generally positive with hopeful expectations, yet still felt somewhat uncertain about some aspects of the environment.

As mentioned, the second class interview was noticeably longer in duration than the first. During the second class interview, more students engaged and what was discussed included greater detail than what had emerged from the first interview. This further supports the suggestion that conceptual understanding of the cloud assessment learning environment had increased amongst the members of the research sample. Interestingly, this also loosely corresponds to a related study that found student conceptual understanding increased and became more complex over time (Lahtinen & Pehkonen, 2012), although it should be noted that the study was focused on a different learning environment and subject area. Nevertheless, the first part of the class interview involved what can be described as initial venting session with a number of students expressing their frustration with aspects of the environment they saw as negatives, these comments were specific and related to bugs within Google Docs and feature limitations. Again, these themes also emerged in other data sources including the CAQ results, concept maps, focus group interviews, and participant observations. Interestingly, the venting session was also coupled with troubleshooting and workaround solutions for each of limitations discussed, this involved various members of the research sample commenting on how the resolved and or avoided each of the issues mentioned by other members of the class. Students also highlighted aspects of the cloud assessment learning environment that they perceived as positives. Interestingly, many of the students who had expressed their frustration were also the same students who were expressing their appreciation of the positive aspects of the environment. These themes also emerged in the CAQ results where individual students provided both positive and negative feedback, and also in the concept maps where

individual students developed concept maps with both positive and negative concepts. The most dominate positive appeared to be the feedback mechanism offered by the cloud assessment learning environment. The majority of the students also tended to agree with the notion that the positive aspects of the environment outweighed the negatives. As with the other themes that emerged, these positives were also seen throughout a number of the other data sources in the study.

5.6 Focus Group Interviews

Two focus group interviews were also conducted during this study and coincided with the second formal data collection (i.e. on the same day as the second CAQ, second concept map session, and second class interview). The focus group participants consisted of a total of 11 volunteers from the wider class (22% of the research sample). In a similar fashion to the class interviews, the focus group interviews again reiterated many of the themes previously discussed.

Students from both focus groups recounted various problems that they had experienced within the cloud assessment learning environment. These issues revolved around two main areas, the first being the limited feature set of Google Docs, and the second being bugs experienced with Google Docs. Interestingly, as the discussions unfolded the limited feature set did not appear to draw as much negativity as the bugs experienced with the system. It was interesting to hear that although students would have preferred more features, that they became content with the functionality available in Google Docs. However, the real frustration arose when the available functionality did not perform as expected (i.e. when bugs were experienced). This insight adds depth to the previously noted results that presented the limited features and bugs as negatives by highlighting that the bugs were perceived with greater disdain.

Students from both focus groups also highlighted a number of positive aspects of the cloud assessment learning environment that they had experienced. The first and most discussed positive focused on the feedback interaction enabled by the environment. Students shared that they valued the early feedback that they received through the commenting features in Google Docs. Interestingly, even students who had experience issues with the system remained positive about the environment due to the overall benefit they saw in the feedback mechanism. Students also noted that the increased interaction that the built in commenting and chat features of Google Docs allowed was a definite benefit. Again, this positive view also arose from a number of the other data sources. However, the insight from the focus group interviews added depth to this

theme by revealing that for some students, the benefit of the feedback commenting system was the main positive that helped outweigh the negatives.

The focus group interviews also revealed an interesting feeling students had with regards to the automatic submission of their assignment document. In a traditional approach to assignment based assessments students would be responsible for submitting their work which would normally take the form of uploading a document to the Moodle LMS. However, with the cloud assessment learning environment, come the due date and time, the lecturer would initiate the submission action by downloading each of the assignment documents. A number of students commented on this change in submission responsibility. From a negative perspective students noted that even when they felt that they had finished the assignment they did not feel a sense of closure. Interestingly, this perception also emerged for a related study that also utilised a cloud based word processor for assignment submission (Petrus & Sankey, 2007). Students noted that not being able to press a submit button left them feeling as if the assignment was still unfinished and that they were never 100% sure that their work had been received. On the other hand, students also saw the automatic submission in a positive light, noting that it enabled them to work right up until to the due date and time without having to stop early and allow time for uploading and submission. This was also a similar theme that emerged from the Petrus and Sankey study (2007). Students noted that this shift in submission responsibility also helped take some pressure off during the latter stages of the assessment. These themes correspond to those that have emerged from other data sources within this study, but again, the focus group interviews have added depth to these findings by revealing both perceived positive and negative aspects of the same feature of the cloud assessment learning environment.

Interestingly, one student from the second focus group also noted that the benefits of the cloud assessment learning environment depended heavily on the students approach to assessment. The student, a self-professed 'king of the last minute', appreciated the benefits of the cloud assessment learning environment, but noted that the benefits were of little value to himself (and other students) who elected to leave the majority of their assignment work until closer to the due date (thus reducing the timeframe in which the lecturer feedback can be utilised). It should also be noted, that even though this particular student shared this view, the student did actually take advantage of the early feedback mechanism through both the in document comments and in document chat features. The only difference was that this occurred over the last few days of the assessment, as opposed to gradually throughout the assessment

process. This perspective is interesting in the sense that it captures a view from a student who harnessed the cloud assessment learning environment in a different manner from the other focus group members.

The focus group interviews also included discussion around student attitudes toward the subject and computing confidence. An interesting split was noted in student attitudes towards the IT Project Management paper in both focus groups. For some students the paper was regarded as a 'necessary evil', a paper that they saw only as necessary due to the fact they had a final project to complete the following year at the conclusion of their studies. For other students, the paper was view as interesting and valuable even beyond their immediate studies. It was interesting to note that the students who valued the paper more highly and expressed a more positive attitude were some of the more mature students from the group. This split in attitudes was a trend also observed in the CAQ results. Similarly, the majority of the focus group students (i.e. all but one) expressed a very high level of self-perceived computing confidence. Some students even expressed the view that collecting data about computing confidence levels from computing students was seemingly redundant as they expected everyone in the class would share the same high level of confidence. Again, this overall high level of computing confidence also coincided with findings from the CAQ data collections and participant observations.

Overall, the focus group interviews results have further corroborated the themes that have emerged from the other data sources. Beyond simple agreement, the focus group interviews have also added depth to the results by revealing specific details related to many of the themes that have emerged from the data. The limited features of Google Docs, although perceived as a negative, were found to be not as detrimental as the bugs that students had experienced with the system. The feedback mechanism was also highlighted as the major positive of the environment. Both positive and negative perceptions of the automatic submission feature were also exposed. Finally, a unique perspective was provided by a student who represented members of the research sample who elected to leave the majority of their assignment work to the last minute. On the topic of student attitude toward subject and computing confidence, the focus group interviews provided further results that agreed with the CAQ findings.

5.7 Lecturer Descriptions

The lecturer descriptions were collected from the focus group participants and served as qualitative data sources to complement the LIQ findings. As mentioned, students

completed the lecturer descriptions for both their ideal lecturer and the current lecturer (i.e. the researcher) and were completely anonymous. The anonymity of the data collection was to ensure complete freedom of expression which would act as a validity and reliability balance for the LIQ findings. The written lecturer descriptions revealed that the researcher was very similar to what students perceived as an ideal lecturer. This finding also agrees with the LIQ findings that suggests the same student perception.

Interestingly, whereas the LIQ instrument was specifically focused on teacher-student interpersonal behaviour, the lecturer descriptions resulted in much broader evaluations of both an ideal lecturer and the students' current lecturer. In particular, the most commonly noted attribute of an ideal lecturer was that they be knowledgeable (i.e. knowledgeable of their subject area). This particular attribute does not related to interpersonal behaviour and consequently is not specifically measured by the LIQ instrument. This highlights a particular limitation of the LIQ and the QTI (the base instrument) in that they are focused on collecting data relating specifically to teacher-student interpersonal behaviour. Accordingly, although the LIQ and QTI instruments are able to provide detailed data relating to eight unique interpersonal behaviour scales, it can be seen that they are not complete measures of either an ideal lecturer or the students' current lecturer. Although outside of the scope of this study, the findings from this data source suggest that if a quantitative instrument were to be developed for the purposes of capturing data relating to the key attributes of a student's ideal lecturer and a student's current lecturer (beyond the dimensions of interpersonal behaviour) it would be worth including a scale relating knowledgeableness. Nevertheless, many of the characteristics attributed to both an ideal lecturer and the students' current lecturer in the qualitative descriptions can be seen to reflect the dimensions of the LIQ (i.e. Helpful, Understanding, Strict, Patient, etc.)

Overall, the lecturer descriptions provided to some extent a check and balance that agreed with the LIQ findings. The descriptions also allowed for a much broader description of lecturers which allowed students to express their opinions beyond the dimensions of teacher-student interpersonal behaviour. The descriptions were also completely anonymous which enabled complete freedom of expression from students. Interestingly, despite the anonymity the results still reflected those from the LIQ data which indicates that the potential bias identified in relation to the LIQ did not eventuate and the results were in fact a valid reflection of student perceptions.

5.8 Participant Observations

Participant observations were collected by the researcher throughout the entire semester with the students from the IT Project Management paper. These observations were divided into three main sections: prior to, during, and after student engagement with the cloud assessment learning environment. As a consequence, the participant observations also encompassed all of the other data collection activities that occurred throughout this study, accordingly emphasis was placed on those areas that fell outside of the other data sources. Nevertheless, the participant observations provided a valuable narrative of the study showing the linkage and progression of the student experiences throughout the semester. Accordingly, this resulted in interesting data relating to each of the key variables within this study, i.e. teacher student interpersonal behaviour, student perceptions of the cloud assessment learning environment (including perceived positive and negatives), changes in students conceptual understanding of the environment, student achievement, attitude toward subject, and computing confidence.

Regarding teacher-student interpersonal behaviour, the participant observations revealed interaction was initially quite limited. However, once students began engaging with the cloud assessment learning environment, interactions with students were observed to increase. In particular, a significant number of questions related to the assessment were asked by the students, and as students began to utilise the environment, interactions within the online cloud based environment were also seen to increase. The majority of interactions allowed the researcher to assist students with their assignment work. This finding also coincides with the suggestion made by the LIQ results that the student current lecturer (i.e. the researcher) was perceived as more helping and friendly during student engagement with the cloud assessment learning environment. Interestingly, after the completion of the assessment the level of interaction between the lecturer and students returned to levels similar to that observed during the first part of the semester.

Students were observed to have mixed perceptions regarding the cloud assessment learning environment. Initially, the members of the research sample appeared curiously excited about using Google Docs for their assessment, although a sense of uncertainty was also present. Nevertheless, despite many students having not used the system before, the majority of the class seemed positive about the new approach to assessment. As the assessment began to unfold it was interesting to note that the students began to almost simultaneously embrace and appreciate the enhanced

feedback and commenting interactions while at the same time express frustration regarding limitations and bugs experienced within Google Docs. By the end of the assessment, the students appeared to have formed very clear opinions regarding the cloud assessment learning environment. Students appeared to be in full agreement regarding the positive perception of the feedback and commenting features, and in equal agreement regarding the negative perception of the system's limitations and bugs. Interestingly, it appeared that the system bugs were perceived as a more significant negative than the system limitations. These positive and negative themes have also emerged from a number of other data sources including the CAQ results, concept maps, class interviews, focus group interviews, and virtual participant observations. The change in conceptual understanding where students were observed to develop a more refined conceptual understanding after having engaged with the environment also emerged from the CAQ results and concept map data.

Levels of student achievement proved to be an interesting variable to observe. Although specific data relating achievement levels will be discussed later in this chapter it is worth noting that the cloud assessment learning environment provided the researcher with a unique view into the development of each student assignment. Many of the high achieving students were observed to have higher levels of engagement and were also observed to begin their assignments earlier than less successful members of the research sample. These characteristics were also observed as indicators of a positive attitude towards the subject with many of these students engaging with the subject matter beyond assessment requirements (evidenced by additional discussions surrounding the wider subject of project management). However, it should also be noted that a number of students who did not display an overtly positive attitude towards the subject were still able to attain high levels of achievement. Again, this will be discussed in more detail in the achievement section.

The level of computing of computing confidence observed amongst the research sample was very high for the majority of the research sample. This high level of confidence was evidenced by students appearing extremely comfortable when interacting with various systems throughout the course of the semester. These systems ranged from those which were familiar, such as, the Moodle LMS, and the standard Microsoft Office application suite (e.g. Word, Excel, PowerPoint), through to unfamiliar systems, such as, Microsoft Project and the Google Docs cloud environment. It was interesting to note, that despite being unfamiliar with a particular system (e.g. Google Docs and Microsoft Project) students remained confident and felt more than comfortable to experiment

with the new systems. For example, some students were found to be experimenting with many of the advanced features of Google Docs within 30 minutes of first exposure. This high level of computing confidence was further exemplified by a lack of help required by the students in using the various systems. Although students sought help regarding assessments, the queries always related to the assessment content as opposed to the assessment tool. Furthermore, the lack of attendance and engagement by a large proportion of the class during the latter part of the semester (i.e. while Microsoft Project was being taught) was also coupled with a very high achievement rate by the entire research sample for the final practical test which revolved around the Microsoft Project software package. This lack of engagement and high level of achievement further supports the notion that students were very confident in their own ability to use, apply, and problem solve with a new piece of software. Interestingly, this same observation also served as an indicator of student attitudes towards subject, those who engaged during the latter part of the semester were also those students who were observed to have a more positive attitude towards the subject as whole. These themes will also be reiterated later in this chapter particularly in the attendance and achievement sections..

In summary, the participant observations served as unique data source within this study. The observations had the added advantage of encompassing all other data collection activities. For this reason, the researcher (i.e. the participant observer) was in an ideal position to gain a holistic understanding of all aspects of the study, and more specifically the relationship and interaction of the key variables unique to this study. Accordingly, these observations have been discussed with an emphasis on the themes that have emerged from each of the other data sources and have added further support to the validity and reliability of these findings.

5.9 Virtual Participant Observations

Like the participant observations, the virtual participant observations were made by the researcher over the course of the entire semester. However, the virtual participant observations were restricted to those interactions that occurred via the various online mediums utilised within the IT Project Management paper, these included the Moodle LMS, email, and Google Docs. The results of the virtual participant observations were also presented in a similar manner to the regular participant observations, before, during, and after engagement with the cloud assessment learning environment. Accordingly, the virtual participant observations provided a unique data source that

encompassed each of the key variables within this study and will now be discussed in the following sections.

For the first part of the semester, online interactions between the researcher and students were restricted to those possible via Moodle and email due to the fact students had not yet begun engaging with the cloud assessment learning environment. During this time, interaction was relatively limited with only a handful of emails being received from students. Students were also interacting with Moodle, however this access was minimal and did not directly involve the researcher (i.e. students accessing resources). Once students began engaging with the cloud assessment learning environment, the interaction levels began to increase. This increased interaction took the form of in document communication via the feedback commenting mechanism, use of the in document chat window, and increased assessment related emails. From the researcher's perspective, the cloud assessment learning environment had created a unique focal point of interaction with each member of the research sample. The majority of the interactions involved typical guidance, confirmation, and assistance type queries from the students. However, it appeared that these interactions were more frequent and involved a larger proportion of the class than the researcher had experienced with previous traditional assessment and other assessments within the paper. As mentioned previously, this theme has also emerged from a number of the other data sources within this study, and supports the notion that utilisation of the cloud assessment learning environment can result in lecturers being perceived as more helping and friendly by students.

From a solely online perspective, it was more difficult to discern student perceptions of the cloud assessment learning environment (as opposed to the regular participant observations). This was particularly the case prior to and after student engagement with the environment. However, while students were engaging with the environment, a number of perceptions began to be observed through the online monitoring of student work. From a positive perspective students began to embrace and appreciate the feedback commenting system made possible by the environment. This was evidenced by students seeking help through the medium and also through leaving 'thank you' comments (as various queries were addressed). From a negative perspective, a small number of students were also observed to leave comments indicating frustration with limitations and bugs experienced within the system. It was interesting to note that over the course of the assessment, many students had become more and more comfortable with the cloud assessment learning environment and had

learned how to best harness the environment given their individual requirements. Students had gained a clear understanding of how the environment worked and how it could be best utilised in order to assist in their completion of the assessment task.

The virtual participant observations revealed some interesting insights into aspects related to student achievement within the cloud assessment learning environment. In particular, students demonstrated four distinct approaches to the assessment task. A small group of motivated students were observed to begin the assignment work early, and as a consequence began embracing the positive features as well as experiencing the limitations of the environment early on in the assessment process. Each of these students went on to achieve at a reasonably high level. A larger group of students approached the assessment more gradually which also resulted in a more gradual exposure to the positive and negative aspects of the system. Again, each of these students attained a reasonably good mark for the assessment. Another large group of students were observed to leave the majority of the assessment work to the last few days of the assessment time frame. Consequently, these students were exposed to the positive and negative aspects of the system in a much shorter period of time. Interestingly, the level of achievement for this group of students ranged from very high down to unsuccessful. Finally, a smaller group of students did not sufficiently attempt the assignment in order to achieve a passing grade. Interestingly, from the researchers perspective it was impossible discern which students were electing not to attempt the assessment and which students were simply leaving the work until the last minute. These four particular approaches to assessment are also highlighted from a quantitative standpoint by the online activity statistics which will be discussed in the following section. Finally, although the students appeared to cluster into one of the four mentioned groups with regards to their approach to the assessment, it is worth noting that the level of assistance was relatively uniform. Although provided at different times throughout the assessment process, the queries asked by, and the assistance given to the students from each of the groups, was essentially the same across all three groups.

A number of virtual participant observations were also made that potentially reflect students attitudes towards the subject. First of all, student use of the Moodle LMS appeared to be limited for the majority of the class and was occasionally observed to spike directly prior to assessments and only involved the accessing of assessment related resources. Likewise, the majority of email communications with students were assessment related and were most common during student engagement with the cloud

assessment learning environment. As mentioned, the students were also observed to take varying approaches to the assignment work. These observations support the notion that for a lot of the research sample, the IT Project Management paper was regarded as a "necessary evil", a paper that they had to complete as part of their study requirements. However, as mentioned earlier, a smaller group of students were also observed to engage more with Moodle and also engage earlier with cloud assessment learning environment. This contrasting level of engagement aligns with a second identified attitude amongst the researcher sample where the IT Project Management paper was seen as an interesting and worthwhile paper in its own right.

Finally, the virtual participant observations provided further support for the suggestion that the majority of the research sample had a very high level of computing confidence. Students were observed to comfortably engage with the online resources and system related to the IT Project Management paper without any need of systems related assistance. Even when students experienced bugs within the Google Docs system, students were able to work around these limitations and bugs without any need of lecturer assistance. The students were confident in their own problem solving abilities.

Overall, like the regular participant observations, the virtual participant observations provided a unique insight into each of the key variables from this study. In particular, the virtual participant observations provided interesting information relating to student approaches to assignment work. A number of themes identified by other data sources within this study were also seen to emerge from the virtual participant observations. This correlation of findings between data sources provides further validity and reliability for each of the associated data sources.

5.10 Online Activity Statistics

The online activity statistics are essentially quantitative measures that complement the virtual participant observations. The statistics included Moodle Activity logs, and Google Docs usage statistics. As mentioned in the results chapter, the Moodle Activity logs show for the majority of students, activity spikes directly prior to each of the assessments in the paper. However, due to limitations of the data source, the Moodle Activity logs have been identified as a potential inconsistent data source (see results chapter). Nevertheless, the activity logs when combined with the other data sources in this study help to support a number identified themes. These themes included the two unique student attitudes towards the subject and the high level of computing confidence throughout the class.

The Google Docs usage statistics provide quantitative data that clearly shows the existence of the four different approaches taken by students with regards to the cloud assessment. These statistics reveal that 10% of the research sample belonged to the small group of early starters; these students produced on average the longest assignment documents and achieved on average the highest grades. 34% of the students were found to belong to the second group of gradual workers; these students produced on average the second longest set of assignment documents and achieved on average the second highest grades. 43% of students were seen to fall into the late starter category, these students produced on average assignment documents shorter than the first two groups, and also achieved on average lower than the first two groups. Finally, 10% of the students from the research sample were found to belong to category of students who did not complete the assignment task. Interestingly, analysis of the members from each group did not reveal a statistical relationship between the approach taken by students for the assignment and student attitudes towards the subject, computing confidence, or perceptions of the cloud assessment learning environment. Nevertheless, the Google Docs usage statistics (where word count was tracked over the course of the four week assessment) provided a very unique insight into student approaches to assignment. Although these identified approaches do not relate directly to any of the key variables within this study, they do appear to be related to student levels of achievement. It is also to this researcher's best knowledge the first time quantitative word count over time statistics have been recorded on a daily basis for an assessment for the purposes of educational research. This in itself sits as a unique contribution to the literature which will be revisited in the final chapter.

5.11 Attendance

Attendance for timetabled lecture and labs sessions was recorded for each member of the research sample over the course of the semester. The attendance records reveal that 58% of the research sample (29 students) attended 75% or more of the timetabled classes, a reasonably high level of attendance. For the rest of the research sample, 14 attended between 50% and 75%, 5 attended between 25% and 50% and finally, 2 students attended between 0% and 25% of the timetabled classes. Analysis of the attendance records versus the final assessment grade did not reveal a statistical relationship. Interestingly, the student with the lowest level of face-to-face attendance (11%) ended up achieving a grade 73.5% for the cloud based PMP assessment. Likewise, a student with very high attendance (93%) ended up achieving one of the lowest grades for the assessment, 18%.

Analysis of the attendance records however does show a very clear pattern where overall student attendance would spike directly prior to summative assessments. Five of the seven most highly attended weeks throughout the sixteen week semester were directly related to summative assessments, with the other two being weeks one and two of the semester. This pattern of attendance also coincides with the observed levels of engagement from both the participant observations and virtual participant observation data sources.

The students with the lowest attendance levels were also identified through observation as those students who seemed to have a relatively low interest level in the IT Project Management Paper. However, statistical analysis did not reveal any significant positive or negative correlations between attendance, attitude scale results, or computing confidence scale results. This is interesting from a statistical perspective as it suggests that attendance is not related to student attitude towards subject, or computing confidence for this particular research sample. Interestingly, a weak positive correlation was found between attendance and assessment grade ($r = .32$, $p = .03$, $n = 50$), attendance and final perceptions of lecturer monitoring ($r = .37$, $p = .02$, $n = 40$), and attendance and final perceptions of the feedback mechanism ($r = 3.6$, $p = .02$, $n = 40$). These correlations suggest that a relationship may exist between attendance and achievement, and also attendance and aspects of the cloud assessment learning environment, specifically student perceptions of the lecturer's ability to monitor progress and the feedback mechanism. Interestingly, both the lecturer monitoring and feedback aspects of the cloud assessment learning environment both involved lecturer and student interaction which suggests that those students who engaged and attended more were also more likely to appreciate the monitoring and feedback mechanisms. This notion was also found to emerge through the participant observations and virtual participant observations where students with higher levels of engagement and attendance were also the students who were found to be the most interactive in terms of face-to-face and online assessment activity.

5.12 Achievement

The final assessment grades for the PMP assignment (which students completed using the cloud assessment learning environment) did not reveal anything overly unusual (i.e. students achieved results consistent with their previous performance). However, the results did reveal a couple of outliers which will now be discussed.

Student 6 (i.e. the student with the sixth highest final grade for the PMP assignment) achieved a final assessment grade of 93%. Interestingly, this student achieved noticeably lower grades on the other four summative assessments within the paper (53%, 77.5%, and 74%) and ended the semester with an overall grade of 79%. It was interesting to note that this student also had a relatively low attendance level of 57%, and also left the majority of their assignment work until the last few days before the assessment due date. However, Student 6 was noted as taking significant advantage of the cloud assessment learning environment features over those last few days, this took the form of using the Google Docs commenting system and in document chat mechanism to seek guidance from the lecturer. The guidance given to the student was also equivalent to the assistance given to many of the early starting students who sought help through face-to-face means and the Google Docs commenting mechanism. In this instance, it can be seen that the cloud assessment learning environment enabled Student 6 to seek assistance in a way that a traditional assessment environment would not have facilitated.

Conversely, Student 48 achieved a final grade of 8%, the third lowest grade achieved by the research sample. However, Student 48 had achieved relatively well on the previous summative assessment for the paper (70%) and went on to achieve reasonable grades in the following two summative assessments (57% and 86.5%). Interestingly, in contrast to Student 6, Student 48 had a relatively high level of attendance (89%). However, observations revealed that Student 48 did not embrace the cloud assessment learning environment to the same extent as many of the other students in the class. Interestingly, up until the last day of the assessment the student still appeared to have the intention of completing the assessment with the following commenting being left in the document:

> "Just letting you know that if I don't successfully complete it today, I'll have it handed in by tomorrow. Thanks :)" - Student 48

However, this was the only student initiated comment, and beyond this no assistance was sought regarding the assessment.

Statistical analysis of the achievement variables revealed some moderate to strong, significant correlations. The PMP grade was correlated with the overall I202 IT Project Management Paper grade ($r = .85$, $p < .001$, $n = 50$), this is not surprising primarily due to the fact that the PMP grade contributed a 30% weighting towards the overall I202 Paper grade. The PMP grade was also found to correlate with the historical student

GPA (r = .60, p <.001, n = 50), this correlation potentially suggests that student achievement levels within a cloud assessment learning environment are reasonably consistent to achievement levels in traditional assessment learning environments. Accordingly, the overall I202 Paper grade was also found to correlate positively with student GPA (r = .66, p <.001, n = 50). A strong positive correlation was also found between the PMP grade and final PMP word count (r =.81, p <.001, n = 50), again this is not surprising as the two variables are intrinsically linked as the PMP grade is based on the words included within the PMP, although quantity does not equal quality, in this instance the correlation appears to suggest that final word count is potentially a good indicator of final achievement for this assessment.

Further statistical analysis of the achievement variables in conjunction with the remaining quantitative variables within the study did not reveal any statistical correlations as strong as those previously mentioned. However, the analysis did reveal several weak positive correlations, these were between PMP grade and attendance (r = .32, p = .03, n = 50), I202 Paper grade and attendance (r = .43, p < .01, n = 50), PMP grade and final student attitude towards the subject (r = .34, p = .03, n = 40), I202 paper grade and final student attitude towards the subject (r = .39, p = .01, n = 40), PMP grade and final student perceptions of the feedback mechanism (r = .33, p = .04, n = 40), and I202 paper grade and final student perceptions of the feedback mechanism (r = .43, p = .02, n = 40). These correlations suggest that three potential relationships relating to achievement could exist with relation to the cloud assessment learning environment. These potential relationships that could exist are between achievement and attendance (as discussed in the previous section), achievement and students attitude towards the subject, and achievement and a specific aspect of the cloud assessment learning environment (i.e. the feedback mechanism). The notion that achievement could be related to attitude is also indirectly supported through the participant observations and virtual participant observations where students who appeared to have more positive attitudes were noted as spending more time on the assessment task (which in theory should produce higher quality work). The possible relationship between achievement and student perceptions of the feedback mechanism is also supported by the other data sources where students frequently cited the feedback mechanism as a helpful and valuable aspect of the system. Accordingly, the help received would likely enable students to improve the quality of their work which could in turn improve the eventual level of achievement.

Statistical analysis also revealed two peculiar correlations between GPA and initial student perceptions of aspects of the cloud assessment learning environment. GPA was found to have a weak significant negative correlation with students initial perceptions of the online access aspect of the environment (r = -.36, p = .01, n=48). GPA was also found to have weak significant negative correlation with initial student perceptions of assessment environment preference (r = -.40, p = .01, n = 48). It is interesting to note that this correlation was only present in the initial student perceptions, when the GPA is contrasted with the same scales from the second CAQ quite different statistics emerge, i.e. GPA and final perceptions of online access (r = -.10, p = .53, n = 40), and GPA and final perception of assessment environment preference (r = -.14, p =.40, n = 40). These two negative correlations that exist only in the initial perceptions could be a reflection of the students who were observed to be initially unsure about the new assessment learning environment, who in time came to appreciate the benefits of the new approach. The relationship to GPA could potentially suggest that students who achieved well in previous traditional assessment environments may have initially preferred to stay with a traditional environment where they had a proven track record of success.

In reviewing the correlation findings as they relate to achievement it is what is not shown that in some ways emerges as significant. That is, apart from the feedback mechanism, achievement levels were not found to correlate with any of the other aspects of the cloud assessment learning environment. This suggests that student perceptions of their lectures ability to monitor their progress, Google Docs as a word processing tool, online access and automatic submission, and preference of the cloud assessment learning environment over traditional assessment environments are not related to achievement for this research sample.

5.13 Discussion Summary

This section has presented a discussion on the results of this study. The results have been discussed in light of the key variables from each of the research questions. For each unique data source included within this study, emerging themes that related to the research questions have been discussed, themes that have emerged from multiple data sources have also been noted.

The first research question which is focused on the validity and reliability of the instruments used within this study has been addressed throughout this chapter. The quantitative validity results for both the LIQ and CAQ were discussed. The LIQ results

were found to be comparable to previous related QTI results, a potential improvement to the Responsibility and Freedom scale (which was adapted for this study) was also discussed. The quantitative validity results for the CAQ were also found to be statistically acceptable and further validated through the correlation of quantitative and qualitative results. The consistency of results across the multiple data sources within this study also helped support the validity and reliability of the instruments used within this study.

The second research question which relates to the teacher and student perceptions of teacher-student interpersonal behaviour has also been addressed through multiple data sources throughout this chapter. The quantitative LIQ results provided data relating to teacher and student perceptions before and after engagement with the cloud assessment learning environment. The LIQ results revealed the first suggestion that the cloud assessment learning environment may impact perceptions of the current lecturer's level of helping and friendliness. This theme was also supported by the quantitative and qualitative CAQ results which indicated students had a positive perception of the feedback mechanism within the environment, a feature which enhances the lectures ability to help students. The improvement in helping and friendliness was also supported by the concept maps, lecturer descriptions, class interviews, focus group interviews, participant observations, virtual participant observations, and online activity statistics. Aside from the change in helping and friendliness, the results did not appear to suggest any other significant differences in teacher and student perceptions of interpersonal behaviour either between teacher and student or before and after engagement with the environment.

The third research question asked if there were aspects of the cloud assessment learning environment that students perceived as either positive or negative. This research question has been addressed through a number of data sources including the quantitative and qualitative CAQ results, concept maps, class interviews, focus group interviews, participant observations and virtual participant observations. The main themes that emerged across each of these data sources were the positive appreciation of the feedback mechanism, mixed perceptions relating to online storage and automatic submission, the negative inconvenience caused by the limited features offered by Google Docs and the more significant negative frustration that resulted from bugs experienced by students while using Google Docs.

The fourth research question has been addressed through the provision of data relating to changes in students conceptual understanding of the cloud assessment learning environment. The repeated data collections for a number of data sources within this study allowed for a comparative before and after engagement analysis, this provided both quantitative and qualitative measures of changes in student perceptions. The study revealed that a consistently high, unchanging perception existed amongst the research sample regarding the positive appreciation of the feedback mechanism. The study also revealed that many students became less positive about Google Docs as a tool as a result of having engaged with the cloud assessment learning environment. The overall conceptual understanding of students regarding the cloud assessment learning environment was also seen to change over the course of the assessment. Originally student perceptions were generally positive and based on expectations, whereas as the end of the assessment student perceptions reflected a mix of positive and negative views relating to different aspects of the environment and were based on experience.

The fifth, sixth and seventh research question ask if there is a relationship between student perceptions of the cloud assessment learning environment and the level achievement, attitude towards the subject, and level of computing confidence. Again, multiple data sources provided data relating to student perceptions of the cloud assessment learning environment and additional data was also provided by the attitudinal and computing confidence scales from the CAQ instrument, and individual student attendance, achievement, and academic history records. Interestingly, no statistical relationship was found between student perceptions of the cloud assessment learning environment, level of achievement, attitude towards the subject, or computing confidence. Finally, the next chapter will systematically address each of the research questions in light of the results that have been discussed in this chapter.

Chapter 6 Conclusion

This thesis set out to investigate student perceptions of the cloud assessment learning environment. Chapter one introduced the study and provided background information relating to the origin of the study, the environment in which the study took place, the technologies involved with the study, the significance and limitations of the research, an overview of the research methodology and the underlying research objectives. The second chapter presented a literature review which sought to examine previous research relating to the key variables under investigation in this study. These included cloud computing, cloud computing in education, learning environments, teacher-student interpersonal behaviour, conceptual changes in understanding, achievement, attitude towards subject, and computing confidence. The third chapter presented the methodology used for this study. The methodology detailed a multi method approach that would result in multiple data sources relating to each of the key variables within this study, data which would be consequently used to address each of the research questions outlined in the first chapter. Chapter four presented the results from the data collection phase of this study. The results included both quantitative and qualitative findings from each of the multiple data sources outlined in the methodology chapter which included the LIQ results, CAQ results, concept maps, class interviews, focus group interviews, lecturer descriptions, participant observations, virtual participant observations, online activity statistics, attendance records, and achievement levels.

The previous chapter discussed the results presented in chapter four and highlighted the key themes that had emerged across the data sources that related to the research questions of this study. This chapter will now address each of the research questions by providing concluding remarks in light of the previously discussed findings. Final remarks relating to this study will also be made which will include a summary of limitations, avenues for future work and contributions made to academia.

6.1 Research Findings

This section will now systematically address each of the following seven research questions:

1. Are the instruments used in this study valid and reliable when used with this research sample?
2. Are there differences in teacher and student perceptions of teacher-student interpersonal behaviour in the cloud assessment learning environment?

3. What factors of the cloud assessment learning environment do students perceive as positive and negative?
4. Is there a conceptual change in student understanding of the cloud assessment learning environment over time?
5. Is there a relationship between student perceptions of the cloud assessment learning environment and their level of achievement?
6. Is there a relationship between student perceptions of the cloud assessment learning environment and their attitude towards the subject in which it is used?
7. Is there a relationship between student perceptions of the cloud assessment learning environment and their level of computing confidence?

6.1.1 Instrument Validity and Reliability

The first research question asked if the instruments used within this study were valid and reliable when used with the research sample. The two main instruments used in this study were the LIQ (an adapted version of the QTI), and the CAQ. Beyond these two instruments, data was also collected via a number of different means, these included: concept maps, class interviews, focus group interviews, lecturer descriptions, participant observations, virtual participant observations, online activity statistics, attendance records, and achievement levels.

The scales from the LIQ were shown to be valid and reliable based on the Cronbach alpha reliability coefficients. The internal consistency values for each scale fell within statistically acceptable ranges, were comparable to previous studies and in some instances showed improvements over previous findings. In particular, the Responsibility and Freedom scale was found to have Cronbach alpha coefficient values ranging from .86 - .93 which were noticeably higher than those reported in previous studies in Science and Mathematics learning environments (Coll et al., 2002; den Brok et al., 2006; Maulana et al., 2011; NeSmith, 2005; Stolarchuk & Fisher, 2001; Telli et al., 2007). In fact, the Student Responsibility and Freedom scale was consistently found to provide the lowest Cronbach alpha values out of all of the QTI scales (see discussion). This potential improvement to the Responsibility and Freedom scale will also be discussed further in the Implications and Contributions section of this chapter. The validity and reliability of the LIQ instrument was further supported by consistency of themes that emerged from both the quantitative LIQ results and numerous other data sources from the study.

The CAQ instrument also included a number of quantitative scales, five relating to specific aspects of the cloud assessment learning environment, and one each relating to computing confidence and student attitude towards the subject. The five cloud assessment learning environment scales were found to have acceptable levels of internal consistency with Cronbach alpha values ranging from .71 to .97. The computing confidence and the attitude towards subject scales were also found to have statistically acceptable levels of internal consistency which were also comparable to previous studies. However, due to the fact the cloud assessment learning environment scales were unique to this study no previous research was available to compare internal consistency results (for this specific environment). The contribution this study makes is a strong one in this sense and it is hoped that the results from this study may serve as a benchmark until further studies are conducted in this unique learning environment. Nevertheless, each of the scales within the instrument (including the computing confidence scale and the attitude towards subject scale) were also coupled with an associated short answer question, the results indicated consistency within data reported for each of the corresponding scales. This direct consistency in the outcomes from the qualitative and quantitative results further supports the validity and reliability of the CAQ instrument from both perspectives. The themes that emerged from the CAQ results were also found to emerge from multiple other data sources within the study which again provides support for the validity, internal consistency and reliability of the CAQ instrument.

A key strength of this study can be seen in the utilisation of multiple data sources to provide a broader as well as a deeper view of the learning environment and the participants who inhabit it which has been used to address each of the research questions. Comparative analysis of these data sets revealed a number of recurring common themes relating to each of the research questions that were found to be consistent across the multiple data sources used within this study. Accordingly, the findings presented in this study are not based on results obtained from a single data source, but are based on consistent results obtained from multiple data sources. This consistency of results suggests that the different data collection methods used in this study have reliably measured each of the key variable related to this study. In simple terms, whether participants were observed, asked to respond to a survey or participated in interviews, they reported similar outcomes for the variables under investigation.

In summary, it can be reasonably concluded that based on the internal consistency findings of the quantitative scales, combined with the consistency of themes that emerged across the multiple different data sources, that the instruments and data collected in this study are valid and reliable when used with this research sample.

6.1.2 Teacher-Student Interpersonal Behaviour

The second research question asked if the cloud assessment learning environment affected or was associated with teacher and student perceptions of teacher-student interpersonal behaviour and whether or not there were differences between these perceptions. In order to address this research question, perceptions of teacher-student interpersonal behaviour were measured in week four of the semester prior to engagement with the cloud assessment learning environment and again four weeks later after students had begun engaging with the environment. The four week wait time before LIQ data were collected (coupled with the research samples prior experience with the researcher as a lecturer) was given in order to allow the learning environment to stabilise (den Brok et al., 2004). The LIQ was the main quantitative data source used for the measurement of perceptions of teacher-student interpersonal behaviour and was also supported by participant observations. The key themes that emerged relating to teacher-student interpersonal behaviour were also seen to emerge throughout a number of the other data sources in this study (as mentioned in the previous chapters).

The LIQ results presented pre and post engagement perceptions of teacher-student interpersonal behaviour for both ideal and current lecturers in relation to eight scales: Leadership, Helping & Friendly, Understanding, Responsibility & Freedom, Uncertain, Dissatisfied, Impatience, and Strict. Interestingly, the result revealed very little difference between teacher and student perceptions of their ideal lecturer and their current lecturer both before and after engagement with the cloud assessment learning environment. This correlation between ideal and current lecturer perceptions was also seen in a number of the other data sources including the participant observations and lecturer descriptions.

The only statistically significant change that emerged between the pre and post LIQ results related to an increase in student perceptions of their current lecturers level of helping and friendliness (this was also reflected in the LIQ results relating to the lecturers own self perceptions). This increase in helping and friendliness also emerged from a number of the other data sources including the CAQ results, participant

observations, virtual participant observations, concept maps, and class interviews. Interestingly, this increase in perceived helping and friendliness can be seen to be related to the unanimous positive view students had relating to the feedback mechanism of the cloud assessment learning environment. From the lecturer's perspective, the monitoring and feedback aspects of the environment enabled the lecturer to better provide assistance to students in a timely and efficient manner. It should be noted that at the time the lecturer did not feel as if they were being any more helpful than they usually would with regards to student learning and feedback, but more that the environment enabled improved facilitation of the help and feedback that was being given. Through engagement with the cloud assessment learning environment the students were able to utilise increased interaction with their lecturer through the form of query and feedback comments. As students embraced this aspect of the environment the amount of help, affirmation, and guidance students received from their lecturer increased.

To summarise, the results of this study suggest that there are very little differences between teacher and student perceptions of teacher-student interpersonal behaviour in the cloud assessment learning environment. However, both the lecturer and students recognised that the environment facilitated improved feedback and interaction which appears to have resulted in a positive increase in student perceptions of their current lecturer's level of helping and friendliness, as well as the lecturer's own self perceptions of their level of helping and friendliness while both were engaged with the cloud assessment learning environment. Accordingly, the study concludes that the cloud assessment learning environment essentially facilitates an increased degree of help that can be provided to the student by the lecturer. In terms of teacher-student interpersonal behaviour, this conclusion is evidenced by a perceived positive increase in the lecturer's level of helping and friendliness towards students by both the lecturer and students.

6.1.3 Positive and Negative Perceptions

The third research question asks what factors of the cloud assessment learning environment do students perceive as positive and negative? A number of key themes emerged from the study that highlighted aspects of the cloud assessment learning environment that students perceived as either positive or negative. These themes emerged across multiple data sources and will be summarised in the following sections.

The aspect of the cloud assessment learning environment that students perceived as a positive that most strongly emerged from the results of this study was the unanimous appreciation of the early feedback mechanism that was made possible by the environment. This positive perception emerged from the CAQ results, concept maps, class interviews, focus group interviews, participant observations and virtual participant observations. The study revealed that this aspect of the environment was appreciated not only because of the help students received but also for the reassurance students felt when the lecturer confirmed that they were on the right track. Interestingly, a number of students experienced bugs when using Google Docs, however, these bugs were never reported as being associated with the feedback commenting mechanism. Furthermore, student appreciation of the feedback commenting mechanism did not appear to be reduced even when bugs were experienced with other parts of the system.

The online storage and automatic submission aspects of the cloud assessment learning environment were subject to mixed perceptions. On the one hand some students saw these aspects as positives while others expressed more negative perceptions. As a positive, students felt that the online storage was secure and offered convenient access to their assessment document from multiple locations. As a negative, students felt the online storage was somewhat unreliable and restricted access to environments with internet access. This negative perception was also associated with students who had experienced bugs within the system. Likewise, as a positive, students perceived the automatic submission of their assignment work as a convenient feature that allowed them to work right up until the due time and removed the added pressure of having to submit on time. Some students expressed a perception that the automatic submission aspect associated with utilising a cloud based approach left them without closure. Students reported that they preferred an environment where they were able to press a submit button and get a feeling of completion. These mixed perceptions clearly emerged from a number of data sources including the CAQ results, concept maps, class interviews, focus group interviews, participant observations and virtual participant observations.

Students perceived two main aspects of the cloud assessment learning environment as negatives. The first aspect that was consistently perceived as a negative was the lack of features offered by Google Docs. Students expressed the perception that they were unable to perform actions that they were accustomed to with more sophisticated word processing applications like Microsoft Word and that this was a little frustrating.

Although the lack of features emerged as a negative, deeper investigation revealed that many students did not view this limitation as overly detrimental with regards to the overall usability of the system. Interestingly, a small number of students actually viewed the reduced feature set as a positive which allowed them to focus on the assessment content without needing to be overly occupied by the presentation of the document. Nevertheless, this aspect as perceived as a negative was seen to emerge from the CAQ results, concept maps, class interviews, focus group interviews, participant observations and virtual participant observations data sources.

The second more significant aspect that was consistently perceived as a negative was presence of bugs experienced through the use of Google Docs. Students reported intense frustration regarding a number of bugs that they had experienced during their engagement with the cloud assessment learning environment. The most commonly cited bugs included: slowness or lag, issues formatting documents, unreliable saving, and other unexpected behaviour of the Google Docs system. Further investigation revealed that the majority of bugs experienced by students were associated with the use of unreliable wireless internet connections, and the use of the Internet Explorer web browser to access Google Docs. Copy and pasting content directly from Microsoft Word was also found to reduce performance and cause lag within the Google Docs system. Once students had become aware of bugs within the system, they were able to adapt their usage of the system to avoid the known bugs (i.e. avoiding the use of unreliable wireless connections etc.) However, by this stage students had already endured a negative experience with the system. Interestingly, the presence of bugs was not experienced by all members of the research sample, with a number reporting entirely bug free, positive experiences with the system. As with the other perceptions that have been discussed, the negative bug related perception was found throughout numerous data sources within this study. From an outcomes perspective, a pre use training session would be recommended for future implementations of the cloud assessment learning environment. The goal of the training sessions should be to prepare students by making them aware of limitations within the system and by providing tips on how to work around these limitations.

In summary, the feedback mechanism was universally viewed as a positive aspect of the cloud assessment learning environment. The online storage aspect was viewed as either positive or negative and appeared to be dependent on the student's user experience (i.e. whether or not students had experienced bugs). The automatic submission feature was also viewed as either positive or negative. However, this

perception appeared to be dependent on student's personal preference and was not found to be associated with the student's user experience. The limited feature set was predominantly viewed as a weak negative by the research sample, with many becoming content with this issue. Bugs experienced within the Google Docs system emerged as the most significant negative aspect of the cloud assessment learning environment as perceived by the research sample. This negative perception appeared to be dependent on individual students user experiences, accordingly the significance of this negative perception varied across the research sample ranging from a mild inconvenience through to an intense dislike for the entire system. Interestingly, the research sample felt that overall, the positive aspects of the cloud the assessment learning environment outweighed the negatives with only those students who had experienced significant bug related issues subscribing to the alternate position.

6.1.4 Conceptual Change in Understanding

The fourth research question investigated conceptual change in student understanding of the cloud assessment learning environment over time. In order to address this research question the same data was collected from students both prior to and after students had engaged with the cloud assessment learning environment. This dual collection provided data that allowed a comparative analysis of students' conceptual understanding of the environment pre and post engagement. The data collection activities relating specifically to the cloud assessment learning environment that were used twice during the study were the CAQ, concept maps, and class interviews. Participant observations, and virtual participant observations provided an on-going data source that spanned the entire engagement process from the lecturer's perspective, while the focus group interviews provided a final reflective data source that presented conceptual understanding from the students own perspectives.

The study concludes that there is a conceptual change in student understanding of the cloud assessment learning environment over time. Prior to engagement students had a simple, hopefully expectant conceptual understanding of the environment. The environment was generally viewed as interesting, new and potentially very beneficial. Students expressed a curious excitement and initially had a number of unanswered questions relating to the environment. This initial conceptual understanding emerged from the results of the first data collection involving the CAQ, concept maps, and class interviews and was also observed by the lecturer through participant observations. After the assessment, students' conceptual understanding of the environment had changed from simple and hopefully expectant to a clearly refined, detailed, and

experienced based understanding. Where students had been initially generally positive about their expectations, students had become very specific about what they understood as positive and negative aspects of the environment and based these views on first-hand experience. Accordingly, the unanswered questions initially expressed by the students were no longer present in post engagement perceptions. Interestingly, the conceptual understanding that emerged prior to engagement was generally consistent across the entire research sample, in contrast, the final conceptual understanding that was captured post engagement tended to vary significantly depending on the individual student's user experience with Google Docs. Although there existed variation in the conceptual understanding possessed by students post engagement, each member of the research sample was seen to undergo a similar change from simple and expectations based to detailed and experienced based. Initial student expectations were primarily positive, whereas actual student experiences were more balanced between both positive and negatives aspects of the environment. It is worth noting that in terms of conceptual change, a study by Cook and Leckey (1999) reviewed in chapter two, although with a different focus, also reported that students often began with unrealistic expectations which were markedly different from their experiences (of the tertiary study environment).

To review, this study has found that there is in fact a conceptual change in student understanding of the cloud assessment learning environment over time. Students' conceptual understanding can be seen to change from a simple understanding that is based on positive expectations through to a detailed understanding that is based on positive and negative experiences.

6.1.5 Relationship with Achievement

The fifth research question asks if a relationship exists between student perceptions of the cloud assessment learning environment and their level of achievement. This research question was addressed through the collection of a number of achievement related variables. These variables were the PMP grade, the I202 IT Project Management paper grade, and the historical GPA of each student. This data was then analysed in conjunction with the other data sources within this study, specifically those relating to the cloud assessment learning environment, as well as other variables associated with achievement.

Although a number of strong, significant positive correlations were found to exist between the achievement variables themselves and also between the project

management plan (PMP) grade and PMP word count, correlations of similar strength were not found between the achievement variables and any of the cloud assessment learning environment variables. However, a number of weaker, yet still statistically significant correlations did emerge, these were between the achievement variables and attendance, attitude towards subject, and the feedback mechanism of the cloud assessment learning environment. The first two relationships coincide with previous studies where achievement has been shown to relate to attendance and attitude. This was also a general observation made by the researcher where the students who had higher attendance and demonstrated a better attitude towards the subject appear to grasp the essential concepts of the subject more easily than other students.

Interestingly, the third correlation is between achievement and the feedback mechanism of the cloud assessment learning environment, a finding that relates specifically to the fifth research question. The correlation suggests that a relationship could exist between student achievement and their perceptions of the feedback mechanism of the cloud assessment learning environment. The participants observations, and virtual participant observations also support the notion of this relationship existing. Students who were observed to more actively engage with the cloud assessment learning environment would often demonstrate that activity through the use of the feedback mechanism, either through asking questions, seeking confirmation, or responding to comments. Interestingly, increased engagement with the cloud assessment learning environment could also be a reflection of students with better attitudes about the subject, i.e. students who are more eager to complete the course work. Accordingly, as previously mentioned, it would also not be surprising for students with better attitudes about the subject to have increased levels of attendance.

In summary, this study concludes that students' perception of the feedback mechanism of the cloud assessment learning environment is related to their level of achievement. However, it appears this relationship could likely be part of a larger variable which encompasses attendance and attitude towards the subject. Essentially, the results suggest that students who have higher levels of achievement also perceive the feedback mechanism of the environment more positively than students with lower levels of achievement. Based on the findings presented in this study, this relationship appears to be a reflection of students who produce higher quality work are also those who seek help through the feedback mechanism which tends to result in higher overall levels of achievement.

6.1.6 Relationship with Attitude Toward Subject

The sixth research question asks if a relationship exists between student perceptions of the cloud assessment learning environment and their attitude towards the subject. In order to address this research question, student perceptions of the cloud assessment learning environment which were captured via a number of data sources (as previously discussed) were analysed in conjunction with data relating specifically to students attitude towards the IT Project Management subject. The data relating to student attitude was obtained from the CAQ results relating to student attitude towards subject, the participant observations, virtual participant observations, online activity statistics, attendance records, class interviews, and focus group interviews.

The study revealed that two main attitudinal groups existed within the research sample. The first group consisted of students who viewed the subject as a necessary requirement for their study that was only useful as it related to their pending third year projects. This first group of student felt the paper was a "necessary evil" and if it were not compulsory would likely have elected to study something different. The second group consisted of students who viewed the subject as not only necessary but also as enjoyable and interesting and felt that it had value for both their pending third year projects and also for future employment and career opportunities.

Comparative analysis of the attitude findings with the student perceptions of the cloud assessment learning environment findings (i.e. perceptions of lecturer monitoring, Google Docs, feedback, cloud storage, and preference) did not reveal any conclusive relationships. Analysis of the quantitative data revealed some correlation between the final attitude scale and the final feedback and online access cloud assessment learning environment scales; however causation could not be assumed in either direction. In the first instance, students with a more positive attitude towards the subject may have engaged and utilised aspects of the environment (i.e. feedback and online access) more actively than students with a less positive attitude, thus having more reason to view the aspects positively. In the second instance, students who more actively engaged with the environment may have had an increased opportunity to benefit from aspects of the environment (i.e. feedback and online access) which could have contributed to a more positive student attitude towards the subject.

Although the data suggests that slight a relationship could exist between student attitudes towards the subject and their perceptions of feedback and online aspects of the cloud assessment learning environment (post engagement), this notion is only

slightly supported by the other data sources. For example, the participant observations also revealed that students who appeared to have a more positive attitude about the subject were also those students who tended to engage most actively with the environment. Ultimately, this study concludes that a relationship between student attitudes toward subject and student perceptions of the cloud assessment learning environment could not be conclusively identified does exist based on the data obtained from this research sample.

6.1.7 Relationship with Computing Confidence

The seventh research question asks if a relationship exists between student perceptions of the cloud assessment learning environment and their level of computing confidence. This research question was addressed through the collection and comparison of student perceptions of the cloud assessment learning environment in conjunction with data relating to students level of computing confidence. The data relating to computing confidence was obtained from the quantitative and qualitative CAQ results relating to computing confidence, the participant observations, virtual participant observations, online activity statistics, class interviews, and focus group interviews.

Unsurprisingly, the study revealed that the research sample had a relatively high level of self-perceived computing confidence. This was an expected finding due to the fact that the research sample consisted of students from the second year of an Information and Communications Technology (ICT) degree. Nevertheless, the high level of computing confidence was formally revealed from a quantitative and qualitative perspective by the CAQ results both before and after student engagement with the cloud assessment learning environment. Students were also observed both face to face and through online environments as having a high level of technical proficiency and corresponding confidence. The class interviews and focus group interviews also supported the notion of a generally high level of computing confidence.

As mentioned, the quantitative CAQ results relating to computing confidence revealed high levels of computing confidence amongst the research sample with the first CAQ reporting a class mean of 4.18 pre engagement and 4.21 post engagement (a score based on the average of nine, five point Likert scale items). The before and after computing confidence scales also displayed a high level of correlation ($r = .80$, $p < .001$, $n = 40$). In a corresponding fashion, the short answer responses from both the first and second CAQ's produced consistent responses that communicated a

high level of self-perceived computing confidence. Statistically, weak correlations between computing confidence and the feedback mechanism and online storage aspects of the cloud assessment learning environment were also noted. This may suggest that a student with a higher level of computing confidence could be more likely to appreciate these certain aspects of the cloud assessment learning environment.

In further support, the researcher consistently observed the members of the research sample demonstrating high levels of computing confidence through the rapid adoption of and experimentation with new technologies (e.g. Google Docs and Microsoft Project). This was also made apparent through the independence and self-sufficiency displayed by the research sample with relation to the use of these new technologies. Although the students often had queries relating to pending assessments that involved these new technologies, the researcher found that the large majority of questions were concerned with the content of the assessments as opposed to technical issues relating to the new systems.

The class interviews and focus group interviews also provided specific examples of students expressing this high level of self-perceived computing confidence that was observed over the course of the semester. Students were able to very clearly articulate what they felt were positive and negative features of the cloud assessment learning environment and during these discussions students often moved into more technical aspects of the systems used, discussed advanced troubleshooting approaches, and commented on workarounds or solutions to commonly experienced problems. From these discussion it became apparent that students had a clear grasp of the systems they were using and were able to not only use these new systems effectively, but also had the confidence to offer advice on how to resolve issues with the technology. This is an interesting outcome as it reveals that the student body, through experience, increased in their understanding of and confidence with the environment to the extent that they were then able to share their knowledge with others. This student to student help also reduced student reliance on the lecturer for problem solving with regards to the Google Docs cloud computing tool.

In concluding, the results from this study show that student perceptions of the cloud assessment learning environment are not related to student levels of computing confidence. However, it would be unwise to generalise this conclusion too widely due to the unique makeup of the research sample used in this study, i.e. Information and Communications Technology (ICT) students.

6.2 Implications and Contribution

This study has sought to make a contribution to the literature in a number of areas of research, namely: learning environments, teacher-student interpersonal behaviour, and cloud computing in education. Within these areas, this study has contributed new findings relating specifically to the very rapidly expanding area of cloud based computing and the cloud assessment learning environment, which is to the researcher's best knowledge a previously unstudied learning environment.

This study has made the first significant step towards understanding student perceptions of the cloud assessment learning environment for teaching and learning in a higher education context. The findings from this study provide a clear insight into aspects of the cloud assessment learning environment and what students perceive as both positive and negative. This information can now be used by educators who are planning to utilise a cloud based assessment and teaching environment. Educators will be able to better prepare students, manage expectations, and emphasise positive aspects of the environment. For example, pre-usage training sessions could be conducted to familiarise students with the technology and limitations and practical solutions to work around these limitations. The training sessions could also help highlight the benefits of utilising positive aspects of the environment, such as the feedback mechanism. Through the use of this type of cloud assessment learning environment induction, students could begin assessments with expectations based on the prior experience of others, as opposed to expectations based on individual assumptions. By providing students with realistic expectations of the environment, the contrast between student expectation and student experience would be less severe. Hopefully this would improve the students overall experience by reducing unexpected negative experiences and promoting positive utilisation of the environment.

Beyond the intentional contributions made to the literature, a number of unintentional contributions also emerged from this study. The first related to the Responsibility and Freedom scale of the LIQ. As mentioned in the study, the scale and instrument was a New Zealand tertiary adaptation of the QTI which is directly comparable to the Australian short form of the QTI with 48 items. Of particular interest was the adapted Responsibility and Freedom scale that was included in the LIQ which produced a notably high Cronbach alpha reliability coefficient, which when compared to previous studies suggests a marked improvement with regards to internal consistency of the scale items. However, as noted within this study, further testing with a larger sample is required before this potential improvement could be confirmed. Nevertheless, this was

an unexpected and exciting outcome from the study. Furthermore, this study has made a contribution to the literature by providing the first insight into teacher and student perceptions of teacher-student interpersonal behaviour within a cloud assessment learning environment.

The collection of online activity statistics, particularly the word count over time, also ended up producing some particularly interesting data (this in itself was a novel and valuable contribution in the area of data collection methods). In order to collect the individual student word counts each day, each assignment document was downloaded and opened using Microsoft Word in order to obtain the word count. As a result, a daily snapshot of each student assignment document was also collected over the course of the four week assessment. Although not specifically analysed in this study (beyond the quantitative word count measure), the collection of assignment documents existed as an interesting data set relating to student progress over the course of an assessment. In itself, this unique data collection method made possible by the cloud assessment learning environment presents a new way for collecting data relating to student progress throughout an assessment process. In particular, this provides another way to triangulate and validate data collection from other sources (e.g. comparing word count statistics with students who felt they worked gradually on an assignment). Analysis of this type of data could allow researchers to study the creative process of assignment writing from both a quantitative and qualitative perspectives (i.e. word count and also content analysis).

This study has also made a contribution to the wider field of educational research by providing a step forward in the study of cloud computing technologies within an educational context. The findings from this study will likely be relevant to future studies that are not only focused on the cloud assessment learning environment but also to studies that utilise cloud computing technology for alternative purposes. A specific example would be research conducted into a peer review version of the cloud assessment learning environment whereby students are able to continually review (and be reviewed) by their peers would be particularly interested in the findings of this study. This alternative peer review cloud assessment learning environment concept will also be addressed in the future work section.

Ultimately, this study has contributed further data in support for the validity, reliability, and adaptability of the QTI through its successful use in the form of the LIQ. New findings relating to teacher-student interpersonal behaviour in a unique learning

environment in a tertiary context have also been made to the literature. Again, new understanding of student perceptions of the cloud assessment learning environment and their relations to student attitude toward subject, computing confidence and achievement levels have also emerged from this study. Overall, this study has made a unique contribution to the literature which will ideally pave the way for future research into cloud assessment learning environments.

6.3 Limitations

The main goal of this study was to investigate student perceptions of the cloud assessment learning environment. Although this goal has been achieved and the study has presented the first body of evidence relating to the cloud assessment learning environment, the study was at the same time limited in a number of areas. These limitations will now be discussed.

Perhaps the most apparent limitations of this study relates to the research sample, in the first instance, the size of the research sample (50 students), and in the second instance the makeup of the research sample (ICT students). While the research sample only consisted of 50 students, it should be noted that this did in fact represent 100% of the sample in this environment. Although, a larger research sample would have obviously provided more data for analysis, this was essentially infeasible given the research design, and in some respect unnecessary given the research goals. Having a research sample of 50 students from a single class actually enabled a number of improvements to the research design. For example, it became feasible to collect much richer data in multiple ways from the research sample, this included participant observations that spanned the entire semester, entire class interviews, focus group interviews, and multiple data collections with various instruments (i.e. LIQ, CAQ, concept maps). In relation to the seventh research question it was not surprising to conclude that the research sample did not report a decrease in computing confidence as a result of engagement with the cloud assessment learning environment, this was due to the fact that the research sample consisted of ICT students. This factor does not invalidate the conclusion (as it was consistently confirmed through multiple data sources), however it does limit the degree in which this conclusion can be generalised to the wider population as it is feasible to suggest that a relationship could emerge given a different research sample (one without a computing focus).

The study was also limited with regards to location and level. As the study was conducted with tertiary students from a New Zealand polytechnic, it is reasonable to

suggest that the finding of this study could have varied given a different level of education and or a different cultural environment. As will be mentioned in the following section, future studies involving different levels of education and or different cultural environments would likely provide further insight and would also help in developing a more generalised understanding of student perceptions of the cloud assessment learning environment.

Finally, although not a limitation of the study, the cloud assessment learning environment (as implemented in this study) was found by the researcher to be likely limited with regards to scale. When the researcher first began experimenting with the environment class sizes of 20-30 students provided an easily manageable workload with regards to monitoring and guidance. However, the particular cohort of students that enrolled in the IT Project Management paper in the semester during which the data collection was scheduled was notably higher (50 students). Although the researcher managed to maintain and facilitate a successful implementation of the cloud assessment learning environment it became apparent that with increasing class sizes the effectiveness of the environment could possibly be reduced. This reduction in effectiveness, in the opinion of the researcher, would be caused by increased time demands on the part of the facilitating lecturer. Essentially the more students involved, the less time the lecturer has to monitor and guide each. However, a potential solution to the scalability issue in larger class sizes could be solved through the employment of graduate assistants or a peer review version of the environment in order to share the monitoring and guidance work load. Again, although this was not an issue for the current study, it is worth noting for future researchers looking to implement a cloud assessment learning environment with differing class sizes.

The study was also noted as having some limitations with regards to scope. The research questions asked by this study have focused on selection of variables considered most relevant by the researcher. Other variables could also have been used including: gender, ethnicity, age, prior qualifications, and many more. However, due to practical limitations and in some cases even in spite of being collected (e.g. gender, age, ethnicity, etc.) an exhaustive analysis and presentation of each of these variables was not included within this thesis. However, this limitation to scope does help to provide a number of interesting avenues for future research which will be discussed in the next section.

6.4 Future Work

Moving forward, a number of future studies can now be conducted that build on the initial findings from this study and in many cases can address the limitations identified in the previous section. Future work relating to student perceptions of the cloud assessment learning environment could be potentially taken in any number of directions, however only a few key areas of study that the researcher views as particularly worthwhile will now be discussed.

As mentioned in the previous section, the study was limited by research sample size and makeup. Accordingly, a future study that incorporated a larger research sample could provide further validation and generalisation of the findings of this study. It is envisioned that this future study would likely report on the results from multiple groups of students engaging with the cloud assessment learning environment. In particular, further use of the Cloud Assessment Questionnaire (CAQ) would provide results that could be compared directly with the findings of this study. This would then provide a means for further validation of the instrument. Further to this, future studies in other education areas (i.e. outside of ICT) would also provide valuable insight into whether the findings of this study are specific to ICT students or if they are in fact generalizable to all students who engage with cloud assessment learning environments.

Research into the cloud assessment learning environment could also be expanded through similar studies however focused at different levels of education and or different locations. For example, it would be interesting to discover if similar perceptions were also found amongst a generally younger research sample (i.e. the secondary school level) or even a more mature research sample. Again, a comparison with research samples from different countries and cultural environments could also provide equally as interesting findings. Again, this findings combined with the results of this study could then be combined to help develop a more generalised understanding of the environment.

Another interesting area of research that could also be conducted could involve the replacement of the tool used to implement the cloud assessment learning environment. In this study Google Docs was used to implement the environment, future studies could use alternative online word processing solutions, e.g. Microsoft 365 or Zoho. These studies could also take the form of parallel comparative studies (i.e. a split research sample with each group using a different tool to implement the environment, but working on the same assessment). These studies would be particularly interesting as

they could provide further data that shows the separation between the concept behind the cloud assessment learning environment and the tools used to implement the environment.

Further research could also be conducted in relation to teacher-student interpersonal behaviour. Even though teacher-student interpersonal behaviour is well developed field of research, the findings from this study provide reason for some interesting future studies. In particular, reuse of the LIQ version of the QTI would ideally contribute further to the validity and reliability of the adapted instrument. Perhaps more interestingly, the reuse of the adapted Responsibility and Freedom scale from the LIQ would help to either confirm or deny the suggested improvement to the internal consistency of the scale as has been suggested by this study. Furthermore, it would very interesting for future studies to re-examine teacher-student interpersonal behaviour in a different implementation of the cloud assessment learning environment to determine if similar results emerge. Specifically, it would be interesting to see if the increase in the Helping and Friendliness scale would continue to emerge. From a research design perspective, the research would also suggest conducting a third LIQ (QTI) data collection that would occur at some point after students had finished engaging with the environment in order to determine if the perceived increased level of helping and friendliness endured beyond the cloud assessment, or if it would return to levels equivalent to pre-engagement.

As mentioned in the contribution section, the online activity statistics taken from the cloud assessment learning environment, specifically the individual student word counts that were collected each day during the assessment process provided some particularly interesting data. Future work could harness and even extend this unique data collection method. The data set (or similar data sets collected via a similar method) could be used to analyse the creative process undertaken by students. This would be particularly interesting as traditional assessment environments would only allow for the analysis of the final assignment product, as opposed to the assessment process, which is made possible through this unique data collection method.

Although this study focused primarily on student perceptions of the cloud assessment learning environment it would be, in the researcher's opinion, very interesting to conduct future work that investigated lecturer perceptions of the environment. The researcher acknowledges that his own perceptions are only one of many possible ways in which the environment could be understood and perceived. Accordingly, it would

be worth trialling the environment in alternative situations with lecturers with different technology backgrounds and investigating their perceptions and identifying any training needs necessitated through the employment of the cloud assessment learning environment.

Moving slightly outside the bounds of the cloud assessment learning environment as described in this study, future work could also include an investigation into alternative versions of the environment. This stream of research could potentially take a number of forms. An entirely peer review focused version of the environment could be implemented where students are able to continually review one or more of their peers while at the same time be continually reviewed by one or more peers. Alternatively, this version of the environment could be extended to also include lecturer monitoring (similar to what has been investigated in this study) that coincides with the peer to peer reviewing. Again, another similar group work focused version of the environment could also be implemented and investigated. With each of these alternative versions of the cloud assessment learning environment it would be interesting to see if similar results emerge. For example, would students feel a similar level of anxiety pre assessment knowing that one or more of their peers would be monitoring their progress, as opposed to their lecturer? Would this be amplified even greater if they knew both peers and their lecturer would be monitoring their work? Would the same trend of eventual acceptance post engagement emerge? Would peer feedback be valued as much as lecturer feedback in these types of environments? Would similar or different themes emerge in group work environments as opposed to peer to peer environments? These are just a few of many interesting questions that could be addressed in subsequent studies which would further provide insight into the use of cloud computing technologies for learning and assessment.

Although this exact study could be replicated with varying research samples and environments, a complete replication would not necessarily be required for comparative purposes. Taking a subset of the data collection methods would, in the researchers opinion, still be sufficient to capture enough data for inter study comparisons. In this sense, future work could also focus specifically on the LIQ instrument, the CAQ instrument, the use of concept maps to capture conceptual change, the collection of cloud based online activity statistics (e.g. word count over time), or any number of variable combinations from this study. It is hoped that this study acts as a benchmark and as a catalyst for further work in this rapidly developing area.

6.5 Summary

In summary, the study has been a success and contributes unique and new information to a rapidly emergent area of study. Each research question was systematically addressed through the comparative analysis of a numerous data sources relating to various aspects of student perceptions of the cloud assessment learning environment. The multiple data sources utilised within this study have provided consistent and internally supportive findings for the key themes that have emerged from the data. The limitations identified within this study have been compensated for through the depth of data collected via the strength of design made available by multiple data sources utilised within this study. Ultimately, valuable contributions have been and will continue to be made to the literature relating to a number of key areas including: teacher-student interpersonal behaviour, learning environments research, conceptual change research, and cloud computing in education research.

This study found that the instruments and data collection methods were valid and reliable for the research sample given the underlying research goals.

With regards to teacher-student interpersonal behaviour, the cloud assessment learning environment was found to have the potential to facilitate lecturers providing an increased level of helping and friendliness towards students. This increase in helping and friendliness was found to tie back directly to the utilisation of the environments feedback mechanism by both the student and the lecturer.

The study also found that students perceived various aspects of the cloud assessment learning environment as either positive or negative. Students were found to unanimously perceive the environments feedback mechanism as a significant positive. The cloud storage and automatic submission aspects of the environment were perceived as both positive and negative, this mix of perceptions were found to be dependent on individual student experiences with the environment. Those students who had relatively good and trouble free experiences perceived the cloud storage and automatic submission aspects as convenient positives. Conversely, those students who had more problematic experiences perceived the cloud storage aspect as a negative.

The study also found that students perceived the limited feature set and bugs experience when using Google Docs as negative aspects of the system, with the latter being the more significant of the two. Interestingly, the study also found that despite the perceived negatives, for the majority of students, the positive aspects of the environment outweighed the negatives.

The conceptual understanding students had of the cloud assessment learning environment was also found to change over the course of the assessment process. The initial conceptual understanding held by students can be described as curious, hopeful, and generally positive (with some slight uncertainty) and also primarily based on expectations. The final conceptual understanding held by students were more refined, reflective, included clear views of the positive and negative aspects of the environment, and were based on personal experience.

Ultimately, student perceptions of the cloud assessment learning environment were not found to have any highly significant or strong relationships with levels of achievement, attitude towards the subject, or computing confidence. Weak relationships between computing confidence and aspects of the cloud assessment learning environment were also identified, however due to the unique makeup of the research sample generalised conclusions were considered unwise. Nevertheless, even though the relationships were not strong, they were consistently reported across multiple data gathering methods, and so had internal consistency. Weak relationships were identified between student perceptions of the feedback mechanism and levels of achievement and attitude towards the subject. Although identified, the exact nature of these relationships could not be conclusive determined, e.g. students with good attitudes, could utilise the environment more actively and have a good experience, and consequently achieve a good grade. On the other hand, students who achieve good grades may have better attitudes about the subjects they're studying, and consequently could be more positive about engaging with the assessment environment. Yet again, a student who has a positive experience with the environment could produce higher quality work, which could result in an improved attitude. Nevertheless, the mere fact the relationship has been identified is a valuable outcome in and of itself.

Ultimately, this study has provided a unique insight into student perceptions of the cloud assessment learning environment. It has utilised an extensive multi method, multiple data collection research design for both quantitative and qualitative data. The study has provided valuable findings relating to an emergent area of computer use in education for learning and assessment and has consequently made a unique contribution to the literature in its associated areas. Finally, the study has provided a solid foundation for future research into cloud assessment learning environments that may allow others to test the outcomes of this study in their own unique educational contexts.

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Appendices

Appendix A Lecturer Interaction Questionnaire (LIQ)

Student ID number:

Lecturer Interaction Questionnaire

Your Ideal Lecturer Questionnaire

The following questionnaire asks for your view of an ideal lecturer's behaviour. Think about your ideal lecturer and keep this ideal lecturer in mind as you respond to these sentences.

The questionnaire has 48 sentences about your ideal lecturer. For each sentence, circle the number corresponding to your response. For example:

	Never				Always
The lecturer would express himself/herself clearly.	**1**	**2**	**3**	**4**	**5**

If you think that ideal lecturers always express themselves clearly, circle the **5**. If you think ideal lecturers never express themselves clearly, circle the **1**. You can also choose the numbers **2**, **3** and **4** which are in-between. If you want to change your answer, cross it out and circle a new number. Thank you for your cooperation.

In order for us to provide you with a report of the results, please write your student ID number.

Your Ideal Lecturer

Student ID number: **Never** **Always**

Leadership	1. The lecturer would talk enthusiastically about his/her subject	1	2	3	4	5
	2. The lecturer would explain things clearly	1	2	3	4	5
	3. The lecturer would hold the students' attention	1	2	3	4	5
	4. The lecturer would be aware of all student activity in the class	1	2	3	4	5
	5. The lecturer would be a good leader	1	2	3	4	5
	6. The lecturer would act confidently	1	2	3	4	5
Helping & Friendly	7. The lecturer would help students with their work	1	2	3	4	5
	8. The lecturer would be friendly	1	2	3	4	5
	9. The lecturer would be someone students can depend on	1	2	3	4	5
	10. The lecturer would have a sense of humour	1	2	3	4	5
	11. The lecturer could take a joke	1	2	3	4	5
	12. The lecturer's class would be pleasant	1	2	3	4	5
Understanding	13. The lecturer would trust students	1	2	3	4	5
	14. If students did not agree with the lecturer, they could talk about it	1	2	3	4	5
	15. The lecturer would be willing to explain things again	1	2	3	4	5
	16. If students had something to say, the lecturer would listen	1	2	3	4	5
	17. The lecturer would be understanding	1	2	3	4	5
	18. The lecturer would be patient	1	2	3	4	5
Responsibility & Freedom	19. Students could decide some things in the lecturer's class	1	2	3	4	5
	20. Students could negotiate with the lecturer	1	2	3	4	5
	21. The lecturer would let students decide on what they do in class	1	2	3	4	5
	22. The lecturer would let students decide when they work in class	1	2	3	4	5
	23. The lecturer would give students a lot freedom in class	1	2	3	4	5
	24. The lecturer would be flexible	1	2	3	4	5
Uncertain	25. The lecturer would seem uncertain	1	2	3	4	5
	26. The lecturer would be hesitant	1	2	3	4	5
	27. The lecturer would act as if he/she did not know what to do	1	2	3	4	5
	28. The lecturer would rely on students to lead the lesson	1	2	3	4	5
	29. The lecturer would not be sure what to do with disruptive students	1	2	3	4	5
	30. The lecturer would get confused easily	1	2	3	4	5
Dissatisfied	31. The lecturer wouldn't have any time for students	1	2	3	4	5
	32. The lecturer would be uninterested in their teaching	1	2	3	4	5
	33. The lecturer would be disgruntled with their job	1	2	3	4	5
	34. The lecturer would be unhappy in their job	1	2	3	4	5
	35. The lecturer would seem dissatisfied	1	2	3	4	5
	36. The lecturer would be disengaged in class	1	2	3	4	5
Impatience	37. The lecturer would get angry unexpectedly	1	2	3	4	5
	38. The lecturer would get angry quickly	1	2	3	4	5
	39. The lecturer would have a short temper	1	2	3	4	5
	40. The lecturer would be impatient	1	2	3	4	5
	41. The lecturer would be quick to reprimand students	1	2	3	4	5
	42. The lecturer would insult students	1	2	3	4	5
Strict	43. The lecturer would be strict	1	2	3	4	5
	44. Students would have to pay attention in the lecturer's class	1	2	3	4	5
	45. The lecturer's tests would be hard	1	2	3	4	5
	46. The lecturer's standards would be very high	1	2	3	4	5
	47. The lecturer would be severe when marking assessments	1	2	3	4	5
	48. Students must show respect for the lecturer	1	2	3	4	5

Student ID number:

Lecturer Interaction Questionnaire

Your Current Lecturer Questionnaire

The following questionnaire asks you to describe the behaviour of your current lecturer.

This is NOT a test.
Your opinion is what is wanted.

The questionnaire has 48 sentences about your lecturer. For each sentence, circle the number corresponding to your response. For example:

	Never				Always
The lecturer would express himself/herself clearly.	**1**	**2**	**3**	**4**	**5**

If you think that your lecturer always expresses himself clearly, circle the **5**. If you think your lecturer never expresses himself clearly, circle the **1**. You can also choose the numbers **2**, **3** and **4** which are in-between. If you want to change your answer, cross it out and circle a new number. Thank you for your cooperation.

In order for us to provide you with a report of the results, please write your student ID number.

Your Current Lecturer

Student ID number: **Never** **Always**

Leadership	1. This lecturer talks enthusiastically about his/her subject	1	2	3	4	5
	2. This lecturer explains things clearly	1	2	3	4	5
	3. This lecturer holds the students' attention	1	2	3	4	5
	4. This lecturer is aware of all student activity in the class	1	2	3	4	5
	5. This lecturer is a good leader	1	2	3	4	5
	6. This lecturer acts confidently	1	2	3	4	5
Helping & Friendly	7. This lecturer help students with their work	1	2	3	4	5
	8. This lecturer is friendly	1	2	3	4	5
	9. This lecturer is someone students can depend on	1	2	3	4	5
	10. This lecturer has a sense of humour	1	2	3	4	5
	11. This lecturer can take a joke	1	2	3	4	5
	12. This lecturer's class is pleasant	1	2	3	4	5
Understanding	13. This lecturer trusts students	1	2	3	4	5
	14. If we do not agree with this lecturer, we can talk about it	1	2	3	4	5
	15. This lecturer is willing to explain things again	1	2	3	4	5
	16. If we have something to say, this lecturer listens	1	2	3	4	5
	17. This lecturer is understanding	1	2	3	4	5
	18. This lecturer is patient	1	2	3	4	5
Responsibility & Freedom	19. We can decide some things in this lecturer's class	1	2	3	4	5
	20. We can negotiate with this lecturer	1	2	3	4	5
	21. This lecturer lets students decide on what they do in class	1	2	3	4	5
	22. This lecturer lets students decide when they work in class	1	2	3	4	5
	23. This lecturer gives students a lot freedom in class	1	2	3	4	5
	24. This lecturer is flexible	1	2	3	4	5
Uncertain	25. This lecturer seems uncertain	1	2	3	4	5
	26. This lecturer is hesitant	1	2	3	4	5
	27. This lecturer would acts as if he/she does not know what to do	1	2	3	4	5
	28. This lecturer relies on students to lead the lesson	1	2	3	4	5
	29. This lecturer is not sure what to do with disruptive students	1	2	3	4	5
	30. This lecturer gets confused easily	1	2	3	4	5
Dissatisfied	31. This lecturer doesn't have any time for students	1	2	3	4	5
	32. This lecturer is uninterested in their teaching	1	2	3	4	5
	33. This lecturer is disgruntled with their job	1	2	3	4	5
	34. This lecturer is unhappy in their job	1	2	3	4	5
	35. This lecturer seems dissatisfied	1	2	3	4	5
	36. This lecturer is disengaged in class	1	2	3	4	5
Impatience	37. This lecturer gets angry unexpectedly	1	2	3	4	5
	38. This lecturer gets angry quickly	1	2	3	4	5
	39. This lecturer has a short temper	1	2	3	4	5
	40. This lecturer is impatient	1	2	3	4	5
	41. This lecturer is quick to reprimand students	1	2	3	4	5
	42. This lecturer insults students	1	2	3	4	5
Strict	43. This lecturer is strict	1	2	3	4	5
	44. We have to pay attention in this lecturer's class	1	2	3	4	5
	45. This lecturer's tests are hard	1	2	3	4	5
	46. This lecturer's standards are very high	1	2	3	4	5
	47. This lecturer is severe when marking assessments	1	2	3	4	5
	48. We must show respect for this lecturer	1	2	3	4	5

Lecturer Interaction Questionnaire

Lecturer Self Questionnaire

The following questionnaire has 48 questions about your behaviour in a particular class.

For each sentence, circle the number corresponding to your response. For example:

	Never				Always
The lecturer would express himself/herself clearly.	**1**	**2**	**3**	**4**	**5**

If you think that you always express yourself clearly, circle the **5**. If you think you never express yourself clearly, circle the **1**. You can also choose the numbers **2**, **3** and **4** which are in-between. If you want to change your answer, cross it out and circle a new number. Thank you for your cooperation.

In order for us to provide you with a report of the results, please write your name.

Self-Questionnaire

Name: **Never** **Always**

Leadership	1. I talk enthusiastically about my subject	1	2	3	4	5
	2. I explain things clearly	1	2	3	4	5
	3. I hold the students' attention	1	2	3	4	5
	4. I am aware of all student activity my class	1	2	3	4	5
	5. I am a good leader	1	2	3	4	5
	6. I act confidently	1	2	3	4	5
Helping & Friendly	7. I help students with their work	1	2	3	4	5
	8. I am friendly	1	2	3	4	5
	9. I am someone students can depend on	1	2	3	4	5
	10. I have a sense of humour	1	2	3	4	5
	11. I can take a joke	1	2	3	4	5
	12. My class is pleasant	1	2	3	4	5
Understanding	13. I trust students	1	2	3	4	5
	14. If students did not agree with me, we talk about it	1	2	3	4	5
	15. I am willing to explain things again	1	2	3	4	5
	16. If students have something to say, I listen	1	2	3	4	5
	17. I am understanding	1	2	3	4	5
	18. I am patient	1	2	3	4	5
Responsibility & Freedom	19. Students can decide some things in my class	1	2	3	4	5
	20. Students can negotiate with me	1	2	3	4	5
	21. I let students decide on what they do in class	1	2	3	4	5
	22. I let students decide when they work in class	1	2	3	4	5
	23. I give students a lot freedom in class	1	2	3	4	5
	24. I am flexible	1	2	3	4	5
Uncertain	25. I seem uncertain	1	2	3	4	5
	26. I am hesitant	1	2	3	4	5
	27. I act as if I do not know what to do	1	2	3	4	5
	28. I rely on students to lead the lesson	1	2	3	4	5
	29. I am not sure what to do with disruptive students	1	2	3	4	5
	30. I get confused easily	1	2	3	4	5
Dissatisfied	31. I don't have any time for students	1	2	3	4	5
	32. I am uninterested in my teaching	1	2	3	4	5
	33. I am disgruntled with my job	1	2	3	4	5
	34. I am unhappy in my job	1	2	3	4	5
	35. I seem dissatisfied	1	2	3	4	5
	36. I am disengaged in class	1	2	3	4	5
Impatience	37. I get angry unexpectedly	1	2	3	4	5
	38. I get angry quickly	1	2	3	4	5
	39. I have a short temper	1	2	3	4	5
	40. I am impatient	1	2	3	4	5
	41. I am quick to reprimand students	1	2	3	4	5
	42. I insult students	1	2	3	4	5
Strict	43. I am strict	1	2	3	4	5
	44. Students have to pay attention in my class	1	2	3	4	5
	45. My tests are hard	1	2	3	4	5
	46. My standards are very high	1	2	3	4	5
	47. I am severe when marking assessments	1	2	3	4	5
	48. Students must show respect for me	1	2	3	4	5

Lecturer Interaction Questionnaire

Your Ideal Lecturer Questionnaire (Lecturer Version)

The following questionnaire asks for your view of an ideal lecturer's behaviour. Think about your ideal lecturer and keep this ideal lecturer in mind as you respond to these sentences.

The questionnaire has 48 sentences about your ideal lecturer. For each sentence, circle the number corresponding to your response. For example:

	Never				Always
The lecturer would express himself/herself clearly.	**1**	**2**	**3**	**4**	**5**

If you think that ideal lecturers always express themselves clearly, circle the **5**. If you think ideal lecturers never express themselves clearly, circle the **1**. You can also choose the numbers **2**, **3** and **4** which are in-between. If you want to change your answer, cross it out and circle a new number. Thank you for your cooperation.

In order for us to provide you with a report of the results, please write your name.

Your Ideal Lecturer

Student ID number: **Never** **Always**

Leadership	49. The lecturer would talk enthusiastically about his/her subject	1	2	3	4	5
	50. The lecturer would explain things clearly	1	2	3	4	5
	51. The lecturer would hold the students' attention	1	2	3	4	5
	52. The lecturer would be aware of all student activity in the class	1	2	3	4	5
	53. The lecturer would be a good leader	1	2	3	4	5
	54. The lecturer would act confidently	1	2	3	4	5
Helping & Friendly	55. The lecturer would help students with their work	1	2	3	4	5
	56. The lecturer would be friendly	1	2	3	4	5
	57. The lecturer would be someone students can depend on	1	2	3	4	5
	58. The lecturer would have a sense of humour	1	2	3	4	5
	59. The lecturer could take a joke	1	2	3	4	5
	60. The lecturer's class would be pleasant	1	2	3	4	5
Understanding	61. The lecturer would trust students	1	2	3	4	5
	62. If students did not agree with the lecturer, they could talk about it	1	2	3	4	5
	63. The lecturer would be willing to explain things again	1	2	3	4	5
	64. If students had something to say, the lecturer would listen	1	2	3	4	5
	65. The lecturer would be understanding	1	2	3	4	5
	66. The lecturer would be patient	1	2	3	4	5
Responsibility & Freedom	67. Students could decide some things in the lecturer's class	1	2	3	4	5
	68. Students could negotiate with the lecturer	1	2	3	4	5
	69. The lecturer would let students decide on what they do in class	1	2	3	4	5
	70. The lecturer would let students decide when they work in class	1	2	3	4	5
	71. The lecturer would give students a lot freedom in class	1	2	3	4	5
	72. The lecturer would be flexible	1	2	3	4	5
Uncertain	73. The lecturer would seem uncertain	1	2	3	4	5
	74. The lecturer would be hesitant	1	2	3	4	5
	75. The lecturer would act as if he/she did not know what to do	1	2	3	4	5
	76. The lecturer would rely on students to lead the lesson	1	2	3	4	5
	77. The lecturer would not be sure what to do with disruptive students	1	2	3	4	5
	78. The lecturer would get confused easily	1	2	3	4	5
Dissatisfied	79. The lecturer wouldn't have any time for students	1	2	3	4	5
	80. The lecturer would be uninterested in their teaching	1	2	3	4	5
	81. The lecturer would be disgruntled with their job	1	2	3	4	5
	82. The lecturer would be unhappy in their job	1	2	3	4	5
	83. The lecturer would seem dissatisfied	1	2	3	4	5
	84. The lecturer would be disengaged in class	1	2	3	4	5
Impatience	85. The lecturer would get angry unexpectedly	1	2	3	4	5
	86. The lecturer would get angry quickly	1	2	3	4	5
	87. The lecturer would have a short temper	1	2	3	4	5
	88. The lecturer would be impatient	1	2	3	4	5
	89. The lecturer would be quick to reprimand students	1	2	3	4	5
	90. The lecturer would insult students	1	2	3	4	5
Strict	91. The lecturer would be strict	1	2	3	4	5
	92. Students would have to pay attention in the lecturer's class	1	2	3	4	5
	93. The lecturer's tests would be hard	1	2	3	4	5
	94. The lecturer's standards would be very high	1	2	3	4	5
	95. The lecturer would be severe when marking assessments	1	2	3	4	5
	96. Students must show respect for the lecturer	1	2	3	4	5

Appendix B Cloud Assessment Questionnaire (CAQ)

(CAQ version one used during the first data collection)

Student ID number:

Cloud Assessment Questionnaire

The following survey asks for your opinion of cloud based assessment (i.e. using Google Docs for assignment writing). It also asks for your opinion of your own computing confidence and what you think about this paper as a subject. There are no incorrect answers, this is not a test, it is your opinion we are seeking.

The questionnaire has 42 questions. 32 are 1-5 scale questions and 10 are short answer questions.

For each of the 32 scale statements circle 1 if you disagree, or 5 if you agree, you can also circle 2, 3, or 4 which are in-between.

For each of the short answer questions share your opinion in a few sentences.

Student ID number: **Disagree** **Agree**

Cloud Assessment	
1. I like that my Assignment will be shared with my Lecturer	1 2 3 4 5
2. I like that my lecturer will be able to see my progress	1 2 3 4 5
3. I don't want the lecturer to see my assignment until it's finished	1 2 3 4 5
4. What do you think about your lecturer being able to see your assignment document for the duration of the assessment? _____ _____ _____	
5. I will enjoy accessing my assignment through a web browser	1 2 3 4 5
6. Google Docs will be easy to use	1 2 3 4 5
7. Google Docs will be good for document formatting	1 2 3 4 5
8. What do you think about using Google Docs (an online/web based document editor) for this assignment? _____ _____ _____	
9. I like that my lecturer can put feedback directly into my assignment	1 2 3 4 5
10. I like that I can get feedback before the due date	1 2 3 4 5
11. I like that I can respond to the feedback I am given	1 2 3 4 5
12. What do you think about your lecturer being able to give you assignment feedback before the due date? _____ _____ _____	
13. I like that my work will be automatically saved	1 2 3 4 5
14. I like that I can't lose my assignment	1 2 3 4 5
15. I like that my assignment will be automatically submitted	1 2 3 4 5
16. What do you think about having your assignment stored online and automatically submitted on the due date? _____ _____ _____	
17. I would prefer to use Microsoft Word over Google Docs for this assessment	1 2 3 4 5
18. I would like to use Google Docs for assessment in the future	1 2 3 4 5
19. Using Google Docs for this assessment will improve my grade	1 2 3 4 5
20. What do you think about using an online word processor (Google Docs) for this assessment instead of a traditional desktop word processor (Microsoft Word)? _____ _____ _____	
21. Any other comments about using Google Docs for this assessment _____ _____ _____ _____ _____	

Student ID number: **Disagree** **Agree**

Computing Confidence	
1. Compared to other students in this class, I have a high computing skill level	1 2 3 4 5
2. Compared to other students at UCOL, I have a high computing skill level	1 2 3 4 5
3. Compared to the general population I have a high computing skill level	1 2 3 4 5
4. How do you think your computing skills compare to others?	
_____	
_____	
_____	
_____	
5. I feel comfortable when a conversation turns to computers	1 2 3 4 5
6. I feel at ease when I am around computers	1 2 3 4 5
7. Working with a computer makes me very nervous	1 2 3 4 5
8. How comfortable do you feel working with computers	
_____	
_____	
_____	
_____	
9. I could teach someone basic computing skills	1 2 3 4 5
10. I know more about computers than most people	1 2 3 4 5
11. I can teach myself new computing skills	1 2 3 4 5
12. How confident would you be to show someone else how to use computers?	
_____	
_____	
_____	
_____	
Subject	
1. I look forward to this paper	1 2 3 4 5
2. I never feel confused during this paper	1 2 3 4 5
3. This paper is a good use of my time	1 2 3 4 5
4. This paper is amongst the most interesting on this course	1 2 3 4 5
5. The work in this paper is enjoyable	1 2 3 4 5
6. I am comfortable when attending classes in this paper	1 2 3 4 5
7. I feel positive when I think of this paper	1 2 3 4 5
8. If this paper were optional, I would still take it	1 2 3 4 5
9. What do you think about this paper as a subject?	
_____	
_____	
_____	
_____	

(CAQ version two used during the second data collection)

Student ID number:

Cloud Assessment Questionnaire

The following survey asks for your opinion of cloud based assessment (i.e. using Google Docs for assignment writing). It also asks for your opinion of your own computing confidence and what you think about this paper as a subject. There are no incorrect answers, this is not a test, it is your opinion we are seeking.

The questionnaire has 42 questions. 32 are 1-5 scale questions and 10 are short answer questions.

For each of the 32 scale statements circle 1 if you disagree, or 5 if you agree, you can also circle 2, 3, or 4 which are in-between.

For each of the short answer questions share your opinion in a few sentences.

Student ID number: **Disagree** **Agree**

Cloud Assessment	
22. I liked that my Assignment was shared with my Lecturer	1 2 3 4 5
23. I liked that my lecturer was able to see my progress	1 2 3 4 5
24. I didn't want the lecturer to see my assignment until it was finished	1 2 3 4 5
25. What do you think about how your lecturer was able to see your assignment document for the duration of the assessment? _____ _____ _____	
26. I enjoyed accessing my assignment through a web browser	1 2 3 4 5
27. Google Docs was easy to use	1 2 3 4 5
28. Google Docs was good for document formatting	1 2 3 4 5
29. What do you think about using Google Docs (an online/web based document editor) for this assignment? _____ _____ _____	
30. I liked that my lecturer could put feedback directly into my assignment	1 2 3 4 5
31. I liked that I could get feedback before the due date	1 2 3 4 5
32. I liked that I could respond to the feedback I was given	1 2 3 4 5
33. What do you think about your lecturer being able to give you assignment feedback before the due date? _____ _____ _____	
34. I liked that my work was automatically saved	1 2 3 4 5
35. I liked that I couldn't lose my assignment	1 2 3 4 5
36. I liked that my assignment was automatically submitted	1 2 3 4 5
37. What do you think about having your assignment stored online and automatically submitted on the due date? _____ _____ _____	
38. I would have preferred to use Microsoft Word over Google Docs for this assessment	1 2 3 4 5
39. I would like to use Google Docs for assessment in the future	1 2 3 4 5
40. Using Google Docs for this assessment has likely improved my grade	1 2 3 4 5
41. What do you think about using an online word processor (Google Docs) for this assessment instead of a traditional desktop word processor (Microsoft Word)? _____ _____ _____	
42. Any other comments about using Google Docs for this assessment _____ _____ _____ _____ _____	

Student ID number: **Disagree** **Agree**

Google Docs	
1. Had you used Google Docs before starting this assessment? Yes/No	
2. If so, what did you use it for?	
_____	
_____	
3. The benefits of using Google Docs for assessment outweigh the negatives	1 2 3 4 5
Computing Confidence	
13. Compared to other students in this class, I have a high computing skill level	1 2 3 4 5
14. Compared to other students at UCOL, I have a high computing skill level	1 2 3 4 5
15. Compared to the general population I have a high computing skill level	1 2 3 4 5
16. How do you think your computing skills compare to others?	
_____	
_____	
_____	
17. I feel comfortable when a conversation turns to computers	1 2 3 4 5
18. I feel at ease when I am around computers	1 2 3 4 5
19. Working with a computer makes me very nervous	1 2 3 4 5
20. How comfortable do you feel working with computers	
_____	
_____	
_____	
21. I could teach someone basic computing skills	1 2 3 4 5
22. I know more about computers than most people	1 2 3 4 5
23. I can teach myself new computing skills	1 2 3 4 5
24. How confident would you be to show someone else how to use computers?	
_____	
_____	
_____	
Subject	
10. I look forward to this paper	1 2 3 4 5
11. I never feel confused during this paper	1 2 3 4 5
12. This paper is a good use of my time	1 2 3 4 5
13. This paper is amongst the most interesting on this course	1 2 3 4 5
14. The work in this paper is enjoyable	1 2 3 4 5
15. I am comfortable when attending classes in this paper	1 2 3 4 5
16. I feel positive when I think of this paper	1 2 3 4 5
17. If this paper were optional, I would still take it	1 2 3 4 5
18. What do you think about this paper as a subject?	
_____	
_____	
_____	

Appendix C Information Sheet and Consent Form

Participant Information Sheet

My name is Aaron Steele. I am currently completing a piece of research for my Doctor of Philosophy at Curtin University.

Purpose of Research

I am investigating student perception of the cloud assessment learning environment.

Your Role

I am interested in finding out what you as a student think about undertaking assessments using cloud computing tools.

I will ask you to complete two questionnaires, two concept maps, and optionally participate in an interview. I will also be making participant observations as the researcher.

Consent to Participate

Your involvement in the research is entirely voluntary. You have the right to withdraw at any stage without it affecting your rights or my responsibilities. When you have signed the consent form I will assume that you have agreed to participate and allow me to use your data in this research.

Confidentiality

The information you provide will be kept separate from your personal details, and only myself and my supervisor will only have access to this. The interview transcript will not have your name or any other identifying information on it and in adherence to university policy. Any transcribed information will be kept in a locked cabinet for at least five years, before a decision is made as to whether it should be destroyed.

Further Information

This research has been reviewed and given approval by Curtin University Human Research Ethics Committee (Approval Number SMEC-15-11). If you would like further information about the study, please feel free to contact me on my UCOL extension 70135 or by email a.r.steele@ucol.ac.nz. Alternatively, you can contact the Linda Teasdale at the Curtin University Human Ethics Office by email l.teasdale@curtin.edu.au

Thank you very much for your involvement in this research.

Your participation is greatly appreciated.

CONSENT FORM

- I understand the purpose and procedures of the study.
- I have been provided with the participation information sheet.
- I understand that the procedure itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw at any time without problem.
- I understand that no personal identifying information like my name and address will be used in any published materials.
- I understand that all information will be securely stored for at least 5 years before a decision is made as to whether it should be destroyed.
- I have been given the opportunity to ask questions about this research.
- I agree to participate in the study outlined to me.

Name: _____

Signature: _____

Date: _____