PREDICTORS OF DESIGN AND ADOPTION OF COLLABORATIVE eLEARNING ENVIRONMENTS: A MULTI-METHOD ANALYSIS

By

UNIVERSITY *of the* WESTERN CAPE

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Abstract

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Research has shown that collaborative eLearning can provide educational opportunities to groups of learners; both distance learners as well as traditional campus-based learners. It provides innovative educational methods in which learning can be constructed. The way collaborative eLearning is administered, managed, used and adopted can assist in providing information for future design and improvement of collaborative software. The objective of this research is to provide an insight into adoption and use of collaborative eLearning environments and to discover new determinants of usage.

To examine the usage of an eLearning environment at the University of the Western Cape, a cross-sectional survey was conducted with Computer Science students. While this study is specific to this university, the underlying principles can be generalised to other organisational types. This study is quantitative and qualitative in nature as well as deductive and inductive. Three hundred and six valid questionnaires were analysed using quantitative methods. Soft Systems Methodology was used to manage the research process and to create conceptual models to explain the research problem and identify solutions. It was a cyclical process.

Findings show that although the university's eLearning platform is utilised, students seem to prefer free and open source platforms. They use social and collaborative applications such as WhatsApp, Telegram, Dropbox, Google Drive, Google Docs as well as email messages. Four types of technology affordances: *communicative-affordance, document share-affordance, course resource-affordance,* and *integrity-affordance* were identified as being relevant in their choice of application. Furthermore, culture—*masculinity/femininity, individualism/collectivism, Uncertainty Avoidance,* and *Power Distance*—also have an effect on the adoption of collaborative eLearning applications and software the students used for learning. Chi-Square

analysis found that individualism/collectivism and Power Distance were both significant and related to the adoption and usage of collaborative eLearning. Gender was found not to be a determinant of how students view the use of collaborative eLearning software applications. Finally, it was also found that understanding use and user behaviour, could provide the theoretical guidance to inform collaborative eLearning design.

The analysis and findings show that culture influences the adoption of collaborative eLearning while technology affordance plays a major role in the use of collaborative eLearning.

Keywords: adoption, technology affordance, collaborative eLearning, content analysis, culture, quantitative analysis, soft systems methodology, usage.

ACM Computing Classification:

• Human-centred computing—Computer supported cooperative work.

• Human-centred computing—Empirical studies in collaborative and social computing.

• Applied computing—Collaborative learning.

• Applied computing—Learning management systems.

Declaration

I declare that *"Predictors of design and adoption of collaborative eLearning environments: A multi-method analysis"* is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Full name: Omolola Ola Bankole

Signed: 

Date: Saturday, 12 September 2020

Dedication

To my mother of blessed memory

Phebean Titilope Ola

Acknowledgments

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Glossary

BIU: Behavioural Intention to Use is the degree to which a person has plans to act or not act upon some specified future behaviour. BIU is built on an "individual's principle of what forms the structure and perception of external world.'' (Maruping, Bala, Venkatesh, & Brown, 2017).

Chi-Square Test: The Chi-Square test is also called a "goodness of fit" test. It examines how likely an observed distribution is due to chance. It determines how well the observed distribution of data conforms to the expected distribution if the variables are independent. A Chi-Square test is intended to analyse only categorical data and test the null hypothesis for independent variables (Baker & Cousins, 1984).

CS: Computer Science is a rapidly changing discipline which emerged in 1970 with its focus, the design and the implementation of software and the solving of computing problems (Joint Task Force for Computing Curricula, ACM and IEEE, 2005, p. 13). *"It impacts nearly every modern endeavour … that includes topics such as computational finance, computational chemistry, bio-informatics, eco-informatics etc."* (Joint Task Force on Computing Curricula, ACM and IEEE, 2013, p. 20).

Culture: Culture is that which accounts for the rationale behind the thinking or reasoning exhibited by the members of a group (Hofstede, 2001). Culture is the morals, and traditions that form part of individuals' behaviours and perceptions of the world (Merchant, 2007).

ICT: Information Communications Technology is a term used to describe the role of communication, telecommunication and computer systems in providing access to information through storage, retrieval, manipulation, transmission or receiving of digital information (Mahapatra, Sahu, Nanda, Kaur, & Prahar, 2017).

IC: Individualism/Collectivism is the degree to which people are socially integrated (Hofstede, 2001).

IT: Information Technology is a broad term that is used to refer to all the levels of abstraction of computer and telecommunication systems. It encompasses the design, development, and implementation of computer hardware and software (Maruping, Bala, Venkatesh, & Brown, 2017)

LMS: Learning Management Systems are software applications for the administration of academic programmes which tend to focus on the management, administration and measurement of academic processes (Ismail, 2002).

M/F: Masculinity/Femininity is the degree to which people of a background show masculine traits such as assertiveness (Hofstede, 2001).

PD: Power Distance is the degree to which less influential members of a group believe that power is not equally allocated (Hofstede, 2001).

PEOU: Perceived Ease of Use is the degree to which the user thinks the technology is simple to use (Agarwal, Rastogi, & Mehrotra, 2009).

PU: Perceived Usefulness is the degree to which the user believes usefulness is the functionality that the technology will provide (Agarwal, Rastogi, & Mehrotra, 2009).

PLS: Partial Least Squares is a statistical method that can also be used to perform multivariate inference, which is used to find the fundamental relationships between two matrices (Hair Jr, Hult, Ringle, & Sarstedt, 2016).

SAS: Statistical Analysis System is a software suite developed by the SAS Institute for advanced analytics, multivariate analysis, business intelligence, data management, and predictive analytics (Waller & Johnson, 2015).

SEM: Structural Equation Model is an analytical method that is used in quantitative analysis. It is a multivariate statistical method that examines complex relationships between latent variables (Richter, Cepeda, Roldán, & Ringle, 2016).

SSM: Soft Systems Methodology is employed where there are conflicting viewpoints about the research problem and there is no apparent solution. SSM requires the formulation of models which are relevant to real world situations; it allows the researcher to be part of the research process (Checkland & Scholes, 1990).

SN: Subjective Norms is the individual's perception of a referent other's opinion about the individual's performance of the behaviour (Srite & Karahanna, 2006).

UA: Uncertainty Avoidance is the degree to which people in a culture feel threatened by uncertain events or unknown circumstances (Hofstede, 2001).

UWC: University of the Western Cape.

Varimax: Varimax rotation method simplifies the interpretation of the factors and it decreases the number of variables that have a high loading factor (Kock, 2016).

Publication

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Chapter 1 Sketching the background

1.1 Introduction

The way people live, work and communicate with each other has been transformed by several technological revolutions over the centuries (Šmihula, 2011). When one technology is replaced by another, or a set of new technologies replaces old technologies more importantly in a relatively short period of time, it is considered to be a technological revolution. According to Schwab (2015) the transformation brought about by the next technological revolution, the so-called fourth industrial revolution will be faster paced than any of the previous revolutions.

> *"When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace" (Schwab, 2015, p. 1).*

and according to him this revolution will be

> *"characterised by a much more ubiquitous and mobile Internet, by smaller and more powerful sensors that have become cheaper, and by artificial intelligence and machine learning". (Schwab, 2015, p. 1).*

This revolution will globally impact the Information Technology (IT) field (Schwab, 2015).

In Africa, the expansion of broadband access is leapfrogging the development and use of information and communication technology (Njikam, Nanna, Shahrin, & Othman, 2019; Song, 2019). Undersea fibre optic cables (as depicted in Figure 1.1) are some of the major drivers of the telecommunications infrastructure which supports broadband communications and Internet access in Africa. For example, the Internet penetration rate in Africa has increased since the laying of the undersea cables and much discourse is being generated on the advantages it can bring specifically to South Africa (Bankole, Bisimwa, van Vuuren, Onumajuru, & Chigona, 2012). Furthermore, access to better Information Communication Technology (ICT) runs parallel with economic and social growth and has increased the proliferation of smart phone use in South Africa (Njikam, Nanna, Shahrin, & Othman, 2019; Venter, *et al.,* 2019).

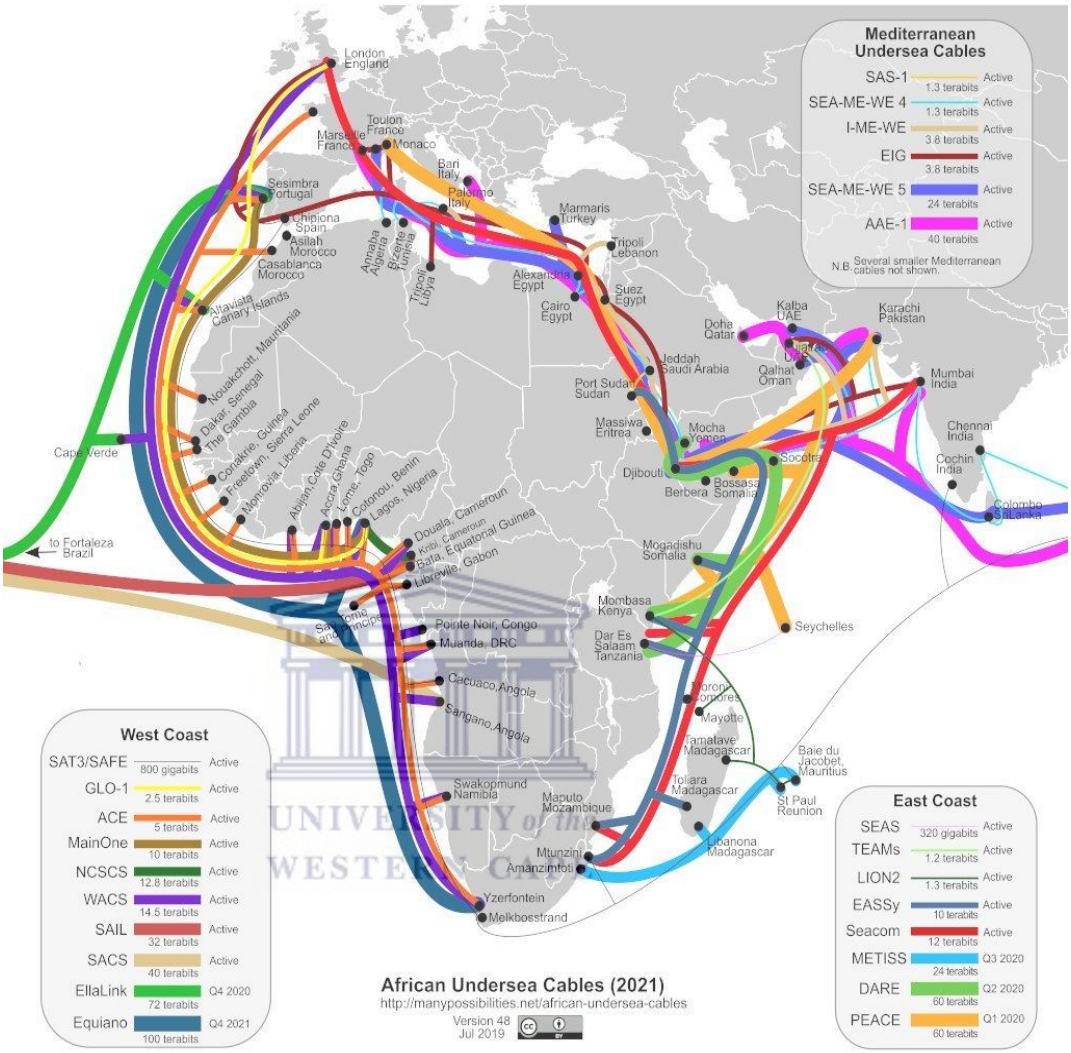

Figure 1.1: Africa undersea cables (Song, 2019)

The projection is that smart phone users will increase from 22 million users in 2019 up to 26.3 million users in 2023[1]. South Africa has one of the highest levels of Internet penetration in Africa (Venter, *et al.,* 2019).

Already the ubiquitous use of smart phones has not only had an impact on the way people communicate but has also had a significant impact on learning and the

[1] Statista (https://www.statista.com/statistics/488376/forecast-of-smartphone-users-in-south-africa/, accessed 13/5/2019)

acquisition of knowledge. This use has furthermore caused a paradigm shift in teaching—a shift from the traditional transfer of knowledge by means of face-to-face contact, to electronic or online learning (eLearning) (Pedro, Santos, Aresta, & Almeida, 2015). Even at residential universities, eLearning systems are now being used to provide blended learning opportunities for students—a combination of distance learning or eLearning and face-to-face learning. With the proliferation of smart phones, mobile devices and free software applications, access to electronic or online resources has become much improved—even when students are not on campus. It allows students to gather information to improve their knowledge, as well as to communicate and share information gained, with their peers (Ignatova, Dagiene, & Kubilinskiene, 2015).

In some instances, on-line learning can isolate learners and deprive them of the opportunity to learn from their peers. According to Totten *et al.,* learning collaboratively allows students to obtain a higher level of reasoning, allows them to gain more knowledge, and also provides a platform to practice good communication skills (Totten, Sills, Digby, & Russ, 1991). And since both communication skills and team work are important graduate attributes (Austin, 2000), learning to work as part of a team at university, should make the transition from university to the workplace less intimidating (Ke & Hsu, 2015).

Information technology is an enabler for what has become known as “collaborative learning”, it provides ways to set up collaborative systems to support team learning practices (Hawryszkiewycz, 2007). Collaborative systems provide platforms where multiple users engage in shared communications from remote locations using, for example, web conferencing and document sharing with tools such as WebEx, Skype, Zoom, Dropbox and The Cloud (Gress, Fior, Hadwin, & Winne, 2010). To be able to collaborate effectively requires well-designed collaborative systems.

Technologies can be employed and, if necessary, adapted for the purpose of learning, according to the cultural characteristics of the users and/or the affordance associated with the use of the technology or object (Chiang, Yang, & Hwang, 2014). There are several theories such as culture and affordance theories which affect the usage of technologies, these will be examined in Sections 1.2 and 1.3.

Culture accounts for the rationale behind the actions exhibited by members of a group (Hofstede, 1991). Previous studies have shown that culture influences the use of technologies (Bagchi, Cerveny, Hart, & Peterson, 2003). The unique properties of a national culture need to be identified to understand their impact on user adoption of IT applications (Min, Ji, & Qu, 2008).

In some instances, IT applications have flexible properties which allow users to discover how these applications can be utilised to serve different needs (Koehler, Mishra, Kereluik, Shin, & Graham, 2014). *Affordance theory* is used to explain why users identify different possibilities for the use of, or for an action performed on, a particular object (Manca & Ranieri, 2013). The usage or actions are often based on how the user interprets the properties or characteristics of the object (Song & Kong, 2017). These interpretations of the properties, afford several possibilities for the use of an object or the action taken on the object (Jeong & Hmelo-Silver, 2016). The properties of a technology are common to everyone who encounters them; however, the affordances of the object are not always so apparent. Affordances are exclusive to the ways in which a person perceives the materiality of the object (Sengupta, Kinnebrew, Basu, Biswas, & Clark, 2013). The collaborative applications used by students, have been created for general or purposeful usage (Giesbers, Rienties, Tempelaar, & Gijselaers, 2014) however, students can perceive the applications in diverse ways which makes them able to use the properties of these applications in personalised ways.

According to (Cross, 2004)

> *"eLearning is learning on Internet Time; it is the convergence of learning and networks and is a vision of what shared/collaborative training can become". (Cross, 2004, p. 104).*

1.2 Predictors of adoption and ICT design

According to Zhang (2008), ICT design should be guided by adoption, affordance and usage. The motivational approach to affordance provides an understanding of ICT use behaviours and it feeds this understanding back into ICT design. The motivational approach pertains to what causes ICT use and its users' behaviour (Zhang, 2008).

According to Zhang (2009) and Iivari, Kinnula, & Kuure (2015), identical design specifications may not serve all ICT design use cases in the same manner, and not all specifications are of equal interest—even to intended users—when building a particular ICT design. When designing ICT, it is important to consider ICT use and users' behaviour because these can provide the theoretical guidance to ICT design. Understanding ICT in terms of its adoption, affordance and usage can benefit ICT design (Zhang, 2009).

1.3 Adoption, affordance and usage explained

Adoption, affordance and usage are terminologies frequently used to describe human interaction with various forms of technology. In order to understand technology usage (Ahearne, Srinivasan, & Weinstein, 2004), it is imperative to understand technology adoption (Mitzner, *et al.*, 2010) as well as technology affordance (Hammond, 2010).

Adoption of a technology is the choice to acquire and use a new innovation which can provide better benefits to the user (Vicente & Lopez, 2010). Affordance refers to the perceived and real properties of a thing/object/tool (Gibson, 2000). Affordance is often used within the environment of interaction design. When an individual observes an object, it causes an action which the object affords to be performed (Anderson, Yamagishi, & Karavia, 2002).

In learning design and naturalistic research, the concept of affordance is often used and questions such as the following are posed:

"how should we design, or at least highlight, affordances to support learning?" and "how can we describe and explain the different ways in which a technology might be perceived?" (Hammond, 2010, p. 208).

Technology affordance therefore refers to the interaction between user and tool. This is the key value of the affordance concept in ICT. The said interaction comprises user perception and responsiveness to the technology—it is the interaction between user and tool that results in technology adoption (Wolf, Krüger, Miehling, & Wartzack, 2019).

Most studies have focused on technology adoption, and not on technology usage. This is observed in models such as: Technology Acceptance Model (TAM) (Davis F. D., 1989); and its extension (TAM2) (Venkatesh & Davis, 2000); Theory of Reasoned Action (TRA) (Davis, Bagozzi, & Warshaw, 1989) and Innovation Diffusion Theory (IDT) (Moore & Benbasat, 1991). All these models only have one common dependent variable namely, “usage”, however they have several independent variables, all of which are used to understand technology adoption (Ahearne *et al.,* 2004).

Therefore, in this thesis, the terminologies discussed above are interpreted as follows: Technology adoption influences technology affordance and technology usage. Adoption, affordance and usage can be used to guide ICT design in terms of how the technology is adopted and used.

1.4 Motivation and problem statement

Most universities have implemented eLearning systems to provide opportunities for students to access not only course material but also information regarding their academic performance (Ismail, 2002). Students adapt their use of eLearning applications according to their academic needs. This is more so for Computer Science (CS) students since they are more inclined to be innovative with their choice of software for collaboration since they are *au fait* with many software applications. Furthermore, their subject matter requires a high level of collaborative applications—for instance, CS students need to work collectively as a group on software development projects by coding, version control of programs and the sharing of resources. The use of collaborative applications creates learning opportunities and contributes to the inculcation of graduate attributes such as knowledge sharing, communication skills and team work amongst students. These graduate attributes are valued skills in the professional work environment (Green & Denton, 2012).

According to researchers: Austin (2000), Chai & Tan (2009) and Ke & Hsu (2015), collaborative eLearning applications have to be designed with regards to the needs of the intended users, while considering their field of study; the type of training; and the experience that is critical to the profession with which the degree is associated. The way collaborative eLearning is adopted and used by students and the

alternatives they choose, can assist in providing information for the future design and improvement of such systems (Ismail, 2002).

It is important to raise questions about the purpose of eLearning applications and how eLearning is seen from an institutional level. Learning Management Systems (LMS) and eLearning systems (as they are generally known in academic institutions) tend to focus almost exclusively on the management, administration and measurement of academic processes. LMSs do not specifically provide for collaboration between students (Ismail, 2002) especially CS students. Some LMSs may provide open forums, where students can post questions, and chat-options for contacting lecturers or mentors, but most—like the one available to the CS students in this research—do not provide collaboration opportunities for students. Students thus tend to find alternatives to enable them to collaborate with peers. CS students are more inclined to be innovative than students in other faculties, with their choices of software applications for collaboration. Furthermore, their subject matter requires a high level of collaborative software since they do coding and programming course work and projects which sometimes require them to work in teams. It is not clear what determines the adoption, affordance and usage of "collaborative eLearning systems". However, by studying how CS students adopt and use collaborative software—based on their affordance towards the software and cultural influences—the design of specialised collaborative eLearning systems can be informed.

1.5 Research question

The main research question is thus:

What are the determinants of design, adoption, affordance and usage of collaborative eLearning systems?

This question can be unpacked into four sub-questions:

1. What determines the adoption and affordance of collaborative applications for Computer Science team projects?

2. What effect does culture have on adoption and usage of collaborative eLearning systems?

3. Does gender determine adoption and usage of collaborative eLearning?

4. How does adoption and affordance guide the design of collaborative eLearning?

With these questions, four influencers (CS team projects, culture, gender and design) are thus considered in terms of the three measurables, namely: adoption, affordance and usage. These three measurables are used to guide the understanding of collaborative eLearning in this research (see Table 1.1).

Table 1.1: Influencers and measurables

	Adoption	Affordance	Usage
What determines the adoption and affordance of collaborative applications for *Computer Science team projects?*	X	X	
What effect does *culture* have on adoption and usage of collaborative eLearning systems?	X		X
Does *gender* determine adoption and usage of collaborative eLearning?	X		X
How does adoption and affordance guide the *design* of collaborative eLearning?	X	X	

1.6 Research approach

Soft Systems Methodology (SSM) is the preferred methodology for this research as it allows for:

> *"…an organised way of tackling messy situations in the real world. It is based on systems thinking, which enables it to be highly defined and described but is flexible in use and broad in scope" (Checkland, 2000).*

The aim was to uncover determinants of design, adoption, affordance and usage of collaborative eLearning. The aspects that were investigated were: the affordance of

the applications adopted for collaboration, the effect of culture on usage, and the interaction between the factors that determine usage.

1.7 Scope

This study examines the adoption, affordance and usage of collaborative technologies by CS students at the University of the Western Cape (UWC). While the dataset is specific to CS students at UWC, the underlying principles can be extended to include other departments within UWC, other universities, and even other organisational types.

1.8 Ethics

The methodology and ethics for this research were approved by the Humanities and Social Science Research Ethics Committee (HSSREC) of UWC (reference number—HS16/7/16).

1.9 Original contribution

The thesis sets out to examine collaborative eLearning systems and their design by reviewing what would be required in terms of adoption, affordance and usage of such systems. While it is important to appreciate that there is no single ideal approach to the design of collaborative eLearning systems, there is a quest for the development of an improved approach to the design of such systems.

This thesis therefore focuses on providing designers of such systems with an insight into how technology “savvy” students currently complement eLearning systems by using free online collaborative tools. It also contributes to current research in this field by identifying that cultural dimensions should be considered in the design and adoption of collaborative eLearning. Cultural dimensions need to be incorporated into IT adoption frameworks in order to fully understand the morals and traditions that guide the behaviours and perceptions of the intended users of a system.

1.10 Organisation and structure of the thesis

In this chapter, the background of the study is discussed. The research question and the theoretical approach are also introduced. The rest of the thesis is structured as follows: Chapter 2 provides a literature review in terms of the keywords and concepts required to understand the research problem. It focuses on culture and collaborative eLearning—its usage and affordance—and how these relate to this research. Chapter 3 provides an in-depth discussion of the research design and methodology followed. It also provides justification for the methods of data collection and analysis employed. In Chapter 4 the data analysis and its results are presented. The findings are discussed in Chapter 5 and it provides the reflection which brings the results into perspective. Contributions, limitations and directions for future research are also presented in this chapter.

Chapter 2 Literature review

2.1 Introduction

In the previous chapter the motivation and background to the research are discussed. In this chapter, the literature that underpins this research is reviewed in terms of the key concepts defined and the research questions posed.

2.2 IT in perspective

> *In the past sixty years or so, computers have migrated from room-size megaboxes to desktops to laptops to our pockets (Chen & Rossman, n.d.).*

In 1843, the English mathematician Ada Lovelace, in collaboration with Charles Babbage, developed what was already seen as the first programmable computer, and wrote the first computer algorithms (Chen & Rossman, n.d.). Thus, computing existed long before the *discipline* of Computer Science (CS) emerged more prominently—with the advent of the micro-processor—in the 1970s. At the time, its focus was primarily on scientific programming, compilers, algorithm development and operating systems (Joint Task Force for Computing Curricula, ACM and IEEE, 2005). It has however changed over the years and now impacts almost every modern endeavour.

The 2013 ACM report stated that:

> *"Computer Science is rapidly changing and will continue to change for the foreseeable future. Curricula must prepare students for lifelong learning and must include professional practice (e.g., communication skills, team work, ethics) as components of the undergraduate experience. Computer Science students must learn to integrate theory and practice, to recognise the importance of abstraction, and to appreciate the value of good engineering design." (Joint Task Force on Computing Curricula, ACM and IEEE, 2013).*

Although CS has evolved, when compared with Information Systems (IS), it places more emphasis on the theoretical and mathematical foundations of computing than IS. IS's focus is more on data collection, data transformation and data storage. The information systems (IS) discipline emerged in the 1980s with its focus on the information aspect of technology and managing information for good organisation and

effective decision making (Joint Task Force on Computing Curricula, ACM and IEEE, 2013). To summarise, IS deals with the transfer of data within and between organisations and the relationship between their systems in order to simplify their interactions and make them as seamless and effective as possible (Florida Tech, 2019).

Since the publication of the Computing Curricula 2001, a number of disciplines have been added to the growing family of new computing-related disciplines. One of these is Information Technology (IT). It emerged in the 2000s when the use of computing technologies became so pervasive and influential that it became an important component of every discipline (Joint Task Force for Computing Curricula, ACM and IEEE, 2005). All of these disciplines have been defined by the Association for Computing Machinery (ACM) in terms of theory, principles, innovation and application, deployment, and configuration (Joint Task Force for Computing Curricula, ACM and IEEE, 2005). Figure 2.1 illustrates the relationship between the organisational issues, the hardware, the theory and the application of IT (Joint Task Force for Computing Curricula, ACM and IEEE, 2005).

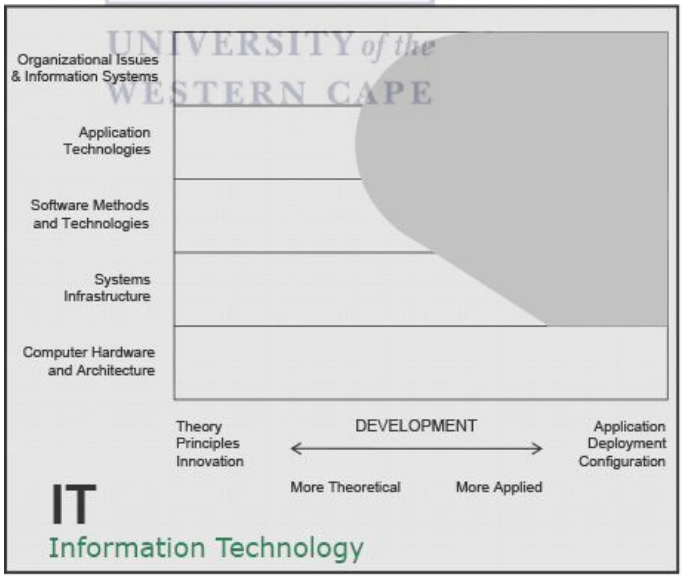

Figure 2.1: Information Technology (IT) in perspective (Joint Task Force for Computing Curricula, ACM and IEEE, 2005)

Similarly, Figure 2.2 illustrates where Computer Science is positioned.

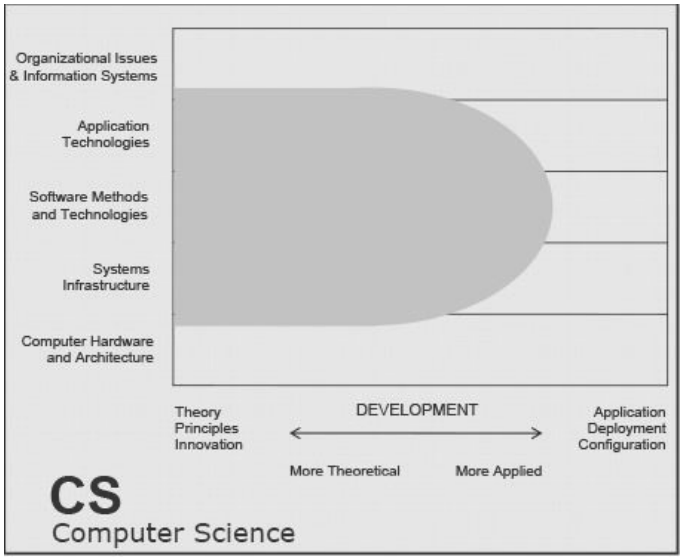

Figure 2.2: Computer Science (CS) in perspective (Joint Task Force for Computing Curricula, ACM and IEEE, 2005)

Figure 2.3 shows the area where the characteristics of IT and CS converge. Application technologies, software methods and technologies as well as systems infrastructure are all common to both the IT and CS fields.

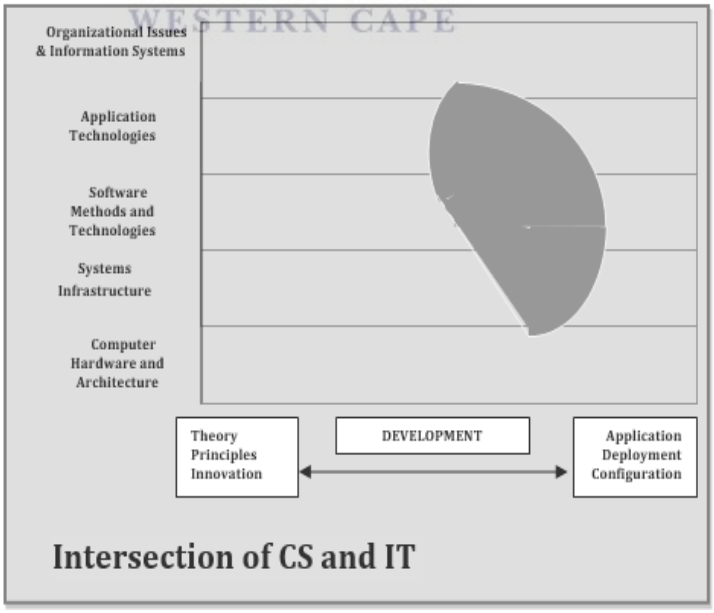

Figure 2.3: Computer Science (CS) and Information Technology (IT)

In another definition by Spraul (2010), IT is described as encompassing information systems (IS), computer engineering (CE) as well as the CS fields (see Figure 2.4). In this definition, IT is a broad term that is used to refer to all the levels of abstraction. It encompasses the design, development, and implementation of computer hardware and software. Computer engineering, information systems and CS are related through these levels of abstraction. CS is the study of computing processes and software development at both applications and/or at the theoretical levels (Spraul, 2010).

> *"The term computational science, and its associated term computational thinking, came into wide use during the 1980s" (Denning, 2017, p. 14).*

The terms used in computational sciences are machine learning, data analytics, etc. According to Denning, the latest computers provide such cheap and massive computing power that "*more people can be computational designers and tackle grand challenge problems*" with these computational algorithms (Denning, 2017, p. 17).

Since this current research deals with software, its design and use, it is situated in the CS field (see Figure 2.4).

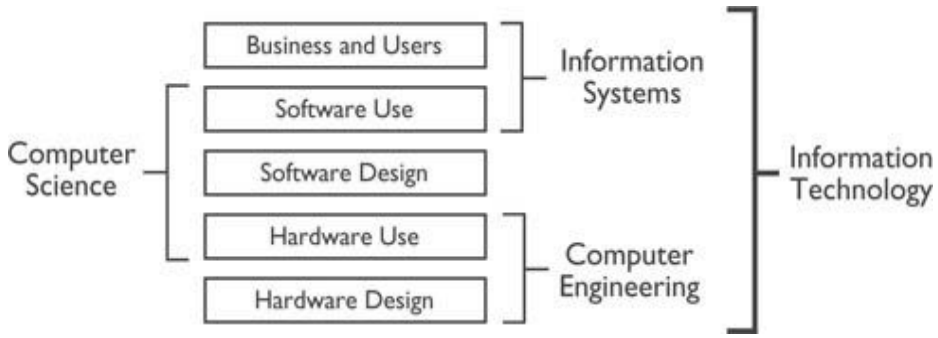

Figure 2.4: Placement of Computer Science within Information Technology (Spraul, 2010, p. 4)

In this thesis, when the term IT is used, it is used according to Spraul's definition of IT in which IT encompasses Information Systems, Computer Science and Computer Engineering.

2.3 eLearning

2.3.1 History of eLearning

The American Society for Training and Development (ASTD) has defined eLearning as a system of using electronic technologies to distribute information and facilitate the development of skills and knowledge (Green & McGill, 2011). There are several accounts of the history and generations of eLearning: Dicheva (2008), has identified three generations of eLearning systems. The first generation comprises LMSs and learning portals which enable access to learning resources, online courses and programmes. The second generation comprises educational adaptive hypermedia systems. These are Internet-based online learning systems which use artificial intelligence procedures to manage functionalities like preferences and requirements specific to the user's needs and abilities (Brusilovsky, 2000). The third generation of eLearning systems employ sets of concepts and categories and other Semantic Internet/Web technologies to allow educational content distribution over the Internet (Al-Yahya, George, & Alfaries, 2015).

The fast development of wireless and mobile technologies, is making eLearning available on mobile devices. Currently, Mobile learning or mLearning is an innovative concept which helps students gain easy access to information in real time using mobile devices. In addition, social media and applications are also changing the eLearning methods. Collaborative online learning (i.e. collaborative eLearning) extends how students learn by incorporating learning in a collective manner. mLearning and collaborative eLearning now form part of the fourth generation of eLearning (Al-Yahya, George, & Alfaries, 2015).

2.3.2 What is eLearning

eLearning is an innovative, technology driven, method which is used to effectively deliver skills and knowledge in various disciplines to individuals or groups e.g. students (Davis, *et al.,* 2007).

According to Ruiz, Mintzer, & Leipzig (2006) eLearning is described as Internet–based learning, web-based learning, computer-aided learning, online learning, distributed learning or remote-based learning. eLearning, allows students to learn at their own pace and convenience while using different IT media and communication services. It facilitates active learning whereby students are able to participate in the process of learning by having the freedom to share and communicate with both their lecturers and peers (Ruiz, Mintzer, & Leipzig, 2006).

eLearning is an educational method, that uses technology to support teaching and learning. It is used for addressing students' academic needs for knowledge and skill acquisition especially within higher education (Nagunwa & Lwoga, 2012).

2.3.3 Different eLearning methods

Făt proposes that there are three methods of eLearning used in education: "s*ynchronous"; "self-directed" and "asynchronous"* (Făt, 2010). Synchronous eLearning provides interaction between the lecturers and the learner at specified time over the Internet. In self-directed eLearning, students are required to self-study and learn through online course content materials independently, and without any time limitation. Asynchronous methods provide students with the ability to interact with the lecturer and other students through IT applications and services such as instant messaging, e-mail, e-document sharing etc. (Făt, 2010). Through observing how university students interact with eLearning systems, face to face academic institutions often use asynchronous eLearning methods, while online distance learning institutions, practice synchronous eLearning. Self-directed eLearning method is often observed in online self-study for students as well working professionals. The research motivation and problem statement of this thesis to some extent lies within the asynchronous eLearning method since university students in face to face education are involved.

There is much interest in affordances of synchronous tools for learning, as well as the opportunities online learning brings to face-to-face teaching and learning. However, synchronous learning tool does not provide comprehensive online interaction/communication, online document and resource sharing between students,

lecturers and their peer like asynchronous interaction/communication does. Thus, a blend of synchronous and asynchronous eLearning would a better combination to fully support improving student's team work through collaboration through eLearning (Giesbers, Rienties, Tempelaar, & Gijselaers, 2014).

2.3.4 eLearning systems, concepts, adoption and usage description

Advancements in ICT have opened up opportunities for innovative learning systems such as eLearning. eLearning systems have enabled students to gain knowledge in a way different from traditional learning methods (Mahmoud, Barakat, & Ajjour, 2016).

The major factor for eLearning usage is its initial adoption by potential users (e.g. students). eLearning has considerable advantages however, there are instances where it has been rejected by intended users (Bervell & Umar, 2017). Research on eLearning adoption and usage has shown that several factors influence behavioural intention to use eLearning (Green & Denton, 2012; Bervell & Umar, 2017). These factors need to be identified and their relationships defined in order to determine eventual usage of eLearning systems (Bervell & Umar, 2017).

An academic institution's adoption and usage of eLearning systems is influenced by the behavioural and social context in place at the time implementation (Yakubu & Dasuki, 2019). Hence the adoption of eLearning in academic institutions cannot be totally generalised. There has been interest for further research into what determines the adoption of eLearning in different academic institutions—this can be extended to research into predictors of adoption of collaborative eLearning with respect to the need of intended users. There have also been calls for comparative research on the adoption of eLearning systems (Boateng, Mbrokoh, Boateng, Senyo, & Ansong, 2016).

There are several and different eLearning systems in use in academic institutions however, they have all originated from the same concept. eLearning systems first appeared as Computer-Assisted Instruction (CAI). The concept of CAI is a means of teaching problem-solving with the aid of computers (i.e. technology) (Zinn, 2000).

Many different concepts of eLearning systems are mentioned in the literature. According to Aparicio, Bacao, & Oliveira (2016), eLearning has developed due to advancements in ICT and the use of computers for learning purposes.

The range of eLearning concepts is explained as follows:

- Computer Assisted instruction (CAI), Computer Assisted Education (CAE) and Computer Based Education (CBE) focus on computer usage for teaching and several uses of computers in education. Computer Assisted Learning (CAL) concentrates on the individual's education and their usage of computers for solving problems (Aparicio, Bacao, & Oliveira, 2016).
- Learning Management Systems (LMS), Computer Managed Instruction (CMI) focus on content and teacher-student interaction, these concepts put an emphasis on a teacher's tasks, and progress reports and assessments for learners. Electronic Learning (eLearning) is implemented through electronic means, thereby providing remote access for learning. A networked system (e.g. Internet) is used to access information or resources for learning (Zinn, 2000).
- Mobile Learning (mLearning) focuses on the ubiquitous nature of mobile electronic devices and technologies in providing flexible learning environments.
- Blended learning (bLearning) combines various learning environments (i.e. face-to-face and distance). Distance learning is used to support face-to-face classroom learning methods (Aparicio *et al.,* 2016).
- Self-Regulatory Efficacy (SRE) (Joo, Bong, & Choi, 2000), Rich Environment for Active Learning (REAL) (Grabinger & Dunlap, 1995) focus on the responsibility and initiative of a student using learning activities within authentic learning frameworks. It provides learners with an independent assessment of their learning ability. Computer Support for Collaborative Learning (CSCL) focuses on computers as a way to enable interaction and collective learning in groups (Aparicio *et al.,* 2016).
- Massive Open Online Course (MOOC) is freely available online content for courses which is accessible on the Internet. MOOC incorporates connectivity to social networks, the facilitation of courses and of freely available online resources (Peter & Deimann, 2018).

eLearning systems—and concepts—are widely used in different organisations and by a variety of users to achieve different goals. For instance, LMSs—the most common of the eLearning systems—are widely adopted by universities and they support the learning model used in universities (Islam, 2016). Likewise, the usage of all the other eLearning systems, are dependent on the learning models adopted by the specific organisations or individuals.

2.4 Collaboration with learning and eLearning

2.4.1 Collaborative learning

> *"There are many problems that cannot be solved at all with computation; their solutions will emerge only from social cooperation among groups" (Denning, 2017, p. 17).*

Collaborative learning is a learning process where knowledge is shared among individuals in order to educate or learn collectively (Barra, Aguirre Herrera, Pastor Caño, & Quemada Vives, 2014). Many improvements have been made in the field of collaborative learning—in particular, the introduction of technology has had a great impact on collaboration—now referred to as collaborative eLearning (Barkley, Cross, & Major, 2014).

The term collaboration means working together and it is any active process that engages two or more individuals working together to achieve outcomes that they cannot realise independently. Collaboration in our modern connected society can be defined as using the capability of ICT to facilitate the collaboration across organisations and nations. Collaborative learning, used in conjunction with peer and self-assessment, can deepen understanding, develop team work skills and draw attention to the process required for effective group work (Gress, Fior, Hadwin, & Winne, 2010).

Technologies such as Web 2.0 (second-generation worldwide web) are focused on the sharing of information on collaborating online through web-based social media and blogging platforms (Cheung & Vogel, 2013). Web 2.0 has transformed the way people communicate and collaborate with one another. This has had an impact on the educational landscape with information dissemination, communication and file

sharing becoming easier than it used to be (Huang, Yang, Huang, & Hsiao, 2010). Several collaborative learning systems have thus been designed and used to support learning (Gress, Fior, Hadwin, & Winne, 2010). In addition, smart mobile devices and access to mobile technologies has improved access to and the inclusiveness of information. These technologies afford students the ability to communicate with their peers through social media as well as access academic materials (Huang *et al.,* 2010). Leonardi (2011) states that people either formulate the perception that a technology hinders their ability to achieve their desired goals or that the technology affords an opportunity to achieve new goals.

Collaborative environments allow: knowledge sharing, ability sharing, mediation and they provide diversity in student contributions (Yau *et al.,* 2003). Research has shown that collaborative eLearning environments can provide very valuable educational opportunities for distance learning students and that they can create similar learning opportunities for traditional campus-based students (Wang, 2007; Järvelä, Kirschner, Panadero, Malmberg, Phielix, Jaspers, & Järvenoja, 2015). A collaborative environment fosters social interaction between students and diminishes student isolation. Although traditional academic institutions still practice on-campus face-to-face learning, there are benefits to be gained from the use of collaborative learning environments (Fernandes, Pinto, Machado, Araújo, & Pontes, 2015).

Collaborative learning supports and contributes to group or individual knowledge acquisition and learning outcomes (Abdullahi, 2009). Knowledge and skills derived through collaborative learning have been found to be related to deep learning, critical thinking, cognitive improvement, skills acquisition and knowledge retention (De Wever, Schellens, Valcke, & Van Keer, 2006).

2.4.2 Collaborative eLearning

2.4.2.1 What is Collaborative eLearning?

According to Făt (2010) the asynchronous eLearning method provides students with collaborative tools and could thus be considered collaborative e-learning *without synchronous* contact. However, collaborative eLearning systems *include*

synchronous contact and are also focused on learning collaboratively. Collaborative eLearning is an approach to learning, where people learn collectively via a social communication platform using educational technologies and ICTs such as blogs, wikis, multimedia sharing services, content syndication, podcasting, video-conferencing and content tagging services (Andersen, 2007). This type of learning is characterised by the sharing and construction of knowledge among participants using technology as their primary means of communication or as a common resource. As technology evolves and collaborative eLearning incorporates these innovations, learning is transformed and made more effective (Andersen, 2007).

Collaborative eLearning teaches the skill of being able to work collectively i.e. team work, effectively and efficiently as part of a group (Chai & Tan, 2009). This ability—to work collaboratively—has become a valuable skill in the workplace. A university also provides a student with all round knowledge and serves as a training environment for skills, such as working effectively in teams (Chai & Tan, 2009, Ke & Hsu, 2015).

Research executed by Kali *et al.,* (2011) has examined the collaborative design process of three teams of students who were part of a university initiative to develop technology-enhanced learning. They have found that each of the teams: (1) suggested design solutions only after extensive group exploration of the various aspects of the problem, (2) made design decisions using a balanced process in which all domain experts were equally involved, (3) appreciated each other's expertise and used team meetings to learn from each other, and (4) carefully provided ideas that were not in their own domain of expertise. Knowledge is explained in the light of the management process of the university initiative (Kali, Markauskaite, Goodyear, & Ward, 2011).

Online courses that consist of a series of interconnected activities form a model for online teaching and learning. Făt (2010) has identified the following activities as the formative stages of collaborative eLearning:

- The first activity in the eLearning model involves access and motivation. This involves initial contact, admission and commitment to engage in learning via the collaborative eLearning platform.

- The second activity concerns online socialisation which gives learners the ability to create online identities that allow them to collaborate. In addition, moderators or administrators are involved with encouraging a sense of community.
- The third activity involves information exchange where moderators or administrators give comments that clarify discussions and messages by providing relevant content material to steer learners in the right direction.
- The fourth activity in the eLearning model is concerned with knowledge construction and relating lessons learnt from practical experience.
- The fifth activity draws on reflecting on the learner's new experiences (collaboration) and knowledge gained (Făt, 2010).

This shows that collaborative eLearning is an alternative way to deliver information as a resource to learners. It provides an innovative means of learning and knowledge sharing which promotes team work and collaboration amongst learners (Făt, 2010).

2.4.2.2 Design of collaborative eLearning systems

According to Ismail (2002) the development of eLearning projects is often "*a purely technical process*" which results in software implementations which are "*unused by uninformed, fearful, or resentful employees*" (Ismail, 2002, p. 331). He further indicates that designers need to understand what "*the basic components are and what constitutes an eLearning 'ecosystem'"* (Ismail, 2002, p. 331). He has developed a framework to specify how to integrate the components of an eLearning system because *"learning and the needs associated with supporting learning evolve and change over time, and so should learning systems"* (Ismail, 2002, p. 331). This is a good statement as it relates to the motivation and problem statement of this thesis since in order to design these new learning (i.e. collaborative eLearning) systems, the needs of the intended users must be considered. The management of eLearning is one of the components of the Learning Systems Framework. Below are Ismail (2002) components of eLearning systems framework:

- Learning Management System (LMS)—As earlier discussed in section 2.3.4 LMSs are the first-generation eLearning systems that focus mainly on the management of the learning process (Ismail, 2002).

- Learning Content Design System (LCDS)—LCDS allows content producers to analyse and design learning programs. LCDS can be used for project management (Ismail, 2002).
- Learning Content Management System (LCMS)—LCMS provides collaborative environment for building and supporting learning content. LCMS allows editing, review and final the approval of submitted learning content (Ismail, 2002).
- Learning Support System (LSS)—LSSs are web-based learning environments that support teaching and learning. LSS manages and supports learners. By providing created course learning resources to learners. (Ismail, 2002).

The elements of collaborative eLearning systems identified by Ismail (2002), when compared to the components identified by Liaw & Huang (2006) are similar in every way. In relation to the above design elements, the building blocks of collaborative eLearning are: use requirement and specification, user management, user resources, usability, user administration and ease of use.

However, McGraw (2001), as cited by Ismail (2002), states the elements which should form the foundation of collaborative eLearning systems design are the following:

- Identification of collaborative eLearning systems requirements and specification must satisfy the users' needs. This is related to "environmental satisfaction".
- There should be support from the relevant management, that is providing collaborative eLearning systems. This can be likened to element "environmental characteristics".
- The knowledge base for collaborative eLearning system development needs to be relevant to the intended users. This is can be related to "environmental acceptance".
- There should be support for student profiles on collaborative eLearning systems which will assist in the eventual acceptance and adoption. This is likened to "learners' characteristics" and "collaborative activities".

  The design layout must be well planned in order for the collaborative eLearning system to be easily linked to other existing systems. This is related to "environmental acceptance".

The elements identified by Liaw & Huang (2006) are: environmental characteristics, environmental satisfaction, environmental acceptance, learners' characteristics, and collaborative activities.

Collaborative eLearning content producers need to: first effectively analyse and design systems which meet identified requirements; secondly offer an environment for developing and maintaining—collaborative authoring by content developers and subject matter experts—of the learning content; and, thirdly provide an online-based setting for the support of teaching and learning (Ismail, 2002).

Computer Support for Collaborative Learning (CSCL)—also referred to as collaborative eLearning—is an extension of eLearning systems (as defined by Ismail) but it includes the facilitation of the interaction amongst students to gain and share knowledge collectively with the aid of computing devices. In designing CSCL, all stakeholders need to be involved in the design and be able to reach a common understanding before its development and implementation (Hernández-Leo, *et al.,* 2006). Specifications and requirements for the design of collaborative eLearning need to be endorsed by the intended users such as student users. Collaborative eLearning users are important stakeholders in the process of tailoring and designing successfully accepted eLearning concepts (Liaw & Huang, 2006).

2.5 Mobile device access and connectivity

Connectivity is essential for collaborative eLearning because it forms the foundation for communication and its related services. The availability of mobile communicative devices and advanced telecommunication technologies has made sharing information very easy (Chiang, Yang, & Hwang, 2014). Mobile communication devices have features that provide more benefits than many common communication systems relying on wired infrastructure (Yoon, 2009). Universities are able to provide wireless Internet connectivity which students can use to access learning resources.

Mobile devices have become less expensive and more user-friendly. Mobile learning (mLearning) employs these ubiquitous devices (i.e. smart phones and tablet PC) for the purpose of learning, most especially among university students. University

students can benefit from mLearning because it gives them the opportunity to access course materials and also learn collaboratively, anywhere and anytime (Abu-Al-Aish & Love, 2013).

2.6 Internet and mobile phone growth in Africa

The proliferation of Information Technologies (IT) is happening at a much faster rate than other technological innovations (World Bank Group, 2016). More individuals in developing countries own smart phones, computers, and other mobile devices than have access to electricity or improved sanitation (see Figure 2.5). Improved Internet access has led to an explosion in the production and consumption of IT.

On average, 8 out of 10 individuals in the developing world, own a mobile phone, and the number is steadily rising. Even among the bottom fifth of the population, nearly 70 percent own a mobile phone (World Bank Group, 2016).

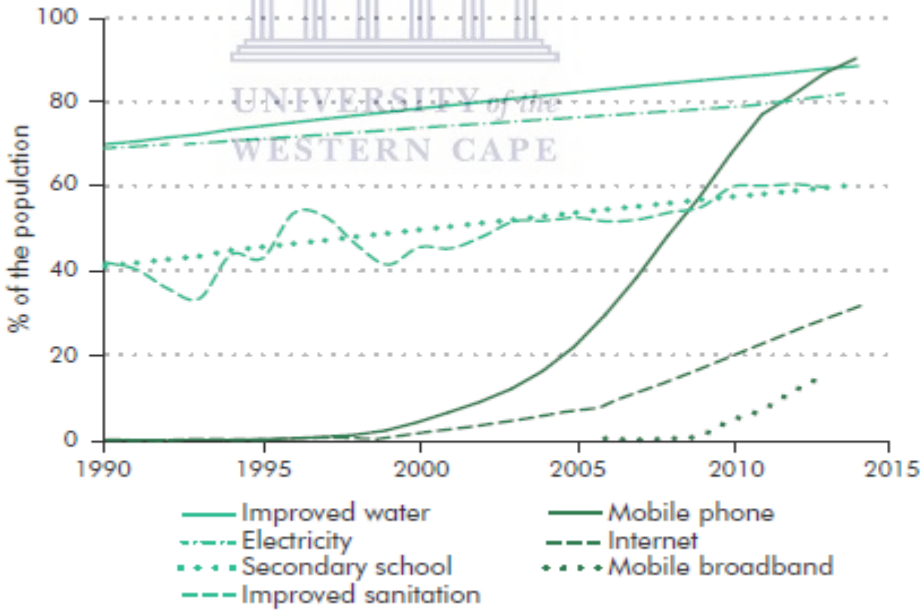

Figure 2.5: IT is spreading rapidly in developing countries (Source: World Bank Group, 2016, pp. 6)

IT has developed the information base considerably, it has lowered information costs, and created information goods. These changes have assisted with the easy searching, matching, and sharing of information. IT has contributed to better organisation and collaboration and to how individuals seek opportunities and perform normal daily tasks. According to the World Bank Group, Africa has reported a steady growth in the wide-spread use of IT from 1995 till 2005. Thereafter, between 2005 and 2015, IT grew at an almost exponential rate. Figure 2.5 shows that in the 10 to 15 years since 2000 mobile phones, Internet and mobile broadband proliferation in Africa has grown to eventually exceed the spread of the improved provision of water and electricity services (see Figure 2.5).

The exponential growth of IT in Africa is an important occurrence which has paved the way for a variety of adoption and usage patterns that have been recorded in a range of similar IT studies. The fast pace at which IT has penetrated Africa has created several initiatives on how to help alleviate issues, common to African countries, such as education, learning, skills development, knowledge and information transfer. Figure 2.6 shows how IT has been able to provide platforms for education, learning and development of lifelong skills which are what individuals require in the 21st century (World Bank Group, 2016).

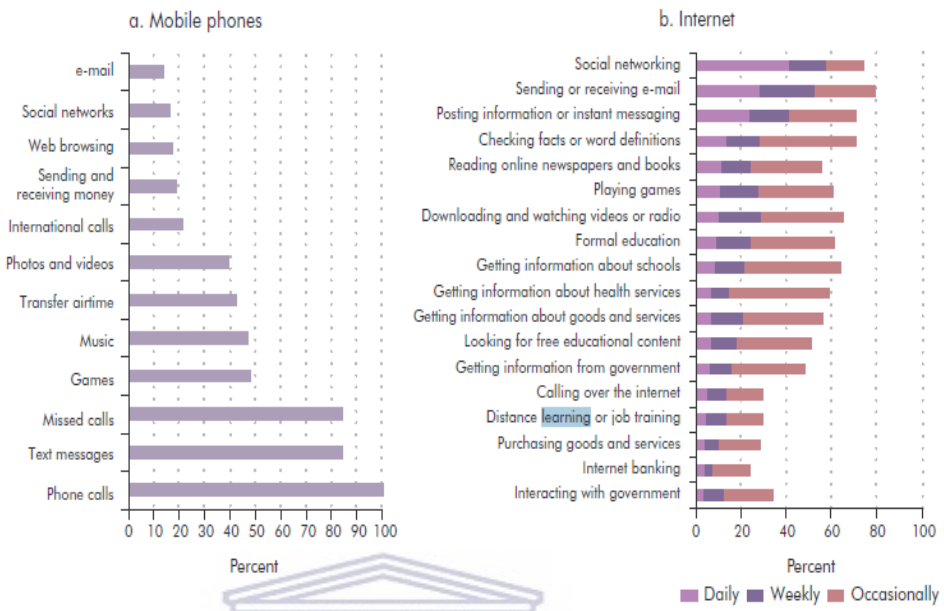

Figure 2.6: How people use mobile phones and the Internet in Africa (Source: World Bank Group, 2016, p. 103)

2.7 Social media—collaborative eLearning tools in education

Social media can be defined in several ways:

- Neier & Zayer indicate that they are Internet based information sources that are created, disseminated and used by consumers for the purpose of educating each other about products, services and other areas of interest (Mangold & Faulds, 2009, p. 357 as cited by Neier & Zayer (2015).
- According to Kaplan *et al.,* (2010) they are a collection of online based applications (i.e. all media that are used to support communication exchanges among individuals, which include forums, text/voice/video messaging, blogs, wikis, e-mail and content sharing) which allow for the creation and sharing of user content (Kaplan, Piskin, & Bol, 2010).
- Whereas Hiltz *et al.* (2000) indicate that social media allow communication and collaboration among individuals, they promote learning, and this results in

improved knowledge outcomes (i.e. good grades in assessments and assignments) among students in higher education (Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000).

- According to Hrastinski & Aghaee social media can be used to support the student learning process by expanding the means by which knowledge and information are shared (Hrastinski & Aghaee, 2012). Social media have been found to assist student learning and their benefits can be realised in many ways (Hrastinski & Aghaee, 2012).

Selwyn (2009), has found that social media do assist students to create and maintain relationships with peers while sharing interests, information and knowledge. Hrastinski & Aghaee (2012) have stated that the unrestricted use of social media in education, has revealed instructiveness and information sharing, which offer learning and educational capabilities.

Wang, Woo, Quek, Yang, & Liu (2012), state that students use social media to connect with their peers and to work together on team projects, assignments and to connect with course lecturers and the faculty. However, Selwyn (2009) has affirmed that many students use "*Facebook"* extensively to exchange information and manage their academic activities, rather than using it for collaborative learning.

The Anderson, Poellhuber, & McKerlich (2010) study has examined the use of social media among self-paced students in Canada. It has been found that a majority of students were in support of using social media in educational settings, and interestingly, students with considerable user experience in social media were more intent than others on using such platforms to support their learning process. Students and lecturers need to find educational applications that support face-to-face learning and also assist with the academic benefits of using social media (Anderson, Poellhuber, & McKerlich, 2010).

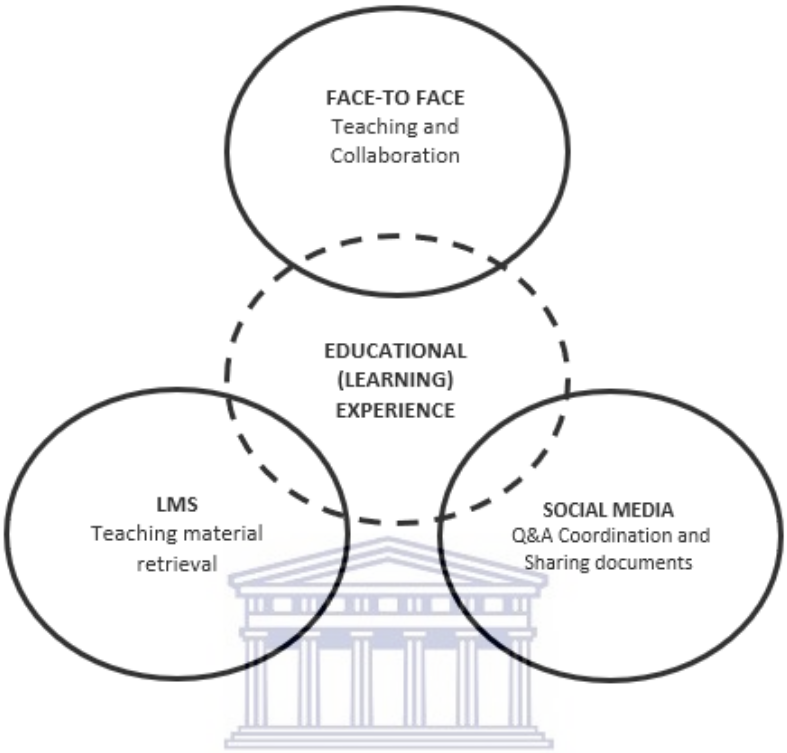

Figure 2.7: Dimensions of educational experience (Source: Hrastinski & Aghaee, 2012, p. 460)

Students perceive that the use of LMS, face-to-face learning and social media, as concepts of learning, yield different outputs. However, these three jointly form the learning experience of higher education students (see Figure 2.7). Social media are seen to support the exchange of questions and answers, the coordination of work and the sharing of documents (Hrastinski & Aghaee, 2012). Hrastinski & Aghaee dimensions of educational experience model captures the idea of how collaborative eLearning design should be approached.

2.8 Team work—a valuable collaborative eLearning skill

IT has transformed the way people communicate and work as a team. This has had an impact on the education landscape with information dissemination, communication and file sharing becoming simplified (Huang, Yang, Huang, & Hsiao, 2010). It is found that learning collaboratively as part of a team allows students to obtain an improved

level of reasoning, gain additional information and also provides a platform to practice good communication (Totten, Sills, Digby, & Russ, 1991; Laal & Ghodsi, 2012; Aberola, Del Val, Sanchez-Angiux, Polamares, & Teruel, 2016) as well as skills competency (Ke & Hsu, 2015).

Hence, collaborative IT systems and applications are used for the promotion of team work and to support learning (Gress, Fior, Hadwin, & Winne, 2010). Collaborative eLearning develops the ability to work effectively and efficiently as part of a group (Chai & Tan, 2009).

2.9 Affordance in collaborative eLearning

Affordance theory is used to explain the reasons why humans identify different possibilities for the use of, or actions performed on, a particular object. The use or actions are often based on how the user interprets the properties or characteristics of the object (Jeong & Hmelo-Silver, 2016; Song & Kong, 2017). In essence, the characteristics of a technology are universal to every individual however, the affordances thereof are not. Affordances are restricted to the ways in which a user visualises the use of an object. In literature, affordance theory has been used to explain IT use and adoption. (Leonardi, 2011; Sengupta, Kinnebrew, Basu, Biswas, & Clark, 2013).

Affordance can be observed both in traditional and online education, since students often develop an affordance for a learning tool in order to achieve a desired outcome (Wang, Fang, & Gu, 2020). Traditional classroom learning includes flexible modes of interaction between lecturers and students, learning resources and course content. Affordance, in traditional learning, is observed in the sociotechnical interaction between the lecturer, student, course content and learning resources within the learning system (Bruce, 2004).

Affordances can be observed in online learning in instances where students are provided with learning actions or tools in a dynamic learning environment (Abrahamson & Sánchez-García, 2016). Affordances in online education occur when the users interact with the active tools and learning actions that are offered (Jeong &

Hmelo-Silver, 2016). Online Collaborative Learning, and other educational technologies that involves social multimedia, afford an innovative arrangement of procedures during collaborative learning actions (Wang, Fang, & Gu, 2020). The procedures support how students coordinate their interactions with each other in order to complete tasks collectively (Kalyuga, 2013). Proper interaction affords opportunities for students to have increased cognitive processing and understanding of information (Wang *et al.,* 2020). Growth in eLearning systems for online education have opened up discussions and research into eLearning design and how to inform the design strategies and technological affordances of eLearning (Gros & García-Peñalvo, 2016).

Previous studies conducted on technology affordance on collaborative eLearning systems have explored perceptions of users in relation to technology affordance. Ge, Yang, Liao, & Wolfe (2015) investigated perceived affordances of a technology-enhanced active learning classroom in solving problems collaboratively. The result of the study showed that the academic staff and students of the institution researched, used the eLearning platform provided according to their perceived purpose and needs.

Seet & Goh (2012) explored how users, perceived affordance and how it influences the acceptance of an e-reader device in a collaborative learning system. The study found some affordance factors that influences users' acceptance of the e-reader system examined. These affordances are: mobility affordance, support affordance, connectivity affordance, immediacy affordance, and collaborative affordance. The affordances identified in the study are related to e-reader devices and cannot be compared to collaborative eLearning systems for student team work.

Rambe (2012) investigated the affordances of social media for purposeful engagement. Rambe's research examines the influence of Facebook adoption on student learning and educational delivery. The study found that Facebook is a platform that provides improved learning for traditional and online education, it also fosters networking experience for collaboration amongst students.

Lim, Park, & Hong (2012) investigated emoticon support tool for emotional affordances to enhance online collaborative learning. This study is not related to this doctoral thesis as it investigated the usage of the emoticon tool by students in order to gauge their acceptance of the tool for collaborative learning (Lim, Park, & Hong, 2012).

Parchoma (2014) studied the contested ontology of affordances and its implications for researching technological affordances for collaborative knowledge production. The extent to which technological affordances interrelate as in situ enablers, restrictors, and regulators in the knowledge production was examined.

> *"I posit potential symmetry between inquiries into the ontological and epistemological nature of technological affordances and, trans-disciplinary, empirical studies to contribute to a more nuanced understanding of collaborative, networked, knowledge production practices. Such studies may shed further light on the extent to which technological affordances interact as in situ enablers, restrictors, and regulators in distributed collaborative teams' knowledge production activities". (Parchoma, 2014, p. 367)*

Parchoma (2014) called for more studies on technological affordance as enablers, restrictors or regulators for collaborative team work. Therefore, more studies are required to fully understand technology affordances in collaborative eLearning.

The findings of these studies all informed this thesis. Previous studies showed a gap—the identification of affordance associated with collaborative eLearning systems' use. The findings of this thesis are aimed at informing the designers of collaborative eLearning systems of the requirements needed for it to be fully adopted by its users after deployment.

2.10 Culture and IT

The ways people view culture are different. These differing views provide guidance into understanding actions of people and their attitudes towards IT (Srite & Karahanna, 2006). Culture is an occurrence, an observable fact which accounts for the rationale behind the thinking or reasoning exhibited by the members of a group (Hofstede, 1991). Culture is the ethics or principles that shape the behaviour of people (Merchant, 2007). IT adoption has been shown through literature to be

influenced by culture (Srite & Karahanna, 2006). There are different classifications for “culture” in the literature; however, for this study the definition of national culture, according to Hofstede (1991), is used. Hofstede (1980) has defined national culture in terms of dimensions: masculinity or femininity, individualism or collectivism, Uncertainty Avoidance and Power Distance. These classifications can be used to understand preferences in the adoption of IT (e.g. the impact of culture on the adoption of technologies) and they will be discussed next.

2.10.1 Individualism and Collectivism

Individualism/collectivism (IC) is the extent to which individuals remain included in a society (Hofstede, 2001). It shows a culture where there are no binding bonds or ties between individuals (Wei, Stankosky, Calabrese, & Lu, 2008). Cultures with high individualism has individuals who are highly disposed to making individual choices as opposed to making joint or collective choices. Cultures with low individualism have individuals that are more closely bonded to a group and choices are made collectively. Low individualism is equivalent to collectivism—which depicts strong and continuous patterns of interrelationship in a society (Hofstede, 2001).

2.10.2 Uncertainty Avoidance

Uncertainty Avoidance (UA) is the degree to which individuals in a culture feel scared by unsure events. It is a measure of how people fear uncertain events or unknown situations. A society with high Uncertainty Avoidance has people that feel insecure when confronted by unknown/unfamiliar events and are guided by rules and beliefs. A society with low Uncertainty Avoidance has individuals that are more forbearing of opinions different from theirs; such people are willing to take risks, and accommodate unfamiliar laws, rules and beliefs (Hofstede, 2001).

2.10.3 Masculinity and femininity

Masculinity/Femininity (M/F) is the extent to which people of a common background show masculine traits such as assertiveness, performance and competitiveness while femininity is the extent to which feminine traits such as empathy, maintaining human

relationships, service and solidarity are exhibited by individuals. A society with high masculinity is ambitious and motivated by the need to portray affirmative personalities and is more assertive. A society with low masculinity (i.e. high femininity) portrays a feminine culture (Hofstede, 2001).

2.10.4 Power Distance

Power Distance (PD) is the extent to which less influential members of a group believe that power is not equal amongst them. It is a measure of how the less influential members construe inequality in their culture. This means that the determinant of inequality in a society is the followers. A society with high Power Distance has people that will condone inequalities in the wealth gap and power differences. A society with low Power Distance promotes equality among individuals. In a low Power Distance culture, individuals adopt IT easily since equality is centralised (Hofstede, 2001).

2.11 The effect of culture on technology adoption

Several studies (Srite & Karahanna, 2006; Lee, Choi, Kim, & Hong, 2007; McCoy, Galletta, & King, 2007; Im, Hong, & Kang, 2011; Reinecke & Bernstein, 2013; Capece, Calabrese, Di Pillo, Costa, & Crisciotti, 2013; Zhang, Hoehle, & Venkatesh, 2015)), to name a few, have been conducted based on Hofstede's research on culture (Hofstede, 1980). Hofstede's studies have considered culture to be the underpinning of and the foundation for IT adoption across various cultures.

Over the years, Hofstede's approach to classifying dimensions of cultures has been subject to criticism. The data reliability and research methodologies used by Hofstede have been questioned by scholars such as Baskerville as well as Bird & Stevens. According to Baskerville (2003), research especially accounting research utilising Hofstede's cultural indices, lack adequate concepts of anthropology and sociology. Baskerville asserts that the assumption of equating nation with culture, and the limitations associated with the understanding (i.e. measuring) of culture by numeric indices and matrices are unfounded in anthropology and sociology (Baskerville, 2003). Bird & Stevens are of the same school of thought, in their 2003 research, they consider Hofstede's national culture as obsolete and an unrealistic measure that

needs to be adapted in order to remain relevant. They propose a new concept—global culture—which has new characteristics, or features, that can describe the emerging global culture (Bird & Stevens, 2003).

According to Hofstede (2003), there are different school of thoughts in social science research concerning the meaning of ‘‘culture’’, which overtly leads to different research approaches. In spite of the criticisms, Hofstede’s national culture still provides researchers with a comprehensive and well-developed tool with which to theoretically analyse the interaction between ICTs and the characteristics of culture (Capece *et al.,* 2013). Zhang, Hoehle, & Venkatesh (2015) have demonstrated in a four-country study of mobile social media application usability, that a cultural perspective can be used to understand the intention to use mobile applications.

Several studies support the influence of Hofstede’s dimension of national culture on IT adoption. The studies provide insight into reasons for the behaviour of individuals (with common cultures) towards technology adoption.

Hofstede’s national culture is an observable element which accounts for the justification behind the thinking or perception exhibited by the members of any given group. Therefore, national culture can be exhibited by a collection of individuals, be it people in a specific geographical location, in an organisation or in any country. In this research, it can be assumed that students at UWC are representative of a “national culture” and this will be identified by an analysis of the dimensions of national culture presented in later chapters of this thesis see Section 4.2.3 of Chapter 4.

Table 2.1 lists technology adoption studies that examine the influence that culture has on user behaviour towards a technology. The studies were predominantly carried out in the United States and Asian countries (such as Japan, Taiwan, Korea, Hong Kong, India and China). The findings show that IT adoption is affected by culture in each respective country of research.

Table 2.1: Summary of culture on technology adoption studies

Research Title	Author and Year	Country of Research
An espoused cultural perspective to understand continued intention to use mobile applications: A four-country study of mobile social media application usability.	(Zhang, Hoehle, & Venkatesh, 2015)	United States, Germany, China and India
The Impact of National Culture on E-commerce Acceptance: The Italian Case.	(Capece, Calabrese, Di Pillo, Costa, & Crisciotti, 2013)	Italy
Knowing what a user likes: A design science approach to interfaces that automatically adapt to culture.	(Reinecke & Bernstein, 2013)	Several countries
An international comparison of technology adoption.	(Im, Hong, & Kang, 2011)	United States and Korea
The effects of national culture values on consumer acceptance of e-commerce: Online shoppers in China.	(Yoon, 2009)	China
Applying TAM across cultures: the need for caution.	(McCoy, Galletta, & King, 2007)	Several countries
User behaviour towards protective information technologies: the role of national cultural differences.	(Dinev, Goo, Hu, & Nam, 2009)	South Korea and the United States
Culture-technology fit: Effects of cultural characteristics on the post-adoption beliefs of mobile Internet users.	(Lee, Choi, Kim, & Hong, 2007)	Korea, Hong Kong and Taiwan

This thesis seeks to understand predictors of design and adoption of collaborative eLearning by applying the theoretical underpinning of dimensions of national culture to provide explanations for behaviours exhibited by student users sampled in this research.

2.12 Related research of culture on eLearning

Zhao & Tan (2010) performed a comparative study on eLearning systems adoption between Chinese and Canadian students. The study is a cross country research that included intrinsic motivator into the TAM and tries to explain students' behavioural

intention to use eLearning system from a motivational standpoint. The research found out that perceived usefulness has influence on usage of eLearning. Zhao & Tan did not consider national culture in this comparison study.

Al-Samarraie, Teo, & Abbas (2013) study on eLearning investigated how students' thinking skills can be improved through structured representation. The research aimed to assess the effects of online structured representation by employing the theory of distributed cognition. The study was carried out with 210 university student participants majoring in four separate academic fields (i.e. Pure Sciences, Applied Sciences, Pure Art, and Applied Art). No reason was provided on why these academic fields were selected and effect of national culture was not considered the research, nevertheless the research showed users a positive response to eLearning artefact that was investigated.

King & Boyatt (2015) explored factors that influence adoption of e-learning within higher education by using phenomenological approach to understand the perceptions of the research participant. The research identified institutional infrastructure, staff attitudes and skills, and perceived student expectations as factors of adoption of e-learning. 47 academic and non-academic staff that were representative of the faculties at University of Warwick were involved in focus group sessions and interviews. The research was focused non-student users of eLearning systems and national culture was not considered as factor in the study. Liaw (2008) investigated eLearning satisfaction, behavioural intention, and effectiveness with a case study of the Blackboard system. Liaw, Chen, & Huang (2008) also investigated user adoption of web-based collaborative learning systems. Liaw, Chen, & Huang found that the factors of adoption should be identified and examined at the same time when building a Web-based collaborative learning system. Likewise, Cheung & Vogel (2013) investigated, with the enhancement of technology acceptance model, the influential factors of adoption of Google applications for collaborative learning. Kahiigi Kigozi, Hansson, Danielson, Tusubira, & Vesisenaho (2011) the study explored collaborative eLearning practices in a developing country context with a case study on Uganda. University students. The study found that the learning and teaching approaches are mainly traditional, with little eLearning system in place. The students also, were able to share knowledge learning resources through eLearning. These studies were all

focused on factors of eLearning or collaborative eLearning without any inclusion of cultural characteristics which can influence adoption (Kahiigi Kigozi, Hansson, Danielson, Tusubira, & Vesisenaho, 2011).

Arenas-Gaitán, Ramírez-Correa, & Rondán-Cataluña (2011) study examined cultural differences and technology adoption of web-based learning platforms in two countries: Spain and Chile. This is a cross cultural study of students of two universities one in each country. The result of the study showed that Spanish and Chilean students have different cultures with respect to dimensions of national culture. El-Masri & Tarhini (2017) study also investigated factors affecting the adoption of eLearning systems in Qatar and USA. This a cross country study which used the extended the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model. The research considers performance expectancy, hedonic motivation, habit and trust as significant predictors of behavioural intention to adopt eLearning systems. This study did not consider cultural dimensions as a factor of adoption rather it is comparative study of eLearning adoption in two countries.

Al-Ammari & Hamad (2008) investigated factors affecting the acceptance and use of eLearning system at the University of Bahrain by adopting the Technology Adoption Model (TAM) and it with the four dimensions of national culture. The study involved 155 student participants from several departments from the university of Bahrain with only 7 of the participants reported to be CS students. They found that power distance and uncertainty avoidance were significant to behavioural intention to use eLearning system while masculinity/femininity and individualism/collectivism were found not to be significant (Al-Ammari & Hamad, 2008).

Following Al-Ammari & Hamad's study of 2008, in 2016, Aparicio, Bacao, & Oliviera study also proposed including cultural characteristic on eLearning systems model and stated that:

> *"eLearning success determinants need more in-depth studies, especially in understanding eLearning determinant factors related to cultural characteristics" (Aparicio, Bacao, & Oliveira, 2016)*

However, in the same study, Aparicio, Bacao, & Oliveira considered only one of the cultural dimension/characteristics (i.e. Individualism/Collectivism) also, 323 students

from 11 different institutions participated in the research. The study found out that individualism/collectivism is a factor that contributes positively the users' satisfaction and eLearning systems' use.

Tarhini, Hone, Liu, & Tarhini (2016) adopted TAM and included the four dimensions of culture: individualism/collectivism, power distance, masculinity/femininity, and uncertainty avoidance to measure users' acceptance of eLearning at the individual level in a developing country context. 569 undergraduate and postgraduate students that registered for different disciplines participated in the research. The study found out that all four cultural dimensions were significant moderators of users' acceptance of eLearning (Tarhini, Hone, Liu, & Tarhini, 2016).

Other studies like Downey, Wentling, Wentling, & Wadsworth (2005) investigated National culture and the usability of eLearning system by involving twenty four attendees in a workshop on training in Malaysia as research participants. The sample size of this study is very small compared to the usually large sample size of research of this nature. Also, the authors did not specify the type of stakeholders (e.g. students, institution staff: academics, non-academics) the participants were making it difficult to properly relate the research to this doctoral thesis.

This doctoral research is on adoption, affordance, the users' cultural inclination to use collaborative eLearning. This doctoral research problem has not been considered in previous studies. All the previous studies have focused on eLearning while this thesis is focused on collaborative eLearning determinants as it relates to students within a specific field of study, and the affordance they show towards collaborative applications for eLearning in that field.

2.13 Gender and eLearning

According to Chinyamurindi & Shava gender plays a role in learning and ICT utilisation (such as eLearning) especially in Africa. In South Africa, gender distribution is one of the initiatives which is driving social transformation. Hence, the formation of a government department—the Department of Women, Children and Persons with a Disability—which was set up to tackle issues that affect the female gender being

recognised as one of the groups of vulnerable people. In spite of these efforts, gender inequality and the non-representation of females in various capacities is still widespread, for example in the learning, training and development sectors of several countries around the world, including in South Africa (Chinyamurindi & Shava, 2015).

Okazaki & dos Santos (2012) have conducted a study on the determinants of eLearning adoption in Brazil and they have found that gender does influence the actual behaviour towards the adoption of eLearning. However, they state that the findings cannot be generalised since the research was carried out in a single country (i.e. Brazil). Likewise, Ramírez-Correa, Arenas-Gaitán, & Rondán-Cataluña (2015) in their study on gender and acceptance of eLearning among students in Chile and Spain, using structural equation model, show that gender does affect eLearning. Their findings go on to state that females have a higher Behavioural Intention to Use eLearning, than males. The result of their study is related to the country in which the research was carried out. In research regarding mLearning, Wang, Wu, & Wang (2009) have found that gender is also a determinant of behavioural intention to use. There is thus sufficient evidence that gender influences eLearning.

2.14 Technology adoption models

There are many theories about the adoption of technology. Some of these used in IT research (Oliveira & Martins, 2011) are: Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis F. D., 1989), Innovation Diffusion Theory (DOI) (Moore & Benbasat, 1991), and the Technology-Organisation-Environment (TOE) framework (Tornatzky & Fleischer, 1990). Of these, UTAUT, Theory of Reasoned Action (TRA), TPB and TAM are at the individual level while the DOI, and TOE framework, are at the firm or organisational level. This study is related to the individual level of technology adoption, hence only, UTAUT, TRA, TPB and TAM will be discussed (Oliveira & Martins, 2011; Schepers & Wetzels, 2007).

2.14.1 Unified theory of acceptance and use of technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) framework is a combination of several technology adoption theories. The UTAUT model includes factors like gender, experience as well as other factors. The major factors are explained below:

- Effort Expectancy—is a measure of how easy it is to use a technology (Agarwal, Rastogi & Mehrotra, 2009).
- Performance Expectancy—is the degree to which users believe that using a technology offers an improved performance (Venkatesh et al., 2003).
- Facilitating Conditions—is the degree to which a user believes that a technology that is being used is being supported at an infrastructure and organisational level (Agarwal, et al., 2009).
- Social Influence—is the degree to which a user thinks other people believe a new technology should be used (Venkatesh et al., 2003).

The model is shown in Figure 2.8.

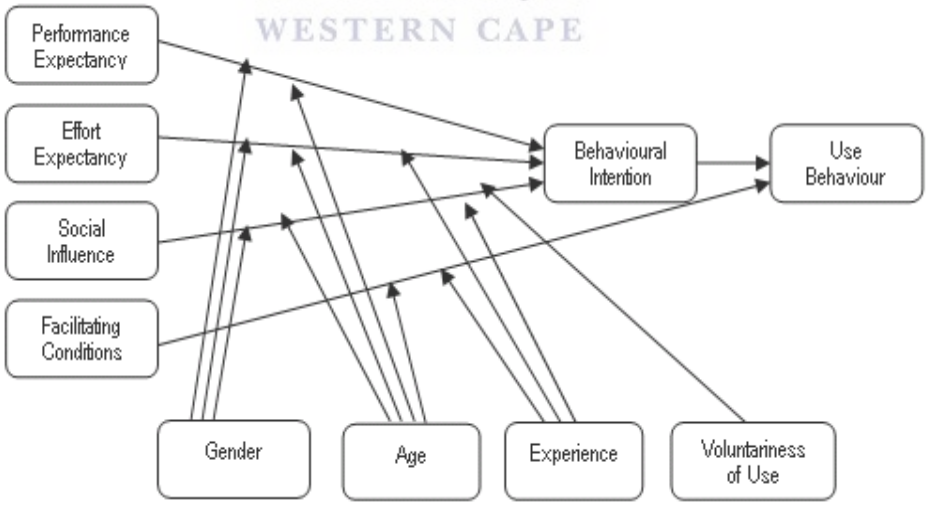

Figure 2.8: UTAUT model (Venkatesh, Morris, Davis, & Davis, 2003)

UTAUT have been employed extensively in literature. The model has been tested and it has been found that dependent variables: gender, age, experience and voluntariness of use accounted for more than 70% of intention to use (Min *et al.,* 2008).

2.14.2 Theory of reasoned action

In social psychology, user behaviour and behavioural intention to use, are determined by employing the Theory of Reasoned Action (TRA) (Davis, Bagozzi, & Warshaw, 1989) (see Figure 2.9). The three determining factors of TRA are: *'Attitude'* (A)—the approach towards a particular behaviour; *'Subjective Norm'* (SN)—the impact of society and its influence on the use; *'Behavioural Intention'* (BI)—the purposeful action to perform a particular behaviour (Davis *et al.,* 1989).

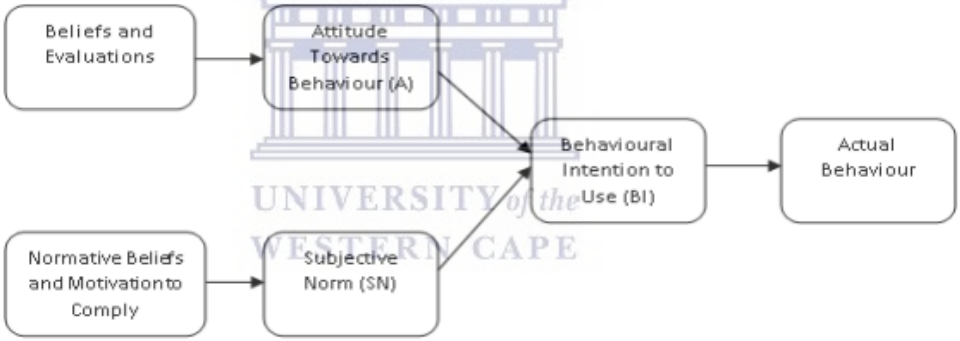

Figure 2.9: Theory of Reasoned Action (Davis *et al.,* 1989)

2.14.3 Theory of Planned Behaviour

Theory of Planned Behaviours (TPB) is an extension of the Theory of Reasoned Action (TRA). TPB was created and designed to solve the limitations within the TRA model. The issue with TRA is that it did not consider those instances where there is an incomplete choice, hence it could not be used in cases where users did not have full control over the situation. (Ajzen, 1991).

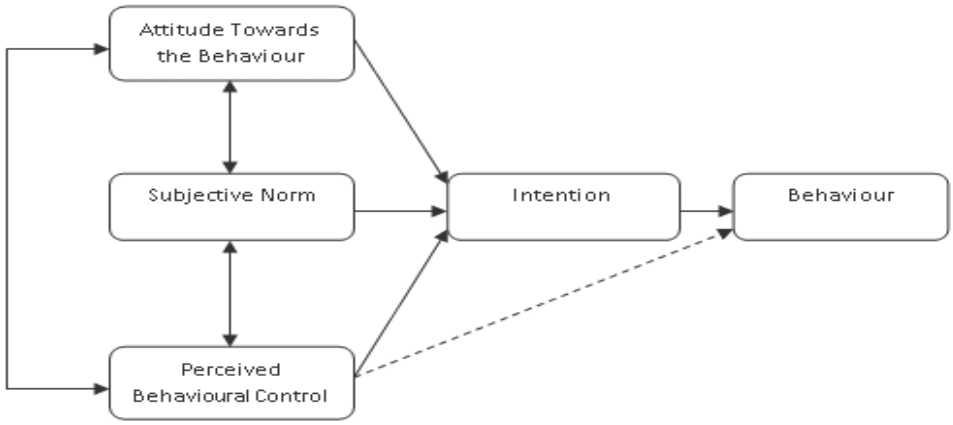

Figure 2.10: Theory of Planned Behaviour (Ajzen, 1991)

The perceived behavioural control factor is very important to the behavioural intention of the TPB model (see Figure 2.10).

With the addition of the perceived behavioural control factor, relationships between actual behaviour and behavioural intention could be further defined. By this means TPB gives a better prediction of a Behavioural Intention to Use a technology or service than TRA.

TPB model has been employed in a study that considered the adoption of Wireless Application Protocol (WAP)-enabled mobile phones among Internet users by Teo & Pok (2003). The results show that the intention to adopt the phone is based on the user's attitude towards its use as well as social factors related to it (Teo & Pok, 2003).

2.14.4 Technology Acceptance Model

The Technology Acceptance Model (TAM), as the most widely accepted adoption model, is still being used to give explanations about the adoption of technologies in many studies. It explains a user's intention to use a technology or service (Vijayasarathy, 2004). TAM states that ease of use and usefulness of a technology influences the user's intention to use or adopt the technology.

2.14.5 The TAM2 model

This current study only deals with technology adoption at the level of the individual user, and thus will be utilising a variation of the TAM model known as TAM 2 (Srite & Karahanna, 2006; Schepers & Wetzels, 2007). The primary reason for employing TAM 2 for this research is that it has a major component—Subjective Norm—which has been proven to be a determinant of user adoption in Srite & Karahanna (2006) and Schepers & Wetzels (2007). Figure 2.11 shows the variables of the TAM 2.

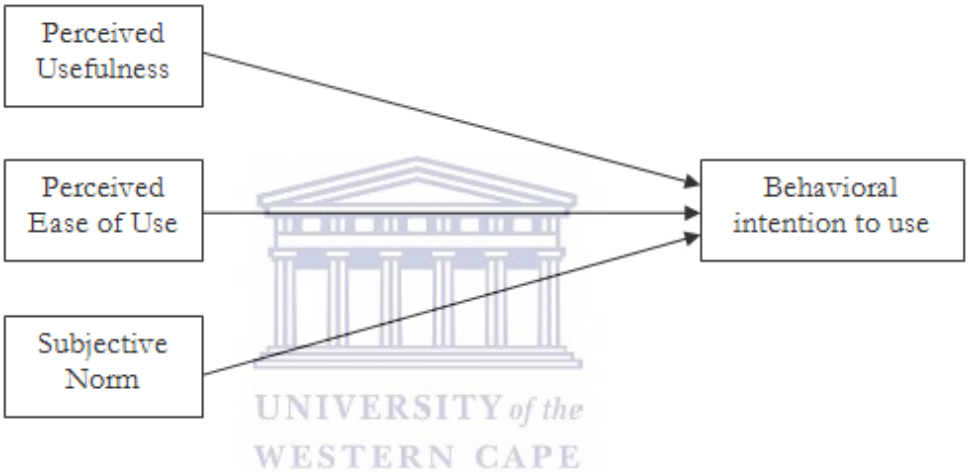

Figure 2.11: Technology Acceptance Model (Davis *et al.,* 1989)

2.14.5.1 Subjective Norm

Subjective Norms have been found to be significant in influencing intentions to adopt a technology. In the adoption of technologies, individuals show an ability to be influenced in their decision about using a technology (Srite & Karahanna, 2006). There are three types of variables that describe social factors in technology innovation namely: Subjective Norm, visibility and image. Subjective Norm could be explained as the individual's perception of a referent other's opinion about the individual's performance of the behaviour. It is a multiplication of an individual's normative beliefs and motivation to conform (Srite & Karahanna, 2006).

2.14.5.2 Perceived Usefulness

Perceived Usefulness is the degree to which a user thinks using a technology will provide satisfaction and perform a function. Specifically, it measures the degree to which people perceive a system will be able to achieve their goals in terms of job performance. It is considered a powerful tool for explaining the intention to use the system in any type of environment, be it mandatory or voluntarily (Agarwal, Rastogi, & Mehrotra, 2009).

2.14.5.3 Perceived Ease of Use

Perceived Ease of Use can be defined as the extent to which ease is associated with the use of a system. It is the extent of the convenience perceived for using a system and explains how much people feel comfortable and find it easy to adopt and employ a system for their job (Agarwal *et al.,* 2009).

2.15 Identified gap

LMSs provide eLearning platforms for third party content that organisations purchase and they are also being employed in organisations for training and course management, therefore it is important for organisations, and LMS vendors to understand how effective LMSs are as learning support tools (Chaw & Tang, 2018). Universities mostly adopt LMSs for student course and programme administration. However, many of the LMSs are also supposed to provide functionality for student use (Green & Denton, 2012). With universities being institutions where users make use of LMSs in different capacities, questions arise: are LMSs adoption and use widespread amongst their intended users? Are these LMSs decided upon with student user in mind? Do LMSs provide for different requirements of students—especially since students are enrolled for a wide variety of programmes in different study fields? LMSs have applications and tools that are instructional, but do they adapt to the needs of students? All these questions were formed from how the current eLearning systems in universities—LMSs are perceived.

eLearning systems should be designed to provide for the learning needs of students. Learning systems and the content provided should be related to the students' course or academic learning requirements. In the case of CS students, do the implemented LMS systems provide the ability to learn collectively or to share programming codes and make the students gain graduate attribute skill of team work?

With the advancement of ICTs, the ways students learn have evolved. Learning now involves the use of innovative technologies, online applications and tools at the disposal of students, to augment the eLearning systems already provided by universities. There is a need to understand why students use other applications for learning collaboratively and in general, what the determinants of design, adoption, affordance and usage of collaborative eLearning systems are. There are several aspects to consider when studying "*Predictors of design and adoption of collaborative eLearning environments*". Several studies have been conducted on the adoption of various software packages using different IT adoption frameworks (as discussed in Section 2.14). IT adoption frameworks can be adapted to investigate collaborative eLearning. More studies need to be conducted to address the reasons why particular students in a certain field of study decide to use freely available online applications and tools to learn collaboratively rather than those provided by the university's LMSs.

There have been cross cultural studies using comparative analysis to assess eLearning across countries (Arenas-Gaitán *et al.,* 2011; El-Masri & Tarhini, 2017). Other studies that are similar to this thesis yet different in terms of the research questions have also considered determinants of national culture as factors adoption of eLearning.

Similar as the previous studies (see Section 2.12) have seemed to this research, they have not been able to address the motivation and problem statement of this research—what informs the design of specialised collaborative eLearning systems—in this case a collaborative eLearning system suitable for use for CS students. The design can be informed by how CS students adopt and use collaborative software, —based on their affordance and cultural influences towards the eLearning system. One may ask why the interest in only CS students? The answer to this is that CS field requires a high level of collaboration in software development since coding,

programming course work and projects are sometimes done as team work. Collaborative eLearning are pivotal to creating learning opportunities and contributes to the learning of graduate skills and attributes such as knowledge sharing, communication skills and team work amongst students. Graduate attributes like those mentioned are valued skills CS graduates need in the professional work environment.

In addition, LMSs in use at universities do not specifically provide for collaboration between students CS students inclusive. LMS provide open forums, a question and answer platforms where instructors or mentors provide guidance to students (Ismail, 2002). This is the case with CS students in this research where the LMS do not provide collaboration opportunities for the students. Students make sure they find alternatives to enable them to collaborate with peers. CS students are often driven to be innovative than students in other faculties, they explore several software applications (e.g. Gitlab, bitbucket etc.) that assist them in pursuit of collaboration and learning. All studies discussed in Section 2.12 of literature belong to one or more following classes identified below:

- Cross cultural studies e.g. (Slotte & Tynjälä, 2005; Zhu, Valcke, & Schellens, 2010; El-Masri & Tarhini, 2017; Zhao & Tan, 2010; Arenas-Gaitán, Ramírez-Correa, & Rondán-Cataluña, 2011).
- eLearning usage e.g. (Al-Samarraie, Teo, & Abbas, 2013).
- eLearning or collaborative eLearning adoption e.g. (Liaw S. , 2008; Liaw, Chen, & Huang, 2008; Kahiigi Kigozi, Hansson, Danielson, Tusubira, & Vesisenaho, 2011; Cheung & Vogel, 2013; King & Boyatt, 2015).
- eLearning, collaborative eLearning and culture e.g. (Downey, Wentling, Wentling, & Wadsworth, 2005; Al-Ammari & Hamad, 2008; Aparicio, Bacao, & Oliveira, 2016; Tarhini, Hone, Liu, & Tarhini, 2016).

The identified gap indicates that, these studies do not show the predictors of design and adoption of collaborative eLearning of a specialised student field such as CS while also not investigating affordance of collaborative eLearning and they did not include culture (i.e. national culture) as a factor of adoption to be considered.

2.16 Summary

This chapter has presented the literature and descriptions of key concepts that relate to collaborative eLearning. The literature shows that the study is rightfully situated in the CS field (see Section 2.2). This review reveals that there is a need for more studies that provide insights into the design, adoption and usage of ITs such as collaborative eLearning.

Chapter 3 Methodology and design

3.1 Introduction

In this chapter, the research approach as well as the research design of this project is presented.

3.2 Research approach

Crotty identified four elements that define a research process (see Figure 3.1). These elements are: epistemology, theoretical perspective, methodology and methods. These form the structure on which all research is built (Crotty, 1998).

This research adopts a constructionist epistemological assumption.

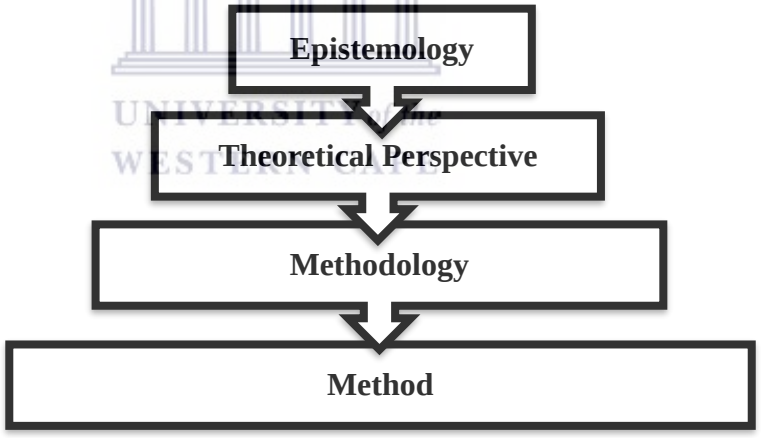

Figure 3.1: Four elements of research process (Crotty, 1998, p. 4)

3.2.1 Epistemology

Academic research is conducted by applying specific research paradigms. Epistemological assumptions are often used to generate the theory about how knowledgeable research can be accomplished (Myers, 2009). There are three main

epistemological assumptions *objectivism*, *constructionism and subjectivism*. Objectivism takes the stance that research can determine objective truth and meaning while constructionism believes that meaning is the construction of a person's perceived social reality (Crotty, 1998). Subjectivism on the other hand, is defined as "*our own mental activity is the only unquestionable fact of our experience*" (Stanek, 2017, p. 2).

3.2.2 Theoretical paradigm

Burrell & Morgan (1979) recognise four mutually exclusive paradigms which are categorised along two dimensions namely "social science" and "nature of society". These four paradigms are identified as positivist, anti-positivist, sociology of regulation and sociology of radical change (see Figure 3.2).

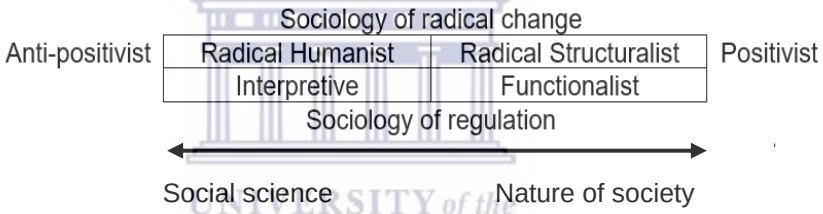

Figure 3.2: Four paradigms for the analysis of social theory. Source: (Burrell & Morgan, 1979, p. 22)

The radical humanist paradigm aims to explore and provide alternatives. People with this point of view are concerned with the subjective world and the need to overturn existing societal standards. The interpretivist paradigm aims to *explain* situations. People with this point of view are certain that occurrences in the world are subjective and they strive to understand the world as it is (Cronje, 2012; Roode, 1993). The functionalist paradigm aims to find solutions to issues. It is believed that occurrences in the world are objectively construed, and that things can be upgraded by having stronger structures and rules. The Radical structuralist view aims to *describe* the current situation. It is also based on an objective world view. Emphasis is laid on structural associations and the belief that radical change is constructed in society (Cronje, 2012; Roode, 1993; Burrell & Morgan, 1979).

A theoretical paradigm attempts to explain how context is provided for the research process, and situates logic and criteria in the study (Crotty, 1998). The Positivist view considers that reality is objective, its properties can be quantifiable, there are no associations to the scholar, or the instruments (Myers, 2009). Positivist research tries to confirm theory with an aim to improve the reasoning behind an observable fact (Myers, 1997). Positivists believe that what the researcher observes can be influenced by the theories, background, knowledge and values of the researcher (Robson, 2002). An interpretivist perspective assumes that truth is only attained via social links like perception, verbal communication and research tools (Myers, 2009).

This research is divided into three study areas:

The first study area, based on the first research question, namely: "*What determines the adoption and affordance of collaborative applications for Computer Science team projects*?", takes on an interpretivist (anti-positivist) approach because it *explains* the reason for the affordances exhibited by the students.

The second and third study areas are based on the questions: "*What effect does culture have on adoption and usage of collaborative eLearning systems?*" and "*Does gender determine adoption and usage of collaborative eLearning?*", which takes on a radical structuralist (post-positivist) approach because it *describes* what causes adoption of collaborative eLearning. The post-positivist approach used in this research follows known quantitative theories and background knowledge on technology adoption and usage, already discussed in the literature review.

The fourth study area, is based on the last research question: "*How does adoption and affordance guide the design of collaborative eLearning?"*

3.2.3 Methodology

A methodology explains the strategy and actions that need to be taken to execute the research. It is the research design and the rationale behind the choice of methods adopted (Crotty, 1998). The research framework for this research will follow a Soft Systems Methodology (SSM) approach.

3.2.3.1 Soft systems methodology

SSM is employed where there are conflicting viewpoints about the research problem and there is no apparent solution. SSM requires the formulation of models which are relevant to real world situations, and allows the researcher to be part of the research process (Checkland & Scholes, 1990). SSM is used to create conceptual models to achieve structural thinking for the complex situations that people are subjected to. SSM can empower a researcher (and participants) to understand alternative points of view in order to solve a problem through learning. Furthermore, it helps foster an understanding of different situations and to help identify solutions (Checkland & Scholes, 1990).

SSM considers real-world problems caused by people with different perceptions, and creates defendable and logical models for comparison with the real world which in turn helps make recommendations for solving the issues or problems. These recommendations are: To proceed from meanings to intentions to actions, while considering the diversity of real situations, thereby eliminating rigidity of techniques (Checkland & Scholes, 1990). These rational and defendable models are called conceptual models and are based on logic. Conceptual models are a representation of what an ideally good and positive scenario looks like and can be compared to reality in order to identify where change could be affected (Wilson, 2001).

In order to proffer purposeful action, there are several significant systems that are possible and can be considered. In other words, to get to the solution of the problem, a root definition of the problem must be made (Checkland & Scholes, 1990).

A root definition is thus defined as:

> *"SSM's 'root definitions', are constructed around an expression of a purposeful activity as a transformation process [T]" (Checkland, 2000).*

And as:

> *"A condensed statement about the system, roughly comparable to a mission statement" (Bergvall-Kåreborn, Mirijamdotter, & Basden, 2004, p. 57).*

A root definition is described as the necessary human customers [C] and actors [A] whose activities need to be carried out in order to achieve the desired transformation [T] within the stated worldview [W], while considering the decisions made by the system's owners [O] as well as constraints of the system environment [E] (Bergvall-Kåreborn, Mirijamdotter, & Basden, 2004). The root definition is important since it is used to logically work out the activities which the researcher has to perform in order to establish it.

CATWOE is a conceptual model which ensures that a draft root definition is acceptable (Checkland & Scholes, 1990). The mnemonic CATWOE is explained below:

[C] The Customer: The individual(s) who receive the output from the transformation.

[A] The Actors: Those individuals who take action on the activities of transformation.

[T] The Transformation: The determined action of change (i.e. of input to output).

[W] Weltanschauung: This is a German word meaning: means "world view". It is the point of view that gives meaning to the root definition.

[O] Owner: The system decision maker who is concerned with the system's performance.

[E] Environmental Constraints: The constraining factors outside the system that are significant to the system.

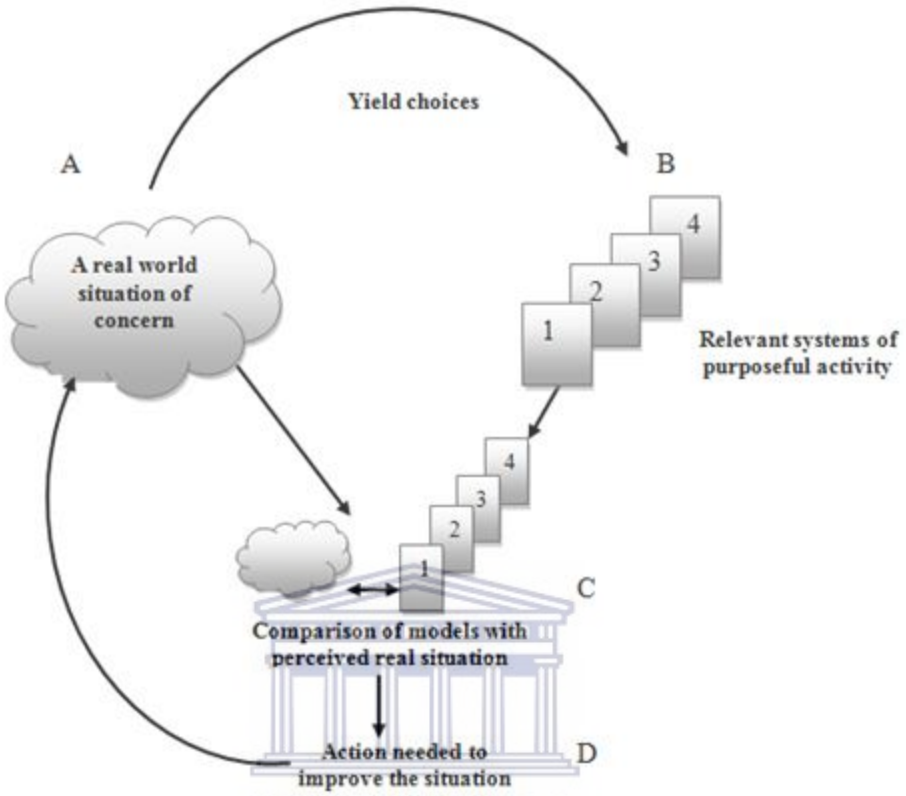

Figure 3.3: The basic shape of SSM (Checkland & Scholes, 1990: 7)

Figure 3.3 reflects the basic shape of SSM as a cyclical learning system. 'A' in the figure represents a real-world situation of concern; it presents how the researcher perceives the particular problem being investigated within the researcher's world view. 'B' in the figure depicts which system models can be used to instigate and devise an action of purposeful change. 'C' shows comparison of the purposeful action with a specific aspect of the real-world problem. 'D' depicts the identification of the action that should be taken for change to take place within the system.

3.2.4 Methods

Methods are the techniques or procedures that are used when carrying out the research. This includes the activities adopted when gathering and analysing the data. Examples of data gathering activities include focus group interviews, surveys and

observation, while examples of data analysis activities include statistical analysis and content analysis. These activities form the research methods (Crotty, 1998).

3.2.4.1 Data gathering methods

FOCUS GROUP INTERVIEWS

The focus group research method is used to obtain data from group discussions which are carefully planned to create a nonthreatening environment. Participants are free to talk openly and are encouraged to express their opinions through probe questions. Focus group interviews can be in a structured or semi-structured format and can yield considerable information in a relatively short time. Participants are chosen on the principle that they have knowledge on the subject matter, have related socio-characteristics and are able to talk to the interviewer. These interviews can be analysed using content analysis (Rabiee, 2004).

SURVEYS

A survey research method is one of the areas of measurement in applied research. It entails several measurement processes that involve asking questions of participants. In a research survey, the researcher selects a justifiable sample of participants from a population and administers a standardised questionnaire to them (Crotty, 1998).

The participants are required to supply demographic information to establish their position/function in the context in which the study is situated; this is to confirm that the participant is rightly positioned to participate in the survey. The questions in the questionnaire often require a scaled response by the participants. A Likert scale of one to seven is frequently employed.

In this study the questionnaire (see Appendix C) used the Likert scale for responses to Sections B and C. This follows the methods used in similar pieces of research on technology adoption by Chin, Marcolin, & Newsted (2003) and Srite & Karahanna (2006).

OBSERVATION

Observation as a research method is useful to researchers in several ways. It presents researchers with ways to identify nonverbal expressions such as feelings, and helps to grasp how participants actually respond to situations when they are in their own environment. Observation allows researchers to identify the context in which terms are used by participants in interviews and, to observe events that participants may not be willing to share. Observation brings to light discrepancies, in responses gathered from interviews and surveys, and makes the researcher aware of inaccuracies in descriptions provided by participants (Kawulich, 2005).

3.2.4.2 Data analysis methods

SAMPLING METHODS

In literature, two primary kinds of sampling techniques (i.e. probability sampling and non-probability sampling) are commonly used (Mouton, 2006, p. 79). Each element of the population has an equal possibility of being chosen in probability sampling (Saunders, Lewis, & Thornhill, 2011, p. 207). However, in non-probability sampling, each element of the population may not have the same chance of being selected (Saunders, Lewis, & Thornhill, 2011, p. 207), and samples are chosen using the expertise or judgment of the researcher or based on the purpose of the study (Mouton, 2006, p. 166).

STRUCTURAL EQUATION MODELLING ANALYSIS

Structural equation modelling (SEM) is an analytical method that is used in quantitative analysis. It is a multivariate statistical method that examines complex associations between latent variables. In SEM, the directional associations between the latent variables are measured to determine sufficient model measurement. Key measurements of relationships between latent variables are path coefficients and corresponding p values (Kock, 2016).

CONTENT ANALYSIS

Content analysis is used to examine text by focusing on how the text is structured, it allows for a knowledgeable interpretation of the phenomenon under study. There are several kinds of content analysis. Only conventional and summative content analyses (Neuendorf, 2016) are discussed in this study. Conventional content analysis requires the researcher to be immersed in the data. It is a method which aims to understand the reasoning behind the research questions. Here, categories are allowed to emerge from the data (Annala, Mákinen, Svárd, Silius, & Miilumáki, 2012). Summative content analysis identifies keywords in context. This is done in order to understand the contextual use of specific words or keywords (Hsieh & Shannon, 2005). This approach explores and analyses the use of a word or the content in a textual context (Lovejoy, Watson, Lacy, & Riffe, 2016).

3.3 Research ethics

In this study, in order to ensure the quality of the data gathered, the research instruments had to be checked to certify that all were correctly filled in and completed. The consent of the student participants was sought and obtained—the questionnaires were completed and consent forms were signed. No personal details were gathered, hence the anonymity of participant responses to the survey was guaranteed. Respondents were given the option to opt out of participation at any stage of the study.

The information provided through the survey was handled with utmost confidentiality. Ethics approval was granted by the university's ethics committee (Appendix E).

3.4 The research design of this study

This current study involved the gathering of data from students at the department of Computer Science at the University of the Western Cape over a period of two years. Students from first year to honours year levels were the target population. All the students participated by responding to the questions on the questionnaire during this time period.

A non-probability sampling method, that uses the researcher's own judgment, was used to identify the population of individuals that are knowledgeable about the problem matter and will most likely be able to provide applicable answers to research questions asked in interviews and questionnaires (Etikan & Bala, 2017).

Judgmental sampling defines a process where the researcher uses his or her own judgment to select a group of people who knows about the problem. Judgmental sampling is also called purposive sampling because it involves a particular purpose. This type of sampling technique is convenient and cost effective.

The first part of the research focused on the final year—i.e. third year—CS students. In the first semester of 2016, the students were required to do a capstone project as a team. The project required the team to design an application over a period of five weeks.

Fifty students were allowed to self-select their team members. Eleven teams, each team consisting of three to five members, were formed. Each team had to propose three project ideas—these were vetted and one was chosen to be developed. Every week students received feedback on the progress of their project. Initially the team had to conceptualise their chosen product idea and present it to a mentor who assisted them in refining the concept.

The teams used techniques to identify needs and establish requirements for their product and then used conceptual models to design three throw-away prototypes. Using the feedback of the mentors, one high-fidelity prototype was developed by each team and evaluated using heuristic evaluation. Students were expected to apply their knowledge of software engineering, database and interaction design in this project. Finally, the teams had to demonstrate the finished product to the class and in their presentation, explain what each participant did, why the specific application was chosen, what conceptual model was used for the design of the graphical user interface, what type of testing was done—and what errors it revealed—and finally what type of technologies were used and why.

During the development of the project, team members had to indicate every week what their contribution was. To ensure that all students contributed to the project,

teams were advised to involve each team member in every aspect of the project. If members did not participate as required, teams were encouraged to discuss their concerns with their mentors. Mentors would suggest some interventions to assist the team with their working relationships, however if these interventions were not successful, teams were allowed to expel the non-participating member.

The students had access to the university-wide eLearning platform, called iKamva, as well as a free open source online platform called Piazza.

> *"iKamva is the institutional Learning Management System (LMS), which enables lecturers to explore the application of eLearning - in particular various eTools for teaching-and-learning purposes" (University of the Western Cape, 2019).*

iKamva is a Sakai® eLearning platform which enables the school management (i.e. administrators, lecturers etc.) to manage student programmes, courses, assessments and grades.

Piazza is an open source online learning system which has more usable features than iKamva. CS lecturers and tutors often prefer to make use of Piazza because of the reasons discussed below.

> *"Piazza is a question and answer discussion board that is uniquely designed to facilitate collaborative interaction among students. It is designed to model face-to-face group discussions allowing for the creation of complex questions and complex answers." (Tufts University, 2019).*

Piazza has features that are convenient and that enable collaborative learning, such as: it provides support for the editing of computer code and it updates in real time; it offers free downloadable mobile apps which allow users remote access to resources; it provides wiki-like problem solving space for the whole class or for study groups; and lecturers can use Piazza discussion boards (Tufts University, 2019).

The students' use of these platforms was mostly determined by the way lecturers adopted the platforms for the dissemination of their course-materials and course-information.

As a teaching assistant and mentor, the researcher was able to observe each team and study how the members interacted with one another and acted as a team. The observations were conducted halfway through the project period. In order to establish if the survey would provide the researcher with meaningful answers, a pilot study was embarked upon and it constitutes the first SSM cycle.

CATWOE on which the root definition is based (see 3.2.3.1) is defined as follows:

[C] The customers: Students receive the output from the transformation.

[A] The Actors: University management, lecturers and students take action on the activities of transformation.

[T] The Transformation: Collaborative online applications create eLearning opportunities and important graduate attributes, such as knowledge sharing, communication skills and team work amongst students.

[W] Weltanschauung: Collaborative online applications assist students in attaining graduate attributes which are important in real job placements or workplaces.

[O] Owner: University management, lecturers and students.

[E] Environmental Constraints: Access to uninterrupted or continuous data service (some student may not have access to uninterrupted Internet services outside the university).

The root definition of the above conceptual model is thus:

University management, lecturers and students' use of collaborative applications can create eLearning opportunities and contribute to the inculcation of important graduate attributes such as knowledge sharing, communication skills and team work amongst students.

3.4.1 Pilot study—first SSM cycle

A pilot study was carried out to check questions that would form part of a questionnaire for meaning, ambiguity, respondent reactions and to assess whether or not it is simple to understand (Baker & Foy, 2008).

The pilot study allowed the researcher to assess the validity and reliability of data collected from the questionnaires and the viability of the study in relation to the designed research methodology (Saunders, Lewis, & Thornhill, 2011, p. 394). The pilot study formed the first SSM cycle (see Figure 3.4).

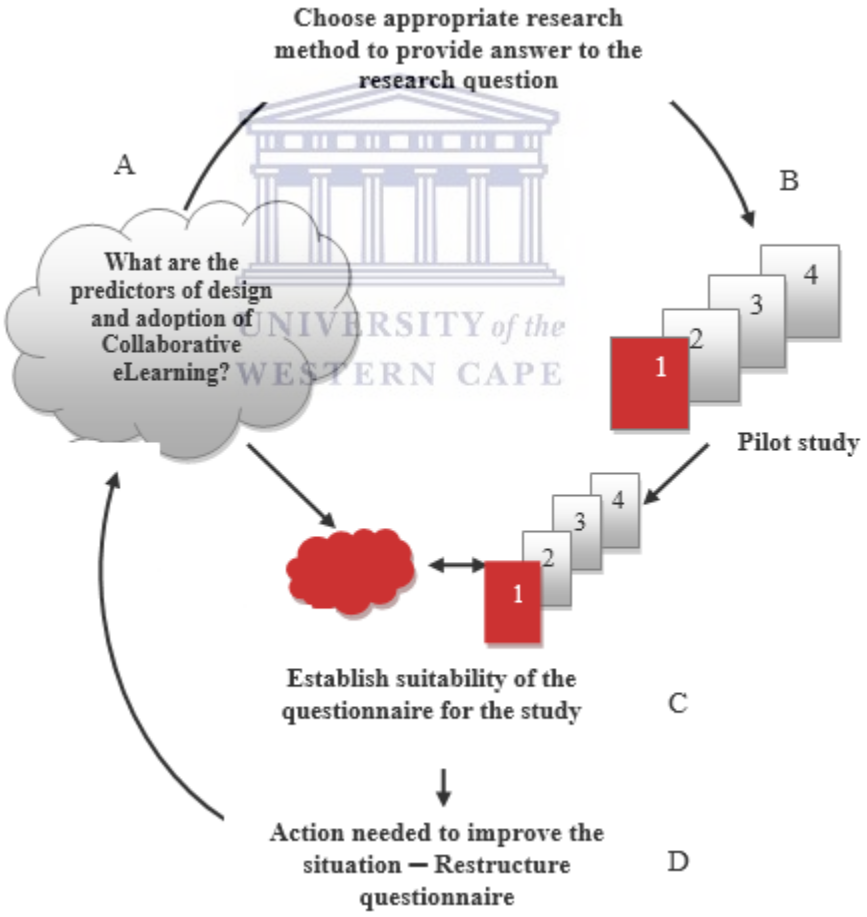

Figure 3.4: Pilot study—first SSM cycle

Semi-structured focus group interviews were conducted with each of the eleven teams. Several probes (based on the questions) were used to start the conversations with the focus groups (see Section A of Appendix B). The responses to these probes provided the corpus of data. This was the textual data that was analysed using content analysis.

In addition, follow-up individual discussions were organised by the researcher with a few individuals randomly chosen from the eleven teams. These individuals, who were representative of the actual research population (i.e. CS students), were interviewed using the same probes that were used during the focus group interviews. This was to give context to the previously collected data and to corroborate responses given.

The results from this first cycle were used to design a survey that was used in the second, third and fourth SSM cycles.

3.4.2 Technologies afford collaboration—second SSM cycle

The second SSM cycle is aimed at finding out what technologies afford collaboration. The researcher uses observation of the eleven teams to collect data but also refers to responses to the probes of the pilot study. The observations are written down as field notes. In this cycle, the researcher investigates which technologies afford collaboration for final (third) year CS students of UWC and how these students determine the collaborative applications to use in order to coordinate group activities for their project (see Figure 3.5) (see Appendix D).

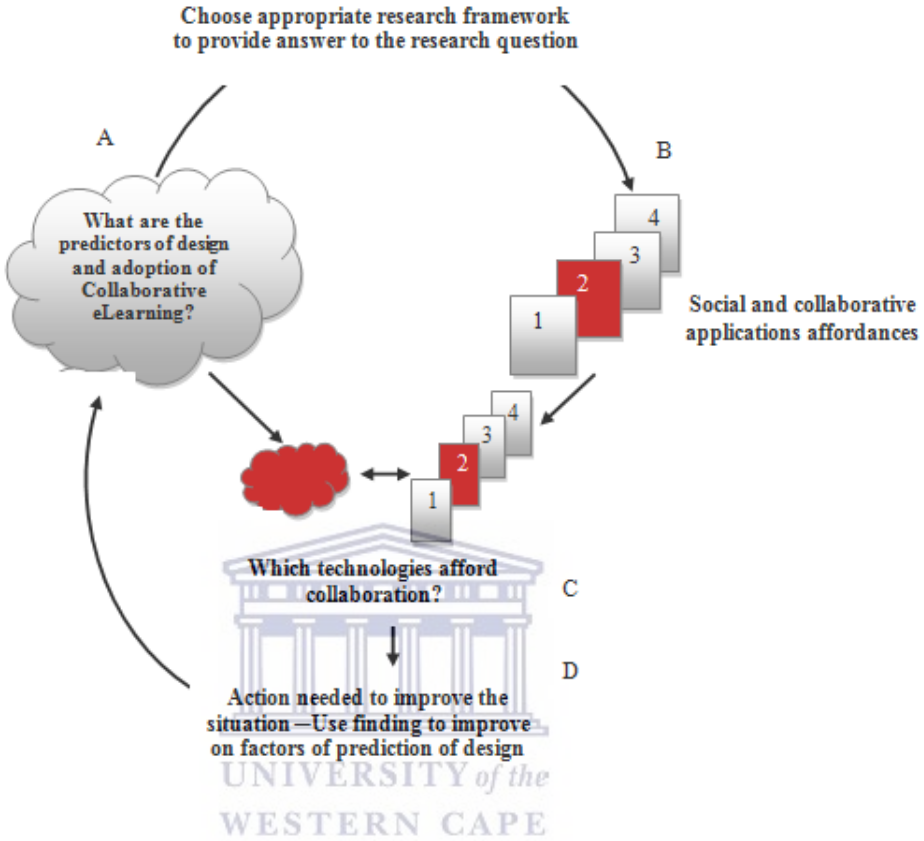

Figure 3.5: Technologies afford collaboration—second SSM cycle

The research question addressed in this cycle is:

What determines the affordance and adoption of collaborative applications for Computer Science team projects?

This question can provide insights into collaborative eLearning applications used by teams and also identify the affordances that are evident for learning when working on team projects.

It was decided to use two content analysis approaches, conventional and summative in order to see the problem from more than one perspective. This course of action is consistent with methodological triangulation since the data is analysed using two different approaches. It offers a rigorous approach to the data gathering and analysis (Bankole, Chigona, & Bankole, 2012).

Conventional content analysis is used to describe the phenomena “collaborative applications” and “team work”. This content analysis approach requires the researcher to be absorbed in the data. It is appropriate since this study aims to understand the reasoning behind the use students make of applications for collaborative team work (Hsieh & Shannon, 2005). Categories such as “document sharing” or “task management” are not allocated a priori to these phenomena. Categories are allowed to emerge from the data (Annala, Mákinen, Svárd, Silius, & Miilumáki, 2012).

Summative content analysis is used to identify and understand the contextual use of specific words or keywords (Hsieh & Shannon, 2005). This approach explores and analyses the use of a word or the content in a textual context (Lovejoy, Watson, Lacy, & Riffe, 2016). These so-called keywords are examined in context and the underlying meanings are explored.

Reliability of the keywords and categories are tested for consistency. The categories as well as keywords are created/identified under test-retest conditions. This means that the researcher must read and reread the data to identify categories and keywords. In a second cycle of analysis, the researcher has to re-evaluate and re-categorise some of the data (Neuendorf, 2016).

Affordance theory—introduced in Section 2.9—is the framework adopted in the second SSM cycle. Both conventional and summative content analyses, which have been described, are used independently to operationalise the framework.

This is consistent with methodological triangulation since the data is analysed using two different approaches. It provides a rigorous approach to the analysis of the data gathered (Bankole, Chigona, & Bankole, 2012). The identified keywords are examined in context and the underlying meanings are explored. Coder reliability of the keywords and categories are tested for consistency. The categories as well as keywords are created or identified under test-retest conditions. This means that the coder read and reread the data to identify categories and keywords. In a second cycle of analysis, the coder re-evaluated and re-categorised some of the data (Neuendorf, 2016).

3.4.3 Culture and collaborative eLearning—third SSM cycle

The third cycle evaluates the influence of culture on the usage of collaborative eLearning. This is illustrated in Figure 3.6Figure 3.6.

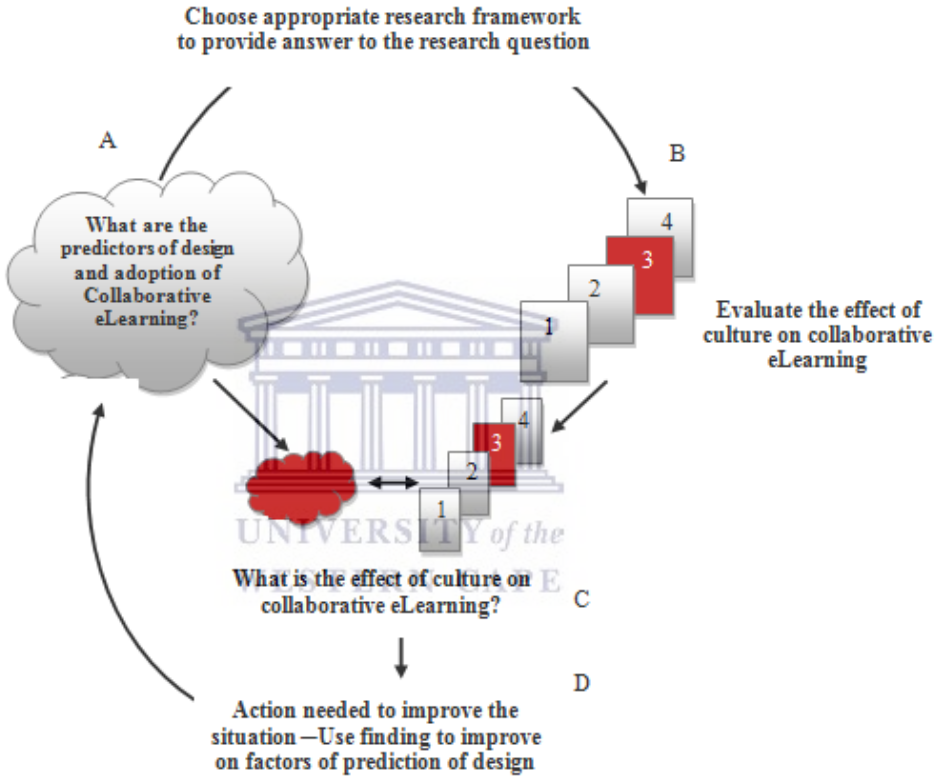

Figure 3.6: Culture on collaborative eLearning—third SSM cycle

The research question that was addressed during this cycle is:

What effect does culture have on adoption and usage of collaborative eLearning systems?

This question can provide insights into the effects of the dimensions of national culture on usage of collaborative eLearning. Also, the relationships between the determining factors of adoption of collaborative eLearning can be determined.

This cycle of the research is aimed at all the undergraduate students of the CS department at UWC, a population that uses collaborative eLearning platforms/software such as Piazza or IKamva (i.e. the university wide LMS platform). A questionnaire of 53 questions—made up of 15 background questions, and 24 questions which address national culture and 14 that address technology adoption—has been administered to 317 undergraduate and graduate CS students at the University of the Western Cape during 2016 and 2017.

The responses are checked for correctness. Incomplete or incorrect responses are removed from the data set and only 306 responses are analysed. A spreadsheet is used to capture the details of each student. Sample distribution of the participants is confirmed.

Structural Equation Modelling (SEM) is used to validate the research model. The choice of using SEM with Partial Least Squares (PLS) is aimed at predicting or identifying the key variables which drive collaborative eLearning. PLS is used when the sample size is small due to a limited number of participants in the targeted population (Hair Jr, Hult, Ringle, & Sarstedt, 2016). PLS can also be used in both confirmatory and/or exploratory research, prediction-oriented analyses, archival or secondary data (Richter, Cepeda, Roldán, & Ringle, 2016).

The data is uploaded unto Warp Partial Least Squares (PLS) version 6.0 for SEM analysis. Warp PLS is selected because it is specifically designed to test for both nonlinear and linear relationships amongst variables. The reliability and validity of the items used to measure the variables in the model are determined. The research model is then examined using structural equation techniques to establish if there are any relationships between the variables in the model.

The structural equation with partial least squares is computed to determine correlations between determining factors of adoption of collaborative eLearning using

Warp PLS version 6.0 and the model fit is evaluated. The recommended p values are $p < 0.001$, $p < 0.01$ and $p < 0.5$ (Kock, 2016).

In literature, the user behaviour of ICT has been shown to be indirectly influenced by culture (Veiga, Floyd, & Dechant, 2001). This study investigates the indirect influence of culture dimensions (i.e. factors) on user acceptance of eLearning. The research framework is shown in Figure 3.7.

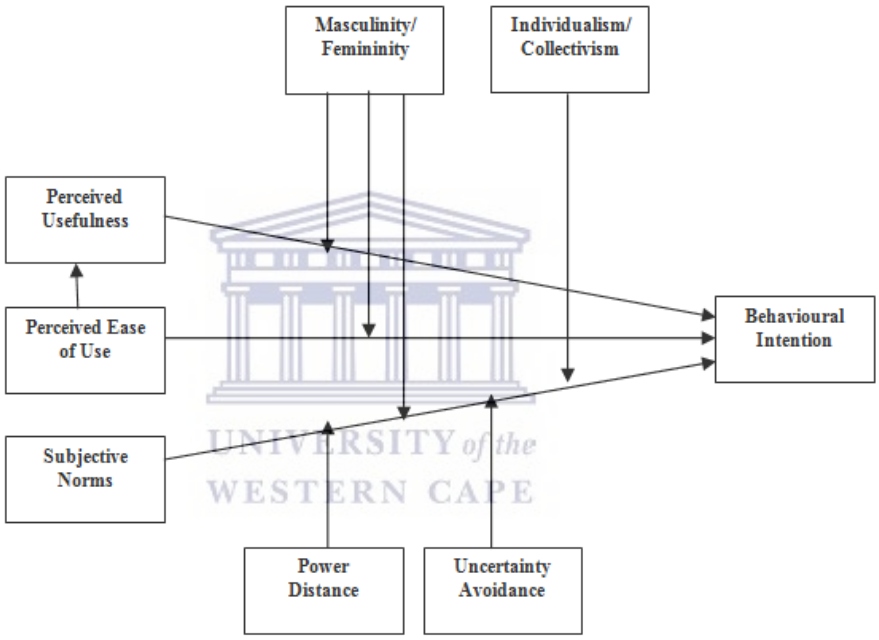

Figure 3.7: Research model

The following hypotheses are considered:

H_1: Individualism/Collectivism positively influences Perceived Usefulness of collaborative eLearning.

H_2: Individualism/Collectivism positively influences Perceived Ease of Use of collaborative eLearning. In an individualist culture, technology is supposed to be beneficial when it is viewed to be as useful to individuals (Veiga, Floyd, & Dechant, 2001). Therefore, using collaborative eLearning will be perceived as

useful technology in an individualist society. Individualist societies favour the use of simple ICTs (Rogers, 2003). Therefore, an individualist culture will accept that collaborative eLearning is easy to use.

H_3: Uncertainty Avoidance influences Perceived Usefulness of collaborative eLearning.

H_4: Uncertainty Avoidance influences Perceived Ease of Use of collaborative eLearning. In Uncertainty Avoidance cultures, trust is important when adopting a new technology (Grabner-Krauter & Kaluscha, 2003). New technologies usage has been found to be linked with high of Perceived Ease of Use and Perceived Usefulness in high Uncertainty Avoidance cultures (Veiga, Floyd, & Dechant, 2001). The effectiveness and easy usage experienced diminishes insecurities expected from the usage of ICT (Brown, Field, Hill, & Wessels, 2006).

H_5: Masculinity/Femininity influences Perceived Usefulness of Collaborative eLearning.

H_6: Masculinity/Femininity influences Perceived Ease of Use of Collaborative eLearning. In masculinity/femininity cultures, users exhibit masculine characteristics like materialism and assertiveness. The acceptance of a new technology like collaborative eLearning in such cultures would be associated with a high Perceived Usefulness (Srite & Karahanna, 2006). Also, high masculinity cultures adopt new technologies due to the view that ICTs are easy to use (Srite & Karahanna, 2006).

H_7: Subjective Norms influence Behavioural Intention to Use collaborative eLearning. Subjective Norms are determinants of use. Users may view collaborative eLearning as useful when relatives or friends use it and recommend its use (Gu, Lee, & Suh, 2009). Subjective Norms like the opinions of the user's social group will affect behavioural intention to adopt and use collaborative eLearning (Zhou, Lu, & Wang, 2010).

H_8: Perceived Usefulness influences Behavioural Intention to Use collaborative eLearning. Perceived Usefulness has been found to influence users' intentions to use and adopt (Brown & Jayakody, 2008). The efficacies experienced from the use of collaborative eLearning will persuade a user to use and adopt

collaborative eLearning (Srite & Karahanna, 2006; Gu, Lee, & Suh, 2009; Zhou, Lu, & Wang, 2010).

H_9: Perceived Ease of Use influences Behavioural Intention to Use collaborative eLearning. Several IT adoption studies have shown Perceived Ease of Use influences behavioural intention to use. In some situations, users' view that IT is easy to use, this tends to affect adoption (Zhou, Lu, & Wang, 2010).

H_{10}: Power Distance influences Behavioural Intention to Use collaborative eLearning. High Power Distance cultures cause users to adopt new IT systems (Veiga, Floyd, & Dechant, 2001).

A null hypothesis (H_0) is returned provided there are no significant associations of the factors with each another.

3.4.4 Gender and collaborative eLearning—fourth SSM Cycle

The fourth SSM cycle investigates whether gender determines the adoption and usage of collaborative eLearning? (see Figure 3.8).

During this cycle, the question

"Does gender determine adoption and usage of collaborative eLearning?"

is addressed.

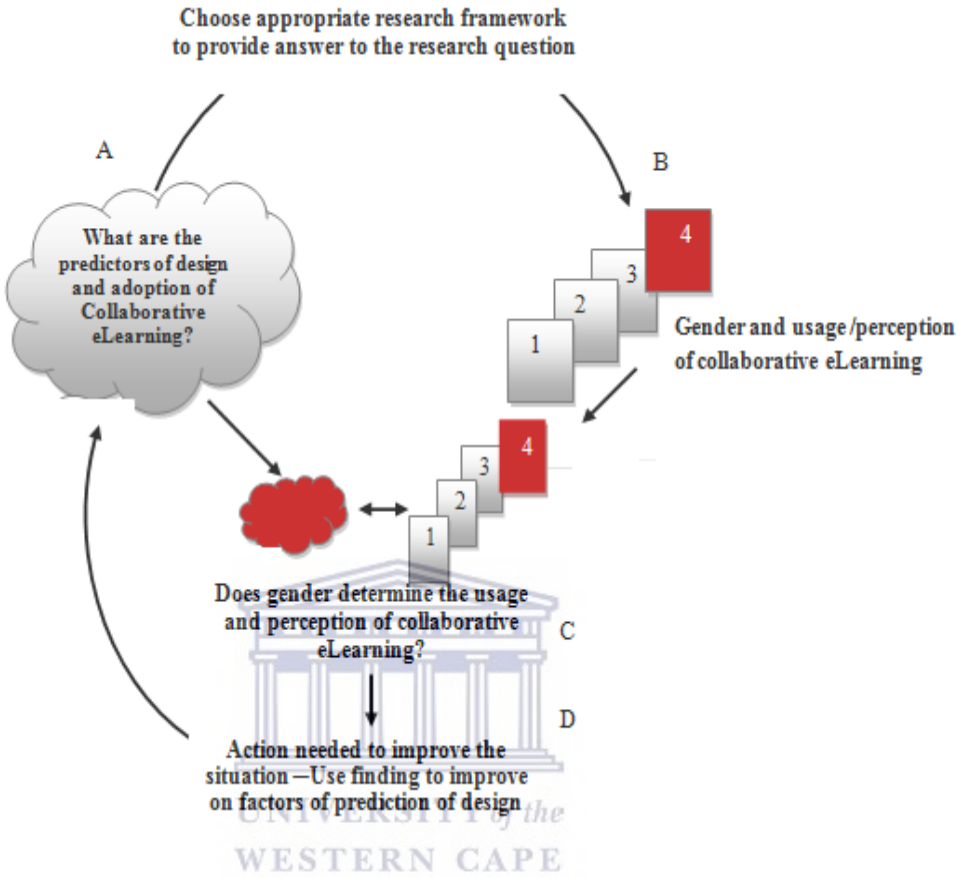

Figure 3.8: Gender and collaborative eLearning—fourth SSM Cycle

Chi-Square analysis is used to examine the distributions of categorical and continuous data in order to look for frequency of occurrence, amount of missing data, distribution, shape, variability of the data and possible relationships. It is used to examine the association between categorical variables (Waller & Johnson, 2015). The data is uploaded unto SAS® version 9.4 which has several statistical analysis tools for both descriptive and inferential statistical analyses.

Chi-Square tests are used to test the relationships of gender to the questions in order to check independence between the responses of the participants based on their gender.

3.5 Research process

The study employs a cross-sectional approach to the research time frame. The cross-sectional research time frame is suitable since the data was collected over a specified duration. The idea is to examine the current situation of collaborative eLearning and suggest an explanation for the usage patterns exhibited by the users. Therefore, data which are gathered on a collaborative eLearning software/platform and other related applications during a specific timeframe of two years is used for the research analysis.

3.6 Research assumptions, limitations and scope

The key assumptions in the questionnaire design are that participants in the survey are all UWC students (some of whom could have been employed as tutors or teaching assistants by the university). The participants have access to a computer, such as a personal computer, which they can use to access collaborative eLearning software or platforms. It is also assumed that the participants understand the concepts of collaborative eLearning software/application and uses.

The limitation to the distribution of the questionnaire in this study is that the sample population is only CS students at UWC during the period 2016-2018. In order to fully represent different users of collaborative eLearning amongst CS students, all the students from first year to honours were given the opportunity to complete the questionnaire. Some questionnaires were not completed appropriately and were thus not used in the study.

This study employs a cross-sectional timeframe thereby making the data gathered concentrated within a period of three years. Gathering the research data through a longitudinal timeframe could provide more diversified responses. However, this cross-sectional study has provided a specific research scope for an in-depth examination of the gathered data.

3.7 Summary

This chapter outlines the research approach. It presents the research approach, design and framework suitable for understanding a study of this nature in the scientific field. This study addresses one of the infrequently researched areas of adoption and usage of IT (i.e. cross-cultural issues in IT adoption). A summary of the research methods used in each cycle of the methodology is shown in Table 3.1.

Table 3.1: The research questions addressing each study area

SSM cycle	Aim	Research strategy/methods	Theoretical perspective	Analytical techniques
1. Pilot study	To test the questionnaire for correctness	Quantitative	-	Quantitative analysis
2. Insights into the use and affordances of social and collaborative applications for student projects.	To determine the adoption and affordance of collaborative applications for Computer Science team projects.	Inductive Qualitative	Interpretive	Conventional content analysis and Summative content analysis
3. Influence of Cultural Factors on Collaborative eLearning.	To investigate the effect of culture on the adoption and usage of collaborative eLearning systems.	Deductive/Quantitative	Positivist	Partial Least Squares and Structural Equation Modelling
4. Does gender determine the adoption and usage of collaborative eLearning?	To investigate if gender determines the adoption and usage of collaborative eLearning.	Deductive/Quantitative	Positivist	Statistical analysis using Chi-Square
The design of collaborative eLearning.	How does adoption and affordance guide the design of collaborative eLearning?	Literature review and results of SSM cycles	Interpretive	Based on the results of the four SSM cycles

Chapter 4 Results

4.1 Introduction

This chapter shows the results of each SSM cycle. The research process went through several cycles of analysis. SSM was successful in managing the research process because the result of each cycle was unique and the results combined to form the answer to the main research question, namely: *What are the determinants of the design, adoption, affordance and usage of collaborative eLearning systems?*

4.2 Results of each cycle

4.2.1 Pilot study—first SSM cycle result

The pilot study revealed some minor issues with the survey instrument—questions aimed at the CS administrative staff. It was decided to omit these from the questionnaire (see Figure 4.1).

From the pilot study results, it was found that each student (in their respective project teams) made use of different applications. This finding assisted in asking further questions on why they use these applications and what they would like to see in an ideal collaborative eLearning application. The questionnaire was compiled in two Sections (Section A and B).

This was done in order to separate specific research questions that addressed the different sections of the study. Qualitative data collected from this (the first SSM cycle) was used in the second cycle; however, the qualitative data was not used for the subsequent quantitative analysis.

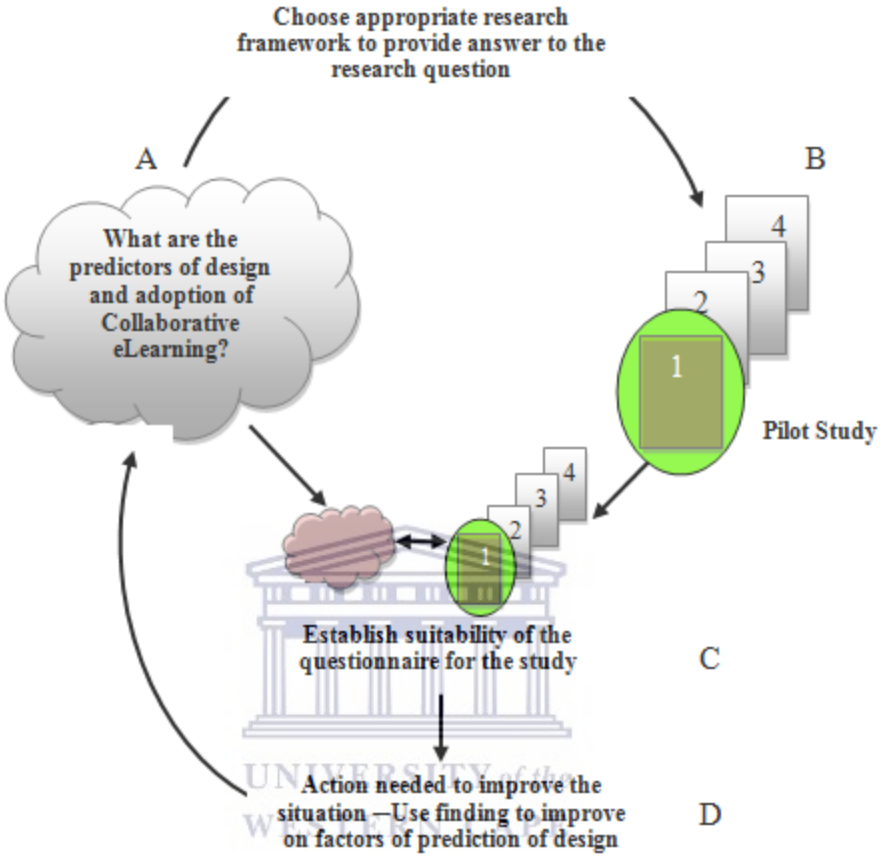

Figure 4.1: Pilot study result

4.2.2 Technologies afford collaboration—second SSM cycle results

The second cycle is aimed at answering the first research question*:*

"What determines the affordance of collaborative applications for Computer Science team projects?" This cycle investigates how affordances are determined, which applications or technologies afford collaboration for final year CS students at UWC, and how the students determine what collaborative applications to use in setting up team work to coordinate their group activities. The findings in Section D are seen as

part of the solution to the main research question—Section A of the SSM cycle (see Figure 4.2).

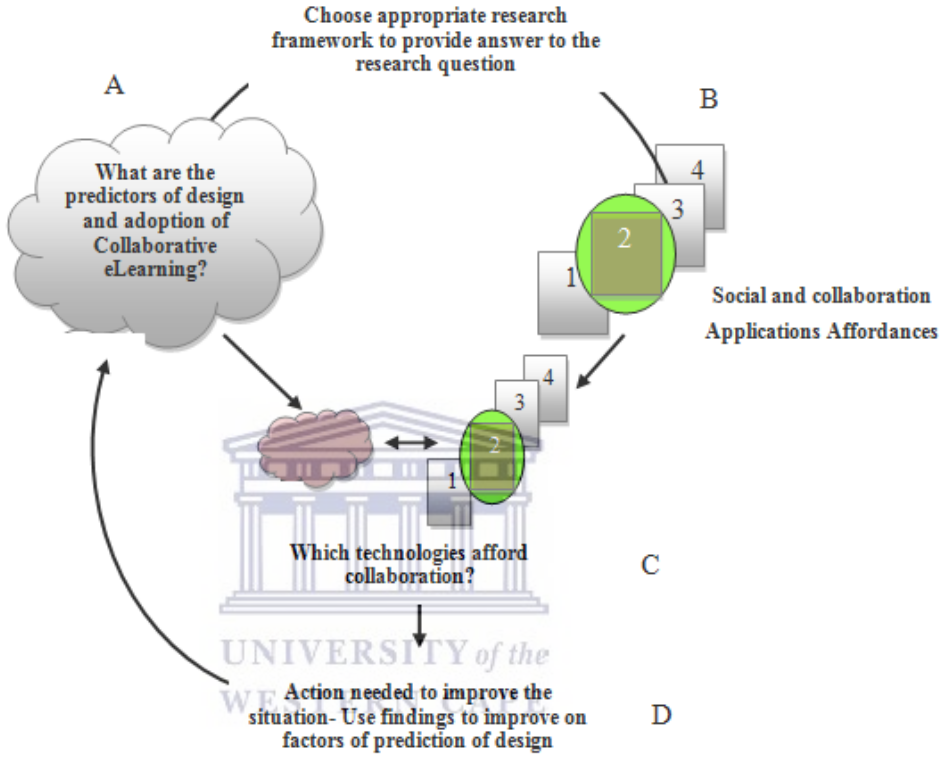

Figure 4.2: Technologies affordance collaboration result

The project teams make use of different applications in order to bring their projects to completion. Figure 4.3 shows the 13 applications the student project teams have used for learning and collaborating as a team. These applications have different functionalities: both *"Dropbox"* and *"Google Drive"* are cloud storage systems, *"Google Hangouts"* is a communication platform very similar to *"Skype"*; *"Google Docs"* is an on-line word-processor that allows collaboration in real-time; "*WhatsApp"* and "*Telegram"* are both instant messaging systems; *"Facebook"* is an on-line social networking system; *Git* is a version control system used for software development; *"Coursera"* and *"Khan Academy"* both provide online academic material; and *"Turnitin"* allows students to check for plagiarism. Most teams have used a

combination of two or more of these applications for their project. The majority of the teams make use of *"WhatsApp"* and *"Telegram"*—both mobile apps for communication—and *"Google Drive"* and *"Dropbox"* for document sharing. Five of the teams have mentioned using *"Google Drive"* for document sharing.

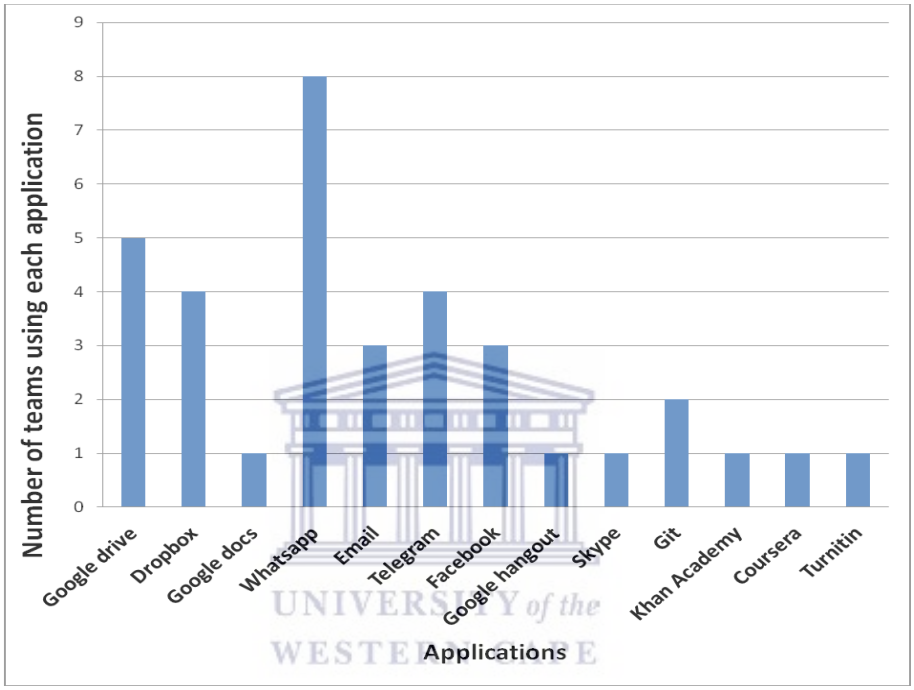

Figure 4.3: Total number of teams using each application

Eight project teams have stated that they made use of "*WhatsApp"* while only three project teams mentioned that they used *"email"* for communication. Two project teams have mentioned they used *"Git"* for version control whilst *"Coursera"*, *"Skype"*, *"Google Hangout"* and *"Khan Academy"* were also mentioned. *"Turnitin"* occurred four times, however only one project team mentioned they used it to check their work for plagiarism.

4.2.2.1 Categorisation of the applications used

The analysis of the corpus identifies the following 4 categories namely: "*document sharing", "communication", "course resources" and "plagiarism detection"*. Three applications are used for document sharing, six applications are used for

communication, four applications are used for obtaining course resources and, only one application is used for plagiarism detection. The number of times each application occurs in the corpus is recorded; see Table 4.1. The application "*Google Drive"* occurs 15 times in the corpus. *"WhatsApp"* and "*email"* occur 18 and 17 times respectively.

Table 4.1: Categorisation of the applications according to their function

Categories	Applications	Number of Occurrences
Document Sharing	Google Drive	15
	Dropbox	3
	Google Docs	2
Communication	WhatsApp	18
	Email	17
	Telegram	5
	Facebook	4
	Google Hangout	1
	Skype	1
Course resources	Git	2
	Khan Academy	1
	Coursera	1
Plagiarism Detection	Turnitin	4

The analysis identifies 20 keywords in the data—see Table 4.2. The table portrays the significance of these words by how extensively these words are used in the corpus.

"*Communication*" has the highest number of occurrences namely 38, "*ease of use*" 35 times, "*access*" 31 times, "*information sharing*" 20 times, *"Voice Call/ Video Call/ Instant Messaging"* 19 times, and "*document sharing*" 17 times. These are therefore important aspects of affordance to collaborative eLearning to the student teams.

Table 4.2: Number of occurrences of the keywords

No	Keywords	Number of Occurrences
1	Communication	38
2	Ease of use	35
3	Access/Availability/Free	31
4	Information Sharing	20
5	Voice Call/ Video Call/ Instant Messaging	19
6	Document sharing	17
7	Effective	10
8	Online forum	8
9	Uploads and downloads	7
10	Convenient	6
11	Notification/reminders/bulletins	6
12	Course resources	5
13	Attractive	3
14	Archiving/storing	3
15	Scheduler	3
16	Innovative	2
17	Marks administration	2
18	Task Management	1
19	Plagiarism Detection	1
20	Posting Queries	1

The keywords "*task management*", "*plagiarism detection*" and, "*posting queries*" all occurred only once in the data and thus are considered to be less important.

4.2.2.2 Clarification of the relevance of the keywords

Communication is a major keyword raised by all the project teams and occurs 38 times in the corpus of the interviews.

> *"Yes, it is not easy to communicate when a member does not have a device"—Team 3.*

It is observed that all eleven teams, mentioned communication in their responses and how it is an important determinant in their choice of the applications they decided to use.

Ease of use is amongst the major factors mentioned by all eleven teams; it appears 35 times in the corpus. Team 11 mentioned that in order to collaborate, their choice of application was based on ease of use.

Access/Availability/Free is mentioned 31 times in relation to having access to Internet facilities and using mobile devices.

> *"Yes, some group members have no access to Internet in their environment"—Team 1.*

> *"There is loss of interest if it (the Internet) is not easily available"—Team 11.*

Information Sharing occurred 20 times in the corpus. This shows that it is very important for collaborative team work.

> *"We use WhatsApp to communicate and email is also used to share information and documents within our team"—Team 8.*

Voice Call/Video Call/Instant Messaging occurs 19 times. Real time instant messaging is appreciated by all the teams since they all mentioned it in different ways and used different applications to collaborate in their respective teams.

> *"The group members see the messages instantly and it is ubiquitous"—Team 6.*

Document sharing is mentioned 17 times.

> *"Document sharing" is an integral part of collaboration as all the teams mentioned. We use telegram and Google drive for document sharing"—Team 6.*

Effective occurs eight times in the corpus. Each team agreed that the combination of applications they adopted for their collaborative team projects was very effective.

> *"Instant messaging and easy access to WhatsApp was used to communicate effectively in our team"—Team 7.*

"We use WhatsApp to communicate and email is also used to share information and documents effectively within the team"—Team 8.

Online Forum is mentioned 7 times.

"Forums, interaction with other individuals, other resources that can help with courses"—Team 1.

"Taking online quizzes and participating on forum discussions"—Team 11.

Uploads and downloads are mentioned 7 times.

"Video uploads of lectures" — Team 10,

"File sharing (video docs) and video uploads"—Team 3,

"Downloading documents and posting queries"—Team 9.

Convenient and **Notification / reminders / bulletins** are both mentioned 6 times while "*course resources*" occurs only 5 times in the corpus.

"Bulletins and notices, course resources, planning"—Team 2.

Attractive, Archiving / storing and **Scheduler** are each mentioned 3 times in the corpus.

"Forum discussions, Notification / reminders for assignment submissions. This can be linked to students email addresses"—Team 5.

Innovative and **Marks administration** each occur 2 times in the corpus.

"Timetable and marks systems"—Team 10,

". . . marks administration. . ."—Team 9.

Task management, plagiarism detection and **posting queries** all appear once in the corpus. The keyword Task management is mentioned by Team 1, while plagiarism detection and posting queries are both mentioned by Team 9.

One of the teams had issues with a team member. When the interventions did not change the student's attitude, the concerned student was asked to leave the team. This student then joined another team.

4.2.3 Culture and collaborative eLearning—third SSM cycle result

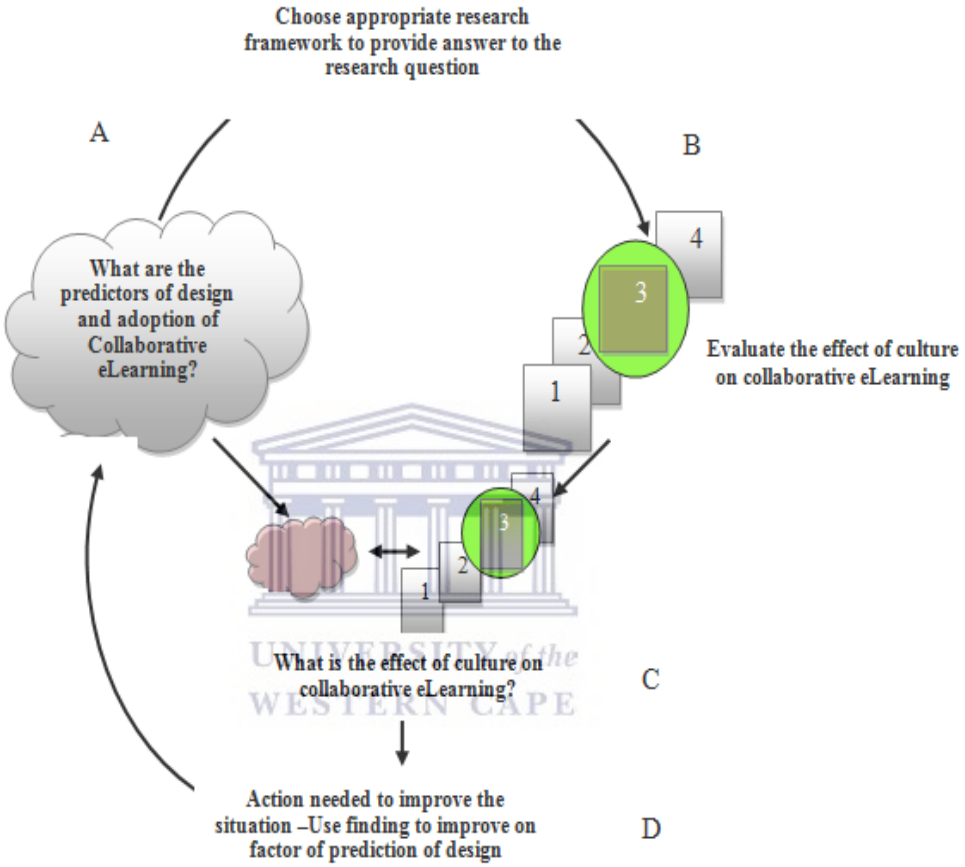

Figure 4.4: Effect of culture on the result of collaborative eLearning

The third SSM cycle is aimed at answering the second research: *"What effect does culture have on adoption and usage of collaborative eLearning systems?"*

This cycle investigates a major cultural factor that influences CS students to adopt and use collaborative eLearning software. It shows how their choice of software shapes the usage pattern. Quantitative methods are used to analyse questionnaire responses. SEM with PLS, are used to produce a prediction of the correlation between determining factors of usage. The finding in cycle two further refines answers to the main research question in Section A (see Figure 4.4).

4.2.3.1 Research Distribution

In the third cycle of the study, 306 responses are used for analysis. A spreadsheet is used to capture the details of each student. The data are uploaded into the SAS® program. There are 268 male students (88.45% of the research population) and 35 female students (11.55% of the research population) in the CS department (see Table 4.3).

Table 4.3: Survey sample distribution in terms of gender

Gender				
Gender	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
Male	268	88.45	268	88.45
Female	35	11.55	303	100.00
Frequency Missing = 3				

Only 301 participants out of the research population of 306 provided their age. The youngest and the oldest in terms of age distribution amongst the research population are aged 17 years and 38 years old respectively. Students aged 19 years old are the largest group and the students aged 20 years old are the second largest group. This implies that the median as well as mode in the age distribution points to 20 years. The research population is representative of the actual age distribution amongst university students (see Figure 4.5).

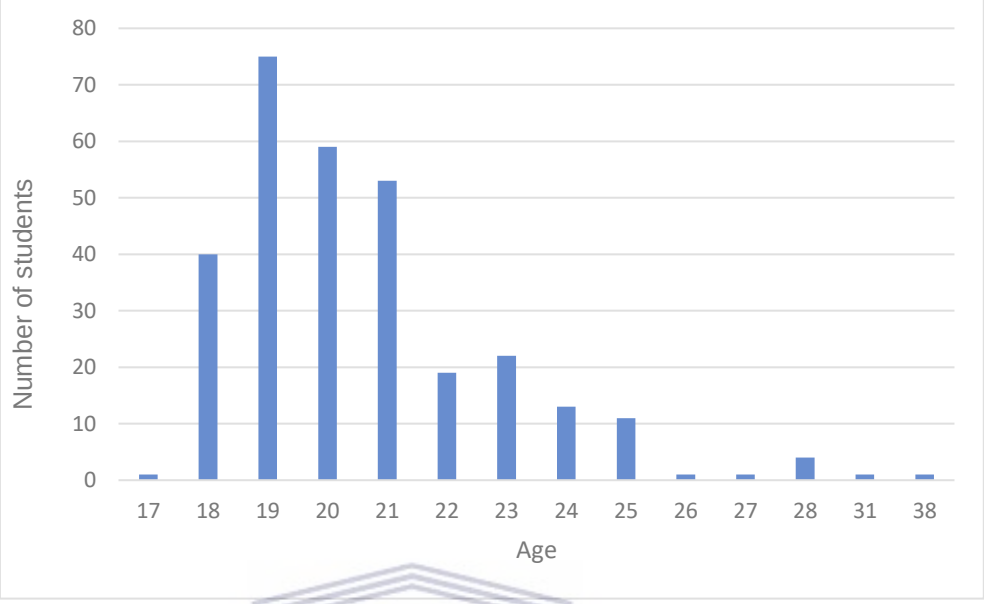

Figure 4.5: Sample distribution of participants' age

4.2.3.2 Validity and reliability of research variables

The survey questions for this study are adapted from those used and validated by Srite and Karahanna (2006). However, to ensure that the research approach in this study is a true reflection of how the research problem is investigated the questionnaire items are again checked for validity and reliability.

Research validity test using, varimax with Kaiser Normalisation rotation (i.e. eigenvalues), as well as factor analysis (i.e. item validity) test is required. To test for reliability Cronbach alpha test needs to be performed.

VALIDITY

Principal components factor analysis is carried out on the data gathered (using SAS® version 9.4) to test for validity of the instrument.

Factor analysis is a multivariate statistical technique that is used to analyse the structure and consistency of the relationships among variables (Hair, Anderson, Tatham, & Black, 1998). This technique helps to determine whether or not all the

items (in the research instrument) qualify to be part of the measurement tool (Straub, Loch, Evaristo, Karahanna, & Srite, 2002).

Eigenvalues analysis

Principal component factor analysis—utilising Varimax with Kaiser Normalisation rotation—is used to test for the Eigenvalues. The Kaiser-Guttman rule states that the Eigenvalues of the research data must be greater than one to be valid. Principal component factor analysis (with the high loadings highlighted) shows that eight factors are relevant since their Eigenvalues are greater than one. The relevant results for the Eigenvalues are shown in Table 4.4. From line 9 onward the Eigenvalues are less than one and thus are not relevant.

SAS code snippets for Eigenvalues and factor scores are as follows:

```
/* EIGENVALUES AND FACTOR SCORES ANALYSIS */
ods graphics on;

Proc factor data=COMP_SCI_ELEARNING_DATA_2017A
priors=smc msa residual
rotate =promax reorder;
var Q44 Q45 Q46   Q47   Q48   Q49   Q50 Q51     Q52   Q53
        Q54     Q55   Q56   Q57   Q58   Q59   Q60   Q61
      Q62   Q63   Q64   Q65   Q66   Q67   Q68   Q69   Q70
      Q71   Q72   Q73   Q74   Q75   Q76   Q77   Q78   Q79
      Q80 Q81;
Run;

ods graphics off;*/

Proc factor data=COMP_SCI_ELEARNING_DATA_2017A
simple corr
method=prin
priors=one
mineigen=1.0
ev score;
var Q44 Q45 Q46   Q47   Q48   Q49   Q50 Q51     Q52   Q53
        Q54     Q55   Q56   Q57   Q58   Q59   Q60   Q61
      Q62   Q63   Q64   Q65   Q66   Q67   Q68   Q69   Q70
      Q71   Q72   Q73   Q74   Q75   Q76   Q77   Q78   Q79
      Q80 Q81;
Run;
```

Table 4.4: Factor analysis using varimax Kaiser normalisation rotation

Eigenvalues				
	Eigenvalue	**Difference**	**Proportion**	**Cumulative**
1	10.5340410	5.8880557	0.2772	0.2772
2	4.6459853	2.0715798	0.1223	0.3995
3	2.5744056	0.3517019	0.0677	0.4672
4	2.2227037	0.2990686	0.0585	0.5257
5	1.9236350	0.5918527	0.0506	0.5763
6	1.3317823	0.1163871	0.0350	0.6114
7	1.2153952	0.0927984	0.0320	0.6434
8	1.1225968	0.0458806	0.0295	0.6729
9 . . .	0.0767161	0.1110882	0.0283	0.7012

Factor analysis- item validity

Factor analysis helps to identify whether one or more of the research items used to measure a factor is appropriate (Straub, Keil, & Brenner, 1997). Each set of items referring to a variable (for example for the variable Perceived Usefulness, items PU1, PU2, PU3 and PU4) must all have a value above 0.5 for the single factor—in this instance Factor 1—for the variable to be both convergent and valid (see Table 4.5). An item is said to have convergent validity when it is a good determinant of the latent variable it is supposed to measure.

The factor analysis indicates that the research items captured 8 distinct factors as earlier identified by the Eigenvalues analysis. All the items loaded strongly on their related factors with factor loading > 0.50 (Hair, *et al.,* 2016). The research instrument items are valid since they have met convergent validity criteria.

Table 4.5: Factor analysis pattern

	Factor Pattern								
Variable	Items of the variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8
PU	PU1	0.79524	0.27625	-0.08663	0.05476	-0.05238	-0.10599	0.07664	-0.00782
	PU2	0.74825	0.28771	-0.13705	0.14078	-0.05552	-0.17601	-0.03178	0.05277
	PU3	0.74715	0.24694	-0.09954	0.22891	-0.08060	-0.20184	-0.00283	-0.03568
	PU4	0.81166	0.19474	-0.17927	0.09680	-0.07953	-0.06326	0.07154	0.00423
PEOU	PEOU1	0.18004	0.66525	-0.19407	-0.05785	-0.03904	0.39413	0.11635	0.06958
	PEOU2	0.16830	0.73664	-0.15219	-0.00237	-0.03404	0.39016	0.10647	0.15060
	PEOU3	0.23663	0.58588	-0.33109	0.13916	-0.01387	0.28835	0.26256	0.01214
	PEOU4	0.09699	0.74169	-0.18705	-0.09668	0.07403	0.35381	0.02123	0.11616
SN	SN1	-0.29010	-0.30936	0.51384	0.107140	-0.19079	-0.14295	-0.07902	-0.19117
	SN2	-0.10719	0.36827	0.57816	0.22273	-0.16616	0.00475	-0.12008	-0.11438
	SN3	0.12321	0.12314	0.70182	0.07155	-0.01722	0.10461	-0.06015	0.05113
	SN4	0.00406	0.23123	0.61812	0.16191	-0.00796	-0.04895	-0.15259	0.12108
BIU	BIU1	0.16445	0.07662	-0.10118	0.80020	0.07089	-0.22037	-0.10715	-0.05161
	BIU2	0.30922	0.14601	-0.17594	0.64722	0.06664	-0.30239	-0.12573	0.01002
IC	IC1	-0.33864	-0.10290	0.29670	0.10123	0.84096	-0.19247	-0.26865	0.53721

	Factor Pattern								
Variable	Items of the variable								
		Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8
	IC2	-0.30693	-0.06206	0.30850	0.01601	0.77393	-0.17913	-0.29157	0.39880
	IC3	0.14224	0.01602	0.10614	-0.51316	0.73434	-0.16540	-0.34251	0.06795
	IC4	0.24153	0.14288	0.10876	-0.57237	0.78042	0.04902	-0.19036	0.00238
	IC5	0.06555	0.09618	-0.02833	-0.56686	0.77237	-0.04463	-0.26399	-0.15801
	IC6	0.14866	-0.08954	0.28279	-0.31082	0.70634	0.17798	-0.12790	-0.32358
MF	MF1	-0.28435	0.26169	0.36034	0.34984	-0.10066	0.82402	-0.17061	-0.05368
	MF2	-0.16576	0.42738	0.23790	0.29467	0.28158	0.85602	-0.27408	0.25605
	MF3	-0.58252	0.08000	0.24032	0.33430	-0.01199	0.87096	-0.03682	-0.15575
	MF4	-0.53372	0.10475	0.27078	0.26894	-0.02835	0.76036	-0.13512	-0.18795
	MF5	-0.48957	-0.00344	0.25118	0.38990	0.03864	0.82891	0.02666	-0.11489
UA	UA1	0.01180	-0.05008	0.06184	-0.14890	0.32500	-0.13611	0.80082	-0.04571
	UA2	0.03213	0.03277	0.13822	-0.08715	0.37734	-0.10197	0.76751	-0.07865
	UA3	0.04509	-0.01386	0.02099	-0.10260	0.33331	-0.05861	0.69478	-0.09046
	UA4	0.15359	0.11861	0.03655	0.04771	0.39836	-0.16148	0.77567	0.01122
	UA5	0.28295	0.26168	0.01899	-0.08820	0.11571	0.01721	0.79637	-0.09865
	UA6	-0.37121	0.31392	-0.24561	-0.03811	0.16619	-0.09821	0.71820	0.24634

	Factor Pattern								
Variable	Items of the variable								
		Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8
PD	PD1	-0.41614	-0.31904	-0.16945	0.00847	0.02763	0.05870	0.23782	0.79799
	PD2	-0.49315	-0.19868	-0.29208	-0.02639	0.02626	-0.09341	0.16215	0.89592
	PD3	-0.28861	0.11867	-0.38822	-0.17686	0.44282	-0.07687	0.07118	0.66359
	PD4	-0.48027	-0.07678	-0.34316	0.08834	0.33124	-0.22951	-0.02638	0.61923
	PD5	-0.23830	0.04492	-0.17188	-0.23046	0.42153	-0.03744	-0.21873	0.66271
	PD6	-0.11810	0.18026	-0.13850	-0.04612	0.33830	0.03297	-0.52353	0.72540
	PD7	-0.26450	0.04153	-0.20170	-0.23002	0.41944	0.11152	0.19058	0.76853

Key		
	PU	Perceived Usefulness
	PEOU	Perceived Ease of Use
	SN	Subjective Norm
	BIU	Behavioural Intension to Use
	IC	Individualism/Collectivism
	MF	Masculinity/Femininity
	UA	Uncertainty Avoidance
	PD	Power Distance

RELIABILITY TEST

The Cronbach alpha for the sets of questions for each variable is calculated with the execution set of codes (see Appendix G). In statistics, Cronbach alpha must be at least greater than 0.70 (Kock, 2016) for the internal consistency (between questions). In this analysis, both the raw and standardised Cronbach coefficient alpha for all the variables is above 0.70 (see reliability test code snippet below).

```
/* RELIABILITY TEST - CRONBACH ALPHA ANALYSIS */

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
```

```
var Q44 Q45 Q46   Q47;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q48 Q49 Q50   Q51;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q52 Q53;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q54 Q55 Q56   Q57;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q58 Q59 Q60   Q61 Q62;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q63 Q64 Q65   Q66 Q67 Q68;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q69 Q70 Q71   Q72 Q73 Q74 Q75;
Run;
Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q76 Q77 Q78   Q79 Q80 Q81;
Run;
```


4.2.3.3 Combination of data items of each variable

In statistical analysis, the values of research items that measure each variable are usually combined through aggregation. This is necessary when further analysis such as Structural Equation Model (SEM) is to be performed on the data. Composite scores are calculated from data with several items in order to form reliable and valid measures of latent or theoretical variables. The items are combined to form a composite score. Composite scores represent small sets of data points that are highly correlated to one another, both in concept and statistics. In this research, variable items are combined using the composite scores technique. The items reliability and validity have been confirmed in the previous sections (see Code snippet for combining the data items).

Code snippet for combining the data items

```
/*DATA ITEM COMBINATION CODE*/
data COMP_SCI_ELEARNING_DATA_2017A;
set COMP_SCI_ELEARNING_DATA_2017A;
Title 'Item_Combination';
PU=.;
PU=(Q44+Q45+Q46+Q47)/28*100;
PEOU=.;
PEOU=(Q48+Q49+Q50+Q51)/28*100;
BIU=.;
BIU=(Q52+Q53)/14*100;
SN=.;
SN=(Q54+Q55+Q56+Q57)/28*100;
MF=.;
MF=(Q58+Q59+Q60+Q61+Q62)/35*100;
IC=.;
IC=(Q63+Q64+Q65+Q66+Q67+Q68)/42*100;
PD=.;
PD=(Q69+Q70+Q71+Q72+Q73+Q74+Q75)/49*100;
UA=.;
UA=(Q76+Q77+Q78+Q79+Q80+Q81)/42*100;
Run;
```

Each variable item was calculated thus:

$$\text{Variable} = \left(\frac{\text{Sum of all items ratings variable}}{\text{Count of items of the variable} * \text{Count of measure ratings}}\right) * 100$$

For example: PU combined value for participant one of this research is thus

$$\text{PU} = \left(\frac{Q44+Q45+Q46+Q47}{4*7}\right) * 100$$

$$\text{PU} = \left(\frac{2+1+2+2}{4*7}\right) * 100$$

$$\text{PU} = \left(\frac{7}{28}\right) * 100$$

$$\text{PU} = 25$$

and

PD combined value of participant one for this research is thus:

$$\text{PD}=\left(\frac{6+7+7+7+3+5+5}{7*7}\right)*100$$

$$\text{PD}=\left(\frac{2+1+2+2}{4*7}\right)*100$$

$$\text{PD}=\left(\frac{40}{49}\right)*100$$

$$\text{PD}=82$$

Etc.

4.2.3.4 Structural Equation Model using Warp Partial Least Squares

The TAM2 model provides a widely accepted interpretation of the variables that cause the adoption of a technology. This model formed the foundation on which the research hypotheses were developed, and Warp partial least squares (PLS) version 6.0 is now used for developing the structural equation model (SEM) analysis. The PLS results revealed those hypotheses that are significant ($p<0.05$) and those that are highly significant ($p<0.001$) (see P-Values in Table 4.6). A significant p value shows that there is a correlation between two factors. If the p value is not significant the hypothesis is rejected and the null hypothesis h_0 is returned.

Table 4.6: Path coefficient and p values

Path Coefficients								
	PU	**UA**	**MF**	**PD**	**SN**	**PEOU**	**IC**	**BIU**
PU		0.393	-0.263				0.14	
UA								
MF								
PD								
SN								
PEOU		0.389	-0.308				0.073	
IC								
BIU	0.484			-0.092	0.226	0.082		

Path Coefficients								
	PU	**UA**	**MF**	**PD**	**SN**	**PEOU**	**IC**	**BIU**
P Values								
	PU	**UA**	**MF**	**PD**	**SN**	**PEOU**	**IC**	**BIU**
PU		<0.001	<0.001				0.006	
UA								
MF								
PD								
SN								
PEOU		<0.001	<0.001				0.099	
IC								
BIU	<0.001			0.051	<0.001	0.074		

The path coefficients and hypotheses that are supported by significant p values are shown in Table 4.6 and in Figure 4.6.

H_1: Individualism positively influences Perceived Usefulness of collaborative eLearning.

Individualism/Collectivism (IC) has a positive correlation with Perceived Usefulness (PU) at 0.14 with $p<0.01$. This supports the relationship between these two factors in hypothesis H_1.

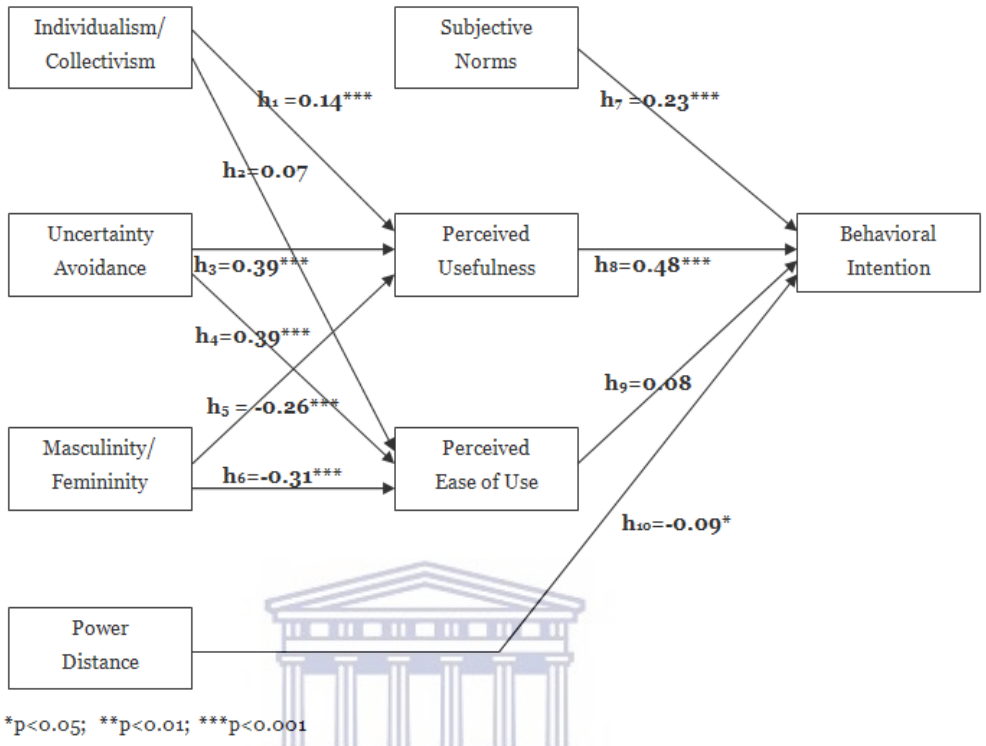

Figure 4.6: Structural Equation Model (SEM)-hypotheses supported

H_3: Uncertainty Avoidance influences Perceived Usefulness of collaborative eLearning.

Uncertainty Avoidance (UA) has a positive correlation with Perceived Usefulness (PU) at 0.39 with $p<0.001$. This supports the relationship between these two factors in hypothesis H_3.

H_4: Uncertainty Avoidance influences Perceived Ease of Use of collaborative eLearning.

Uncertainty Avoidance (UA) has a positive correlation with Perceived Ease of Use (PEOU) at 0.39 with $p<0.001$. This supports the relationship between these two factors in hypothesis H_4.

H_5: Masculinity/Femininity influences Perceived Usefulness of Collaborative eLearning.

Masculinity/Femininity (MF) has a negative correlation with Perceived Usefulness (PU) at -0.26 with $p<0.001$. This supports the relationship in hypothesis H_5. However, it shows a negative correlation—inverse relationship—between the two factors.

H_6: Masculinity/Femininity influences Perceived Ease of Use of Collaborative eLearning.

Masculinity/Femininity (MF) has a negative correlation with Perceived Ease of Use (PEOU) at -0.31 with $p<0.001$. This supports the relationship in hypothesis H_6. However, it shows a negative correlation between the two factors.

H_7: Subjective Norms influence Behavioural Intention to Use Collaborative eLearning.

Subjective Norms (SN) has a positive correlation with Behavioural Intention to Use (BIU) Collaborative eLearning at 0.23 with $p<0.001$. This supports the relationship between these two factors in hypothesis H_7.

H_8: Perceived Usefulness influences Behavioural Intention to Use Collaborative eLearning.

Perceived Usefulness (PU) has a positive correlation with Behavioural Intention to Use (BIU) Collaborative eLearning at 0.48 with $p<0.001$. This supports the relationship between these two factors in hypothesis H_8.

H_{10}: Power Distance influences Behavioural Intention to Use collaborative eLearning.

Power Distance (PD) has a positive correlation with Behavioural Intention to Use (BIU) collaborative eLearning at 0.09 with $p<0.05$. This supports the relationship between these two factors in hypothesis H_{10}.

These following relationships between the factors in the two hypotheses H_2 and H_9 below are rejected and the corresponding null hypothesis H_0 is returned since there are no significant influences of one factor on the other.

H_2: Individualism positively influences Perceived Ease of Use of collaborative eLearning.

Individualism/Collectivism (IC) shows no significant relationship with Perceived Ease of Use (PEOU) at 0.07 with p<0.099.

H_9: Perceived Ease of Use influences Behavioural Intention to Use_collaborative eLearning.

Perceived Ease of Use (PEOU) shows no significant relationship with Behavioural Intention to Use (BIU) collaborative eLearning at 0.08 with p<0.074.

4.2.4 Gender and collaborative eLearning—fourth SSM Cycle result

The fourth SSM cycle (see Figure 4.7) is aimed at the third research question: *"Does gender determine adoption and usage of collaborative eLearning?"* Chi-Square analysis on gender's relationship to the adoption and usage of collaborative eLearning reveals that only Individualism/Collectivism (I/C) and Power Distance show strong significant associations at p value of 0.05 and positive Cramer's V statistics value between 0 and 1.

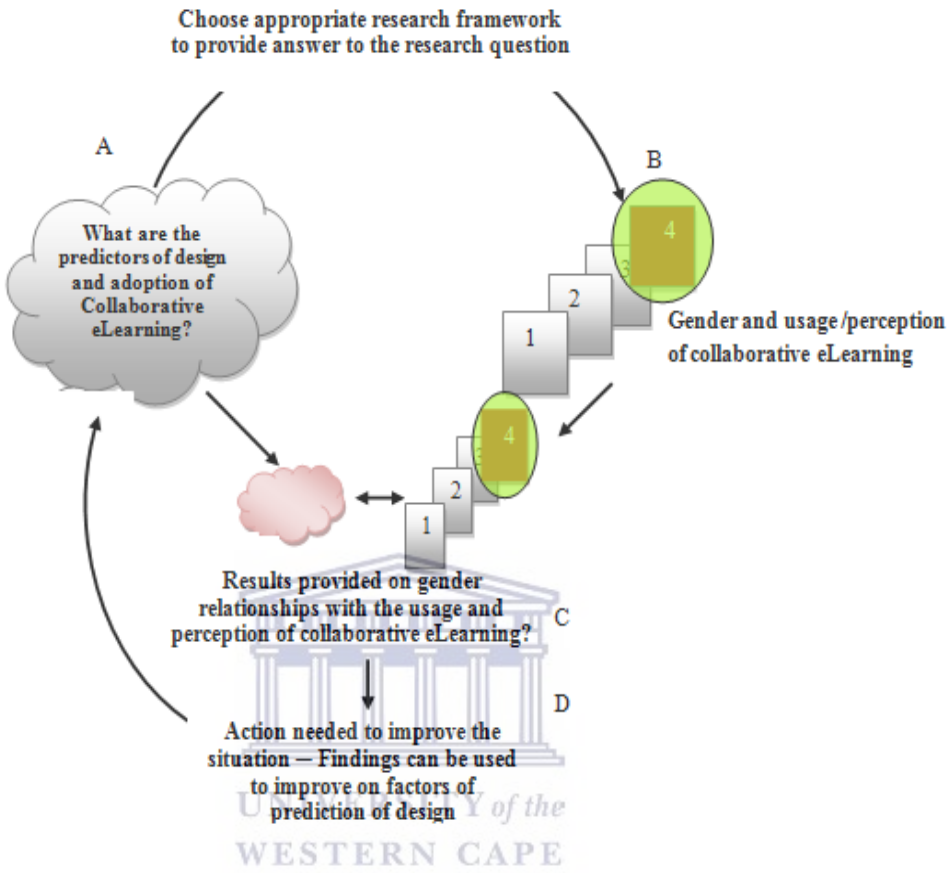

Figure 4.7: Adoption and usage of collaborative eLearning

4.2.4.1 Chi-Square analysis

PARTICIPANTS' DISTRIBUTION

Figure 4.8 presents the illustration of Gender and Group (Class year). Group 0 and 1 were enrolled first year CS students (Group 0 were first years in 2016 while Group 1 enrolled in 2017), Group 2 were second year CS students in 2017, Group 3 were third year CS students in 2017, and Group 4 were honours students of the same department in 2017.

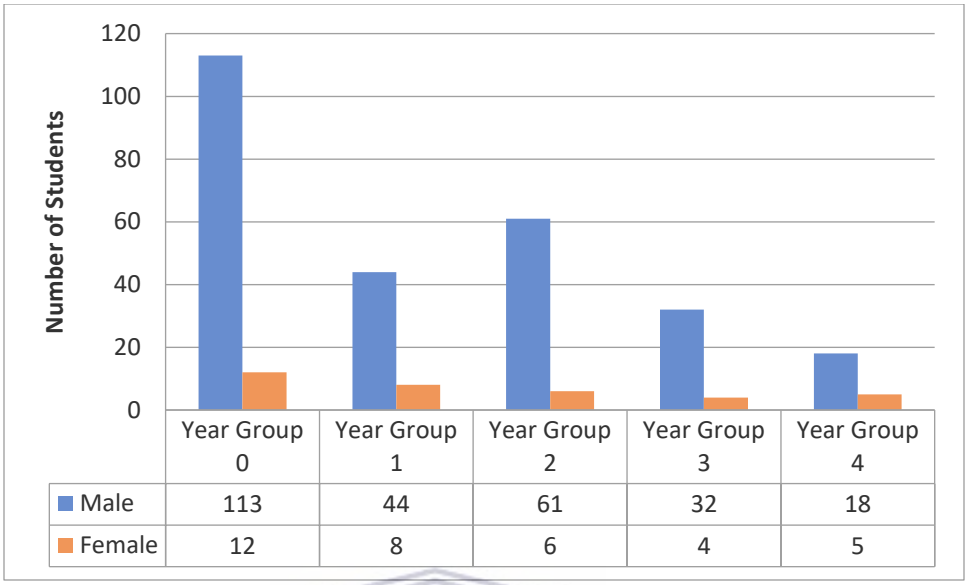

Figure 4.8: Distribution of participants according to class year

DESCRIPTION OF TABLES

Each cell of Table 4.7, Table 4.9, Table 4.11, Table 4.13 and Table 4.15 lists four numbers, as follows:

1. Frequency of the response as it related to each gender.
2. Overall percentage of number of responses as it related to each gender in the total sample size.
3. Row percentage of the number of responses in that cell over the total number in that particular row of the table.
4. Column percentage of the number of responses in that cell over the total number in that particular column of the table.

In Table 4.7, 110 out of 253 (i.e. 43.48%) male students disagree with Q63 (i.e. being accepted as a member of a group is more important than having autonomy and independence) while 23 out of the 35 (i.e. 65.71%) female students also disagree.

Table 4.8, Table 4.10, Table 4.12, Table 4.14 and Table 4.16 shows Cramer's V statistics values.

GENDER AND INDIVIDUALISM/COLLECTIVISM

The values discussed in this section shows that there is association between gender and individualism/collectivism (IC). The observed response shows that both males and females disagree with the IC statement. Chi-Square analysis shows significant association with IC items Q63 and Q64.

Table 4.7: Gender and Q63

Q4(Gender)	Q63 (Being accepted as a member of a group is more important than having autonomy and independence)			
	Agree	Unsure	Disagree	Total
Male	93	50	110	253
	32.29	17.36	38.19	87.85
	36.76	19.76	43.48	
	93.94	89.29	82.71	
Female	6	6	23	35
	2.08	2.08	7.99	12.15
	17.14	17.14	65.71	
	6.06	10.71	17.29	
Total	99	56	133	288
	34.38	19.44	46.18	100.00
Frequency Missing = 18				

In Table 4.7, 110 out of 253 (i.e. 43.48%) male students disagree with Q63 (i.e. being accepted as a member of a group is more important than having autonomy and independence) while 23 out of the 35 (i.e. 65.71%) female students also disagree.

Table 4.8: Statistics for gender and Q63

Statistics for Table of Q4 by Q63			
Statistic	**DF**	**Value**	**Prob**
Chi-Square	2	6.8422	0.0327
Likelihood Ratio Chi-Square	2	7.1963	0.0274
Mantel-Haenszel Chi-Square	1	6.2342	0.0125
Phi Coefficient		0.1541	
Contingency Coefficient		0.1523	
Cramer's V		0.1541	

Table 4.8 is found to be significant at 6.8422 with associated p-value of 0.0327 which is less than 0.05. The Cramer's V statistics value of 0.1541 measures the strength of the association detected by Chi-Square as a strong relationship.

Table 4.9: Gender and Q64

Q4(Gender)	**Q64 (Being accepted as a member of a group is more important than being independent)**			
	Agree	**Unsure**	**Disagree**	**Total**
Male	94 32.64 37.15 94.95	38 13.19 15.02 90.48	121 42.01 47.83 82.31	253 87.85
Female	5 1.74 14.29 5.05	4 1.39 11.43 9.52	26 9.03 74.29 17.69	35 12.15
Total	99 34.38	42 14.58	147 51.04	288 100.00
Frequency Missing = 18				

In Table 4.9, 121 out of 253 (i.e. 47.83%) male students disagree with Q64 (Being accepted as a member of a group is more important than being independent) while 26 out of the 35 (i.e. 74.29%) female students also disagree.

Table 4.10: Statistics for gender and Q64

Statistics for Table of Q4 by Q64			
Statistic	**DF**	**Value**	**Prob**
Chi-Square	2	9.1669	0.0102
Likelihood Ratio Chi-Square	2	9.8937	0.0071
Mantel-Haenszel Chi-Square	1	8.3081	0.0039
Phi Coefficient		0.1784	
Contingency Coefficient		0.1756	
Cramer's V		0.1784	

The Chi-Square test statistic value shown in Table 4.10 is found to be significant at 9.1669 with associated p-value of 0.0102 which is less than 0.05. The Cramer's V statistics value of 0.1784 measures the strength of the association detected by Chi-Square as a strong relationship.

GENDER AND POWER DISTANCE

These values show that there is association between gender and Power Distance (PD). The observed response which disagrees with the PD statement, is shared by both genders. Chi-Square analysis shows significant association with PD items Q71, Q73 and Q75.

Table 4.11: Gender and Q71

Q4(Gender)	Q71 (Decision making power should stay with top management and not be delegated to lower level employees)			
	Agree	Unsure	Disagree	Total
Male	82	42	130	254
	28.47	14.58	45.14	88.19
	32.28	16.54	51.18	
	96.47	89.36	83.33	
Female	3	5	26	34
	1.04	1.74	9.03	11.81
	8.82	14.71	76.47	
	3.53	10.64	16.67	
Total	85	47	156	288
	29.51	16.32	54.17	100.00
Frequency Missing = 18				

In Table 4.11, 130 out of 254 (i.e. 51.18%) male students disagree with Q71 (Decision making power should stay with top management and not be delegated to lower level employees) while 26 out of the 34 (i.e. 76.47%) female students also disagree.

Table 4.12: Statistics for gender and Q71

Statistics for Table of Q4 by Q71			
Statistic	DF	Value	Prob
Chi-Square	2	9.1938	0.0101
Likelihood Ratio Chi-Square	2	10.7195	0.0047
Mantel-Haenszel Chi-Square	1	8.8805	0.0029
Phi Coefficient		0.1787	
Contingency Coefficient		0.1759	
Cramer's V		0.1787	

The Chi-Square test statistic value shown in Table 4.12 is found to be significant at 9.1938 with associated p-value of 0.0101 which is less than 0.05. The Cramer's V statistics value of 0.1787 measures the strength of the association detected by Chi-Square as a strong relationship.

Table 4.13: Gender and Q73

Q4(Gender)	Q73 (Individuals in top management should perform work which is important and delegate lesser tasks to subordinates)			
	Agree	Unsure	Disagree	Total
Male	77	64	112	253
	26.83	22.30	39.02	88.15
	30.43	25.30	44.27	
	93.90	91.43	82.96	
Female	5	6	23	34
	1.74	2.09	8.01	11.85
	14.71	17.65	67.65	
	6.10	8.57	17.04	
Total	82	70	135	287
	28.57	24.39	47.04	100.00
Frequency Missing = 19				

In Table 4.13, 112 out of 253 (i.e. 44.27%) male students disagree with Q73 (Individuals in top management should perform work which is important and delegate lesser tasks to subordinates) while 23 out of the 34 (i.e. 67.65%) female students also disagree.

Table 4.14: Statistics for gender and Q73

Statistics for Table of Q4 by Q73			
Statistic	**DF**	**Value**	**Prob**
Chi-Square	2	6.7968	0.0334
Likelihood Ratio Chi-Square	2	6.9948	0.0303
Mantel-Haenszel Chi-Square	1	5.1422	0.0234
Phi Coefficient		0.1539	
Contingency Coefficient		0.1521	
Cramer's V		0.1539	

The Chi-Square test statistic value shown in Table 4.14 is found to be significant at 6.7968 with associated p-value of 0.0334 which is less than 0.05. The Cramer's V statistics value of 0.1539 measures the strength of the association detected by Chi-Square as a strong relationship.

Table 4.15: Gender and Q75

Q4(Gender)	**Q75 (Individuals in top management should be careful not to ask the opinions of subordinates too frequently)**			
	Agree	**Unsure**	**Disagree**	**Total**
Male	93	45	115	253
	32.40	15.68	40.07	88.15
	36.76	17.79	45.45	
	91.18	97.83	82.73	
Female	9	1	24	34
	3.14	0.35	8.36	11.85
	26.47	2.94	70.59	
	8.82	2.17	17.27	
Total	102	46	139	287
	35.54	16.03	48.43	100.00
Frequency Missing = 19				

In Table 4.15 115 out of 253 (i.e. 44.45%) male students disagree with Q75 (Individuals in top management should be careful not to ask the opinions of subordinates too frequently) while 24 out of the 34 (i.e. 70.59%) female students also disagree.

Table 4.16: Statistics for gender and Q75

Statistics for Table of Q4 by Q75			
Statistic	**DF**	**Value**	**Prob**
Chi-Square	2	8.9232	0.0115
Likelihood Ratio Chi-Square	2	10.4361	0.0054
Mantel-Haenszel Chi-Square	1	2.8006	0.0942
Phi Coefficient		0.1763	
Contingency Coefficient		0.1736	
Cramer's V		0.1763	

The Chi-Square test statistic value shown in Table 4.16 is found to be significant at 8.9232 with associated p-value of 0.0115 which is less than 0.05. The Cramer's V statistics value of 0.1763 measures the strength of the association detected by Chi-Square as a strong relationship.

4.3 Summary

This chapter provides the demographic distribution of the sampled data of CS students of UWC. The pilot study's purpose and its improvement with regards to the questionnaire are discussed. The research results of each SSM cycle are presented. The Varimax with Kaiser Normalisation rotation factor analysis, reliability tests and descriptive statistical analysis are used to establish the suitability of the data and survey items of the research. Conventional and summative content analysis—were used to analyse the text in the second cycle, SEM with PLS was employed in the third cycle and Chi-Square analysis was used to identify associations between the categorical variables. All of these results, together with the literature review, will inform how adoption and affordance of collaborative applications should influence their design.

Chapter 5 Discussion and Conclusion

5.1 Introduction

This thesis investigated (using a multi-method analysis) the predictors of adoption of collaborative eLearning environments keeping the design of these systems in mind. The results of the different SSM cycles were discussed in the previous chapter. In this chapter, the results will be discussed by revisiting the research questions. Finally, the contribution of the thesis will be argued.

5.2 Revisiting the research questions

5.2.1 Adoption and affordance of collaborative applications

Question 1: What determines adoption and affordance of collaborative applications for Computer Science team projects?

It was observed that technology affordance determined what applications or technologies are the preferred means of collaboration by CS student project groups. Students do not make use of a single or specific collaborative eLearning platform, environment or application for their team projects, rather; they make use of combinations of a variety of applications to collaborate during their team project execution. The applications have different functionalities which the students are able to adapt to their specific team projects. The student teams were able to use these applications by identifying the affordances that the applications would provide for their respective groups.

The functionalities of *IKamva*—the university LMS—were not used by student teams for collaboration on their projects since it was not designed to function in ways that satisfy the needs of students in a particular field of study. The emergent functionalities that the students indicate they would require in a collaborative eLearning system are: communication; document (file) sharing capabilities; access to course resources (learning materials); and access to software to test the originality of their work. These

are not present in Ikamva, therefore, the students preferred to use alternative applications. This tendency was also found by Mtebe in a study about LMS usage in Sub-Saharan Africa:

> *"…despite the increased adoption LMS in the region, the actual usage is reported low..." (Mtebe, 2015, p. 53)*

This thesis identified four distinct affordances in the use of social and collaborative applications for student projects:

- Communicative affordance,
- Document share affordance,
- Course resource affordance, and
- Integrity affordance—this affordance relates to the checking of their work for plagiarism.

These results agree with similar studies in terms of technology adoption and usage (Bankole, Bankole, & Brown, 2011; Zhang, Hoehle, & Venkatesh, 2015). The analysis revealed that characteristic non-functional requirements such as *ease of use*, *access/availability/free*, *effective*, *convenient*, *attractiveness* and *innovativeness* are important determinants of usage and it also established in what combinations the applications were used. This is evident from the number of occurrences of these keywords in the discussions.

WhatsApp was the preferred instant messaging communication application. *WhatsApp* was mentioned together with the keywords, *Voice Call*, *Video Call*, and *Instant Messaging*. In addition to this, *WhatsApp* appealed to students since most of them may have been making use of the application as a social media platform for communication with friends and family. Hence by simply creating a *WhatsApp* group for their team members, the students were able to communicate and work together.

Email was used by most teams since all students had email accounts. Email can easily be used for both communication and transferring of files such as programming codes and all other associated documentation required for the project. A recent study by Pilkington & Sanders, on online collaborative document management, provided a similar conclusion. That is, emails can be used as a communicative tool to manage

collaboration on projects (Pilkington & Sanders, 2014). Pilkington & Sanders alluded to the fact that email is usually available and convenient to use for collaborative purposes. Furthermore, the author of this thesis determined—in terms of access to financial resources, ownership of smart devices as well as constant connection to the Internet—that the students were not all equal but had diverse opportunities and backgrounds. In those cases, where some team members did not have access to all the resources required by popular applications, the teams would resort to using email for most of their communications as well as for document sharing.

Google Drive was the most used application for document sharing. The student university email service account is hosted by *Google*; therefore, all students have access to *Google Plus*, i.e. G+, applications. It was thus easy for the teams to manage their tasks, activities and share documents using *Google Drive*. A few teams employed *Google Docs* and *Google Hangouts* as well. Quite a few teams made use of *Dropbox* for document sharing. This is due to personal preferences for this application. The teams that made use of *Dropbox* probably had team members that already used *Dropbox* and were familiar with its user interface and environment.

Each project team selected different combinations of applications which adequately coordinated the team members in such a way that each individual made an equal contribution. It was found that the types of applications used by the teams were the same, i.e. all the project teams made use of both communication and document sharing applications. However, the characteristics of the applications used to perform their team project tasks, were different in terms of functionalities, team member's preferred means of collaboration and each team's preferred application. For instance, since WhatsApp is installed on most people's mobile devices, a team might have found it easier to collaborate by creating a WhatsApp group, to communicate, share documents and files through the WhatsApp instant messaging function, rather than having to use Facebook, which is a social networking site.

To effectively collaborate on their projects, the teams exhibited evidence of technology affordance in the way they selected the combination of applications that they employed for their team work. The actions taken by the project teams in their collaborative work presented four affordances namely: communicative, document

share, course resource and integrity affordances. This implies the need for affordances in using collaborative applications in order to carry out a team project. These affordances made the students exploit their world and improvise, thus providing an effective means of team work and collaboration. Team work and collaboration is a graduate attribute and skill that has been shown to benefit students—especially CS graduates who often take up IT professions that require working in project teams and collaborating with colleagues in building software—when they eventually move on to professional workplaces (Solimeno, Mebane, Tomai, & Francescato, 2008).

The practical implication of this research dovetails with comments by Gasevic *et al.,* (2014) about Massive Open Online Courses (MOOCs):

> *"Research needs to come up with theoretical underpinnings that will explain factors related to social aspects in MOOCs that have a completely new context and offer practical guidance of course design …" (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014, p. 167).*

It also has implications for the design and development of collaborative eLearning functionalities which are important for collaboration during team projects. More functionality and user centric collaborative features can be developed when the appropriate affordances are identified at an early stage of the application design.

5.2.2 Effect of culture on collaborative eLearning systems

Question 2: What effect does culture have on adoption and usage of collaborative eLearning systems?

This study describes the use of collaborative eLearning applications by the students. It evaluates the factors, including culture, that influence usage. The analysis performed and results obtained have provided much needed understanding of collaborative eLearning usage. *Uncertainty Avoidance* shows that students trust collaborative eLearning as it relates to its *Perceived Usefulness* as well as *Perceived Ease of Use*. *Power Distance* has a positive correlation with *Behavioural Intention to Use* collaborative eLearning. This implies that the introduction of collaborative eLearning by the university management is a determining cause of the *Behavioural*

Intention to Use collaborative eLearning. The university management has the power to make decisions about applications such as providing IKamva, the collaborative eLearning platform for use within the university. The users (such as CS students) are expected to make use of this software even though IKamva does not meet most of their needs (as seen in the affordance section of the study). There is a high differential of authority and inequality exhibited because the students are expected to accept the decision made by the university management.

Subjective Norms also has an influence on *Behavioural Intention to Use* collaborative eLearning. It means social determinants like the opinions of a user's classmates affect behavioural intention. Students do tend to make use of tools and applications their classmates introduce to them when taking on group tasks. Also, the collaborative characteristics of some of the class work of CS students tends to influence usage of collaborative eLearning applications or tools and team members can easily introduce such tools to their classmates.

Masculinity/Femininity has a high negative correlation with *Perceived Usefulness* at -0.26 with $p<0.001$, and with *Perceived Ease of Use* at -0.31 with $p<0.001$. The fact that *Masculinity/Femininity* shows a negative relationship with both of these factors indicates that gender inequalities common to male or female individuals do not determine how the students view the usefulness of collaborative eLearning. The students, irrespective of their *Masculinity/Femininity* values, consider collaborative eLearning applications as essential tools to their academic progress as well as a platform which helps develop the graduate attribute of team work and communication.

Individualism positively influences *Perceived Usefulness* of collaborative eLearning. This result is expected since students use collaborative eLearning applications individually; thus, they decide how useful it is for their usage. However, *Individualism* shows no influence on *Perceived Ease of Use*. This implies that the level of complexity experienced or the effectiveness of using collaborative eLearning is not realised individually. Hence the collective use of collaborative eLearning can be used to determine the extent of it use.

Perceived Ease of Use shows no association on *Behavioural Intention to Use* collaborative eLearning. This result means that the level of complexity experienced with collaborative eLearning applications is not a determining factor of adoption. The majority of the hypotheses in the model are positively supported. This shows and further emphasises the results of previous studies ((Zhang, Hoehle, & Venkatesh, 2015; Dinev, Goo, Hu, & Nam, 2009) as was discussed in 'The effect of culture on technology adoption' in Section 2.11 of this thesis, which found that culture is a very important determinant of ICT adoption.

5.2.3 Gender and collaborative eLearning

Question 3: Does gender determine adoption and usage of collaborative eLearning?

In the context of the methodology described in Chapter 3 and with a target population of only CS students at UWC, the Chi-Square analysis shows that Individualism/Collectivism (IC) and Power Distance (PD) are the only variables which show significant association with Gender. The responses show males and females disagree with IC and PD item statements.

The students agreed that gender is not relevant to Individualism/Collectivism as it relates to collaborative eLearning applications usage. The individual or collective use of collaborative eLearning applications is not determined by gender. Irrespective of their gender, the students knew before enrolling for their courses, that collaborative eLearning applications would be tools they would use as students and as professionals. Likewise, with respect to students, gender is not relevant to Power Distance in collaborative eLearning applications usage. Finally, the reason why the students felt that gender is not relevant is because the entrance or admission requirements for CS degree at UWC are non-gender based.

5.2.4 Adoption and affordance guide collaborative eLearning design

Question 4: How does adoption and affordance guide the design of collaborative eLearning?

IKamva, just like any other LMS, has many functionalities that serve different user groups—lecturers, students, administrative and management staff. Students use IKamva according to general functionalities made available for their user group. It was found that IKamva did not fully provide for the learning needs of the students. This prompted students, lecturers and tutors to adopt other applications that afford the functionalities they require in order to learn collaboratively. Applications that provide communication, document sharing, course/learning resources and integrity (i.e. checking of work originality or plagiarism) functionalities are sought by UWC CS students when collaborating. This finding was also shared by Du, Fu, Zhao, Liu, & Liu in a study about an eLearning Platform with Integrated Social Software and Learning Management System:

> *"…eLearning featured by active participation, interaction and collaboration of learners and educators is becoming more and more important in education both for learners and educators. While learning management system (LMS) is the traditional approach to eLearning which is organised as courses; social software including blogs, wikis, social networking sites, and social bookmarking sites etc. are adopted by many educators to meet their emerging needs in education. In order to satisfy the needs for participation, interaction, and collaboration of learners and educators…" (Du, Fu, Zhao, Liu, & Liu, 2012, p. 11).*

UWC is not the only university that uses LMS, therefore, this is not an omission on the part of the university, rather, it is logical to acknowledge that ICT roll-out in any organisation is implemented in stages—which might depend on how critical each stage is to the entire university—and UWC is no exception. However, when it comes to the design of collaborative eLearning systems, the affordance identified in several collaborative applications can help in shaping the design of a collaborative eLearning system that students can use to its full potential.

Being able to understand the technology affordance of collaborative eLearning for students, is pivotal to the design. Affordance—the perceived and real properties of collaborative eLearning from student's perspective—can be employed to influence the design. Therefore, understanding use and user behaviour, could provide the theoretical guidance to ICT design (Zhang, 2009).

5.3 Research contribution

According to Dubin (1978), a complete theoretical contribution must consist of four vital elements, identified as *'What', 'How', 'Why'* and *'Who, Where and When'.* These elements add value to the contribution and form the building blocks of theory development (Whetten, 1989). These elements are considered and the questions and answers as they relate to this research are discussed below.

What—Does this study make a significant contribution to knowledge?
Two criteria responsible for judging that the right variables are selected are comprehensiveness and parsimony. Comprehensiveness takes care of the notion that all relevant variables are included while parsimony considers if some variables should be discarded because they add little value to the study subject.

Answer—In this study, the research process involves a literature review which is focused on investigating research and publications on collaborative eLearning, IT adoption and qualitative and quantitative analytical methods. It is found (through the literature review) that affordance theory would be appropriate to identify how users understand the use of collaborative eLearning applications. Management boards of universities make the decisions concerning the resources that will be utilised at the university, one of which is collaborative eLearning applications. In making these decisions, it is easy to exclude the opinion of the students who form a large proportion of the intended users.

Ismail's stance on involving all the stakeholders in the design process of collaborative eLearning system, is valid, however, this needs to be done initially as well as during the design process. The requirements and specifications need to be gathered from all the stakeholders—especially from student users, who usually form the largest subset of the system's users. A good way to gather requirements and specifications from student users, is to find out how the collaborative eLearning system will be used by them. Only when it conforms with what they expect, will they endorse and use the collaborative eLearning system as intended. This doctoral thesis identified the predictors of design and adoption of collaborative eLearning systems and as such relates to the studies by Ismail (2002) and Liaw & Huang (2006).

By understanding affordances, determinant variables of collaborative eLearning and the culture of the students, Management could make informed decisions on the design of collaborative eLearning which would meet the needs of the intended users. This conclusion aligns with the frameworks suggested by Ismail (2002) and Liaw & Huang (2006) (Section 2.4.2.2). Here we see that identifying the affordance, determinant variables and cultural inclination of the intended users, can guide the decisions on what forms the building blocks (i.e. use requirement and specification, user management, user resources, usability, user administration and ease of use) of collaborative eLearning system design.

How—how are the identified variables associated and is there any emergent explanation from the associations?

Answer—There are several associations between the variables in the data and these is verified by the quantitative analysis results in SSM cycles three and four.

Why—Does the study identify the theoretical assumptions that shaped the causal links to the selection of variables and the resulting conceptual model.

Answer—The theoretical assumptions in this research emerged from the suggestion that UWC CS students utilise IKamva, the university-wide eLearning platform and that it satisfies their academic needs. Due to the observation and analysis in this research, the above assumption has been shown to be false. IKamva was not the preferred application for the students. However, some students used it because they were mandated to do so. Hence the use of IKamva was not voluntary.

Who, Where and When—These are circumstances which place boundaries on the procedures produced from a theoretical framework (Whetten, 1989).

Who

Answer—This study is limited to CS students and this may hinder the findings from being applicable to other sample populations, if the study needs to be replicated. The results of this research explain the behaviour of the students towards collaborative

eLearning usage. In spite of this limitation, this study implies that cultural disposition is a highly significant contributor to adoption and usage. In conclusion, this research presents knowledge on the determinants of culture on collaborative eLearning as experienced by the CS department of UWC. Hence it builds on the findings of recent studies that deals with the effects of culture on ICTs in education, for example the research of Hammer, Janson, & Leimeister (2014). In their study, conducted in Germany and China, it was found that culture had a significant effect on eLearning. Furthermore, the methodologies and approach adapted in this research could be useful for practitioners, managers and decision-makers of ICT in creating versatile collaborative eLearning applications.

Where

Answer—The study was done in the Western Cape, a province of South Africa, which is a developing country. The results of this research could be useful to other countries with similar characteristics.

When

Answer—This research was carried out in 2016–2018 and with the IT field being a fast-changing environment, if this study is replicated, the findings will probably be different. Findings of this study show that users of collaborative eLearning software enact their own original meaning into the software and this affects its adoption. If the meaning the users enact into the software is known beforehand, the university decision-makers would be able to provide a collaborative eLearning environment which caters to the exact needs of the users.

The research was able to identify the predictors of design and adoption of collaborative eLearning environments. The results of the study propose an approach to usage patterns and acceptance amongst CS students of UWC. It can therefore be stated that stakeholders (decision-makers) involved in the provision of IT applications should to be aware of the requirements and expectations of the users within collaborative eLearning environments.

This study presents the affordances associated with social and collaborative applications for student projects. In order to work effectively and collaborate as part

of a team, appropriate application features or functionalities must be properly conceived and developed. This can be achieved by knowing the affordances that are plausible from the needs and abilities of the students working on a team project in a collaborative environment. In this study, communicative affordance, document share affordance, course resource affordance, and integrity affordance are found to be associated with the students' preference for using the particular applications they employed for their project.

Lastly, this thesis has passed through quality control; a professional editor was employed to check the language. An academic researcher was consulted to check the logic and correctness of both qualitative and quantitative analysis and results of the research.

5.4 Implication of this study

The associations between the factors which determine the usage of collaborative eLearning were identified by means of the results of both qualitative and quantitative analysis. Not all the hypothesised associations were confirmed in this research; however, there was important evidence that the researched factors do predict adoption and usage of collaborative eLearning in universities - in this case, UWC CS students. This research provides insight on the affordances that cause user acceptance of collaborative eLearning "*Document sharing", "communication", "course resources" and "plagiarism detection" were* identified and noted to be such affordances to technology usage.

Findings from this research show there are technological platforms for collaborative eLearning available at UWC, however, they are not being used to their full potential. Students still prefer to perform collaborative learning activities by using social collaborative applications. This is because of the technology affordances they associate with these applications. In addition, students are accustomed to using mobile devices, online social media and applications and they would naturally rather use these for learning as well. In order for students to use collaborative eLearning applications, the affordances students consider possible in using other online social collaborative applications need to be incorporated in the university-wide platform.

This may be the major reason the students were not maximising the use of the institutional collaborative eLearning platform provided at UWC.

5.4.1 Implications for universities

In order for collaborative eLearning to be widely adopted by students, university stakeholders have to acknowledge the usage needs of the intended users. The needs of collaborative eLearning application users differ. With respect to student users, their needs vary according to the specific year, course of study or subject enrolled for. For instance, CS students design and develop program codes for applications hence they need resources and services that would facilitate learning such as these. The results of this study show the students utilise several applications that provide the resources and services they require to learn. The universities need to take this into account when providing collaborative eLearning platforms.

Likewise, the university should take into account the needs and usage requirements of other users of collaborative eLearning such as the lecturers and administrative staff.

5.5 Limitations and future research

5.5.1 Limitations of the research

The sample research participants are limited to CS students of UWC. The participants are university students with a demographic distribution that represents students of a university. The sampled participants are drawn from different groups of individuals with mixed gender, age group, class (i.e. enrolment) year and culture.

This research adopted a cross-sectional timeframe to data gathering. A longitudinal timeframe would have provided more diverse responses from the participants. However, the cross-sectional study offers a specified scope for an in-depth investigation of the sampled data. Also, more interesting findings would have emerged if the study had been extended to other courses and departments within the Science faculty and in other faculties at the university. The usage patterns could be

studied to provide vast knowledge and improve the provision of collaborative eLearning in the university.

The final limitation of this study—which future studies should seek to address—is that the findings of this research are based on data gathered from only one cohort of CS students within a specific time period. Future research will source data from more student teams in different academic years and other departments in the Science faculty.

5.5.2 Future research

This study integrates Hofstede's dimensions of culture and investigates their effect on collaborative eLearning amongst CS students of UWC in the period 2017–2018. Further research could be conducted by creating research questions and methodologies which are suitable for similar study areas. Such studies would be able to investigate software design from another perspective, thereby proposing more insights for predicting the adoption of collaborative eLearning software. A longitudinal time frame and a different target population could be employed to investigate another collaborative eLearning research.

An additional attempt could be made to conduct a similar study in other countries and other universities. The university staffs also make use of collaborative eLearning for teaching, tutoring and administrative purposes. These users can also be included in the further research, in order to better understand how to design and use collaborative eLearning platforms with multiple users that have different uses for the software.

5.5.3 Conclusion

In this chapter, the findings of the study were discussed. It was mentioned why this thesis is a legitimate contribution to knowledge. A multi-method analysis was employed to determine causes of adoption and usage of collaboration eLearning amongst university students. The study presented affordances associated with social and collaborative applications for student projects which in turn can be used to determine future designs of a collaborative eLearning environment at universities.

The qualitative and quantitative methods adopted in this research were rigorous. In addition, adopting both methods were beneficial to this research given that both the quantitative and qualitative method provided a different perspective of the research in order for the study to move into the next cycle. The overall findings point to collaborative eLearning usage as being highly essential for team work amongst students.

Several hypotheses associated with adoption of technologies were tested based on the survey. The questionnaire was designed based on the foundation of validated survey questions employed in Srite and Karahanna (2006). This study showed that the predictors of design and adoption of collaborative eLearning environment are the affordances (meaning enacted by the users) associated with its use.

The analysis and findings show that culture influences the **adoption** of collaborative eLearning and technology **affordance** further plays a major role on **usage** of collaborative eLearning. The research result confirms that culture is a predictor of adoption and usage of collaborative eLearning.

In conclusion, this study presents what to consider when designing a collaborative eLearning environment: culture; communication affordance; document share affordance; course resource affordance; and integrity affordance. All of these are the predictors for the adoption of collaborative e-learning systems.

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Appendices

Appendix A

Letter to research participant

To whom it may concern
I am a doctoral student at the Computer Science department of University of the Western Cape (UWC). I am conducting a research on an empirical investigation on the determinants of collaborative eLearning adoption. The study aims to understand the association of the major determining factors which leads to actual adoption of collaborative eLearning.
The study will involve gathering information with the use of questionnaires. This is to request your participation as a participant in the survey. This questionnaire takes up to 15 minutes to complete. The data collected will be kept confidential. Your identity will be kept anonymous as no identifiable information such as names, contact phone and address will be requested. Also, data gathered will be treated with strict confidentiality.
Participation in this survey is strictly voluntary and you have the right to withdraw your participation should you wish. The set of questions have been approved by Natural Sciences Faculty Ethics in Research Committee. A copy of the results will be made available to you, should you request the final outcome of the survey. Thank you for your anticipated participation in my research project.
Kind Regards,

Omolola Bankole (Doctoral Student)
University of the Western Cape

Please send queries to my contact below:
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OR
Research Supervisor:

Isabella M Venter (Professor)
Chair of Computer Science
Chair of the Management Committee of the Telkom/Cisco/Aria Technology Centre of Excellence
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Appendix B

Consent Form

Predictors of Design and Adoption of Collaborative eLearning Environments: A Multi-Method Analysis

I confirm that I have read and understand the purpose of this survey and have had the opportunity to ask questions. I understand that my participation is strictly voluntary and I can decide to discontinue from the survey at any time.

My identity will be kept anonymous as I have not provided any identifiable information such as names, contact phone and address.

I give permission for the information I provide to be used for research purposes. Signing this form indicates my participation in the research “Predictors of Design and Adoption of Collaborative eLearning Environments: A Multi-Method Analysis”. The result of the survey will be made available to me, should I request such from the researcher.

Signature:.....

Date: .....

Appendix C

Questionnaire collaborative eLearning usage

Instructions

STUDENT PARTICIPANTS with no work activities on campus that allows you to make use of any COLLABORATIVE ELEARNING platform as an administrator, please complete only Section A and C. ALL OTHER PARTICIPANTS please complete SECTIONS A, B and C.

Section A: Background information:

Q1. Please select which one of the options below applies to the participant:

Academic	Non-academic	Student
1	2	3

Q2. What is your job function? *(if you selected student in Q1 above please state if you work as a tutor/teaching assistant/other on campus)*_____

Q3. What is the age of the participant?_____years

Q4. Gender

Male	Female
1	2

Q5. Do you make use of any collaborative eLearning software/platforms? *(e.g. IKamva, Piazza, Blackboard etc)*

Yes	No

1	2

Q6. If ‘Yes’ please provide name(s) of the collaborative eLearning software/platforms’ you make use of. *(You can name more than one).* If ‘No’ go to Q8.

Q7. Why do you make use of this/these collaborative eLearning software/platform(s)?

Q8. If ‘No’, are you planning to make use of any collaborative eLearning software in the nearest future?

Yes	**No**
1	2

Q9. If ‘Yes’, please state the collaborative eLearning software/platform(s) you are planning to make use of in the future.

Q10. Please provide any other software or application that you make use of among your peers/classmates/colleagues for collaborative learning, communication or information/document sharing. *(You can name more than one)*

Q11. Why do you make use of the software or application(s) stated in Q10

Q12. Which device(s) do you use to access this/these collaborative eLearning software(s)? *(You can select more than one option)*

Q13.

Desktop computers	**Laptop computers**	**Tablets**	**Smart phones**	**Others *(Please Specify here)*** …….
1	2	3	4	5

Q14. Does availability of access device(s) affect the way you make use of the software? Please explain.

Q15. What activities/services do you perform/use when you are logged on to the collaborative eLearning software of your choice?

Q16. In order to further improve the use of your chosen collaborative eLearning software by students, academics and non-academics, what other activities/services do you think should be incorporated *(You can state as many as you want)*

Section B[1]: Original Questionnaire:

Circle only one of the options for the following questions:		Rating Circle only one options for the following questions: **1 = Strongly agree; 2 = Agree; 3 = Somewhat agree; 4 = Unsure; 5 = Somewhat disagree; 6 = Disagree; 7 = Strongly disagree**						
Q17.	PU1 Using IKamva improves (would improve) my (academic/work) performance.	1	2	3	4	5	6	7
Q18.	PU2 Using IKamva enhances (would increase) my productivity.	1	2	3	4	5	6	7
Q19.	PU3 Using IKamva enhances (would enhance) my effectiveness on learning.	1	2	3	4	5	6	7
Q20.	PU4 I find (would find) IKamva useful in my academic/work activities.	1	2	3	4	5	6	7
Q21.	RA1 Adoption will lead to cost reductions.	1	2	3	4	5	6	7
Q22.	RA2 Adoption will lead to transaction acceleration.	1	2	3	4	5	6	7
Q23.	RA3 Adoption will improve coordination with suppliers.	1	2	3	4	5	6	7
Q24.	RA4 Adoption will provide timely information for decision making.	1	2	3	4	5	6	7
Q25.	CPLX1 The skill required are complex to our employees.	1	2	3	4	5	6	7
Q26.	CPLX2 We believe that an MHRS is complex to implement.	1	2	3	4	5	6	7
Q27.	CPLX3 We believe that developing an MHRS is a complex process.	1	2	3	4	5	6	7
Q28.	CPLX4 Integrating an MHRS into our work practice is very difficult.	1	2	3	4	5	6	7
		1	2	3	4	5	6	7

Q29.	COM1 E-procurement is compatible with my firm's values and beliefs.							
Q30.	COM2 The changes introduced by an MHRS are consistent with my hotel's existing beliefs/values.	1	2	3	4	5	6	7
Q31.	COM3 An MHRS is compatible with my hotel's existing information infrastructure.	1	2	3	4	5	6	7
Q32.	COM4 The changes introduced by an MHRS are consistent with my hotel's existing practice	1	2	3	4	5	6	7
Q33.	FSLK1 I believe the enterprise is adequately capitalised	1	2	3	4	5	6	7
Q34.	FSLK2 The enterprise can easily get outside funding if it needs.	1	2	3	4	5	6	7
Q35.	FSLK3 The enterprise can raise ample resources to adopt e-procurement.	1	2	3	4	5	6	7
Q36.	FSLK4 The cost of maintenance and support are not high.	1	2	3	4	5	6	7
Q37.	TOP1 Top management support for adoption of e-procurement.	1	2	3	4	5	6	7
Q38.	TOP2 Top management is aware of the benefits of e-procurement.	1	2	3	4	5	6	7
Q39.	TOP3 Top management encourage employee to use new technology.	1	2	3	4	5	6	7
Q40.	TOP4 My top management is likely to invest funds in an MHRS.	1	2	3	4	5	6	7
Q41.	TOP5 My Top management is willing to take the risks involved in the adoption of an MHRS.	1	2	3	4	5	6	7
Q42.	TOP6 My top management is likely to be interested in adopting an MHRS in order to gain competitive advantage.	1	2	3	4	5	6	7
Q43.	TECH1 The enterprise has technological readiness capacity to adopt e-procurement.	1	2	3	4	5	6	7
Q44.	ExP1 Our suppliers require us to adopt e-procurement.	1	2	3	4	5	6	7
Q45.	Exp2 E-procurement is a strategic necessity in order to	1	2	3	4	5	6	7

	compete in the current marketplace.							
Q46.	ExS1 Community agencies can provide required training.	1	2	3	4	5	6	7
Q47.	ExS2 Community agencies can provide effective support.	1	2	3	4	5	6	7
Q48.	PU1 Using IKamva improves (would improve) my (academic/work) performance.	1	2	3	4	5	6	7
Q49.	PU2 Using IKamva enhances (would increase) my productivity.	1	2	3	4	5	6	7
Q50.	PU3 Using IKamva enhances (would enhance) my effectiveness on learning.	1	2	3	4	5	6	7
Q51.	PU4 I find (would find) IKamva useful in my academic/work activities.	1	2	3	4	5	6	7
Q52.	PEOU1 It is easy for me to become skilful in using computers.	1	2	3	4	5	6	7
Q53.	PEOU2 I find computers easy to use.	1	2	3	4	5	6	7
Q54.	PEOU3 I find it easy to get a computer to do what I want it to do.	1	2	3	4	5	6	7
Q55.	PEOU4 Learning to operate a computer is easy for me.	1	2	3	4	5	6	7
Q56.	BIU1 I intend to use a PC during my studies.	1	2	3	4	5	6	7
Q57.	BIU2 I intend to use a PC frequently during my studies.	1	2	3	4	5	6	7
Q58.	SN1 My relative think I should use a computer.	1	2	3	4	5	6	7
Q59.	SN2 My friends believe I should use a computer.	1	2	3	4	5	6	7
Q60.	SN3 My professors think I should use a computer.	1	2	3	4	5	6	7
Q61.	SN4 My classmates at UWC will think I should use a computer.	1	2	3	4	5	6	7
Q62.	MF1 It is preferable to have a man in high level position rather than a woman.	1	2	3	4	5	6	7

Q63.	MF2 There are some jobs in which a man can always do better than a woman.	1	2	3	4	5	6	7
Q64.	MF3 It is more important for men to have a professional career than it is for a woman to have a professional career.	1	2	3	4	5	6	7
Q65.	MF4 Solving organisational problems require the active forcible approach which is typical of men.	1	2	3	4	5	6	7
Q66.	MF5 Women do not value recognition and promotion in their work as much as men do.	1	2	3	4	5	6	7
Q67.	IC1 Being accepted as a member of a group is more important than having autonomy and independence.	1	2	3	4	5	6	7
Q68.	IC2 Being accepted as a member of a group is more important than being independent.	1	2	3	4	5	6	7
Q69.	IC3 Group success is more important than individual success.	1	2	3	4	5	6	7
Q70.	IC4 Being loyal to a group is more important than individual gain.	1	2	3	4	5	6	7
Q71.	IC5 Individual rewards are not as important as group welfare.	1	2	3	4	5	6	7
Q72.	IC6 It is more important for a manager to encourage loyalty and a sense of duty in subordinates than it is to encourage individual initiative.	1	2	3	4	5	6	7
Q73.	PD1 Managers should make most decisions without consulting subordinates.	1	2	3	4	5	6	7
Q74.	PD2 Managers should not ask subordinates for advice, because they might appear less powerful.	1	2	3	4	5	6	7
Q75.	PD3 Decision making power should stay with top management in the organisation and not be delegated to lower level employees.	1	2	3	4	5	6	7

Q76.	PD4 Employees should not question their manager's decisions.	1	2	3	4	5	6	7
Q77.	PD5 manager should perform work which is difficult and important and delegate tasks which are repetitive and mundane to subordinates.	1	2	3	4	5	6	7
Q78.	PD6 Higher level managers should receive more benefits and privileges than lower level managers and professional staff.	1	2	3	4	5	6	7
Q79.	PD7 Managers should be careful not to ask the opinions of subordinates too frequently, otherwise the manager might appear to be weak and incompetent.	1	2	3	4	5	6	7
Q80.	UA1 Rules and regulations are important because they inform workers what the organisation expects of them.	1	2	3	4	5	6	7
Q81.	UA2 Order and structure are very important in a work environment.	1	2	3	4	5	6	7
Q82.	UA3 It is important to have job requirements and instructions spelled out in detail so that people always know what they are expected to do.	1	2	3	4	5	6	7
Q83.	UA4 It is better to have a bad situation that you know about, than to have an uncertain situation which might be better.	1	2	3	4	5	6	7
Q84.	UA5 Providing opportunities to be innovative are more important than requiring standardised work procedure.	1	2	3	4	5	6	7
Q85.	UA6 People should avoid making changes because things could get worse.	1	2	3	4	5	6	7

Section B: Final Questionnaire

	Circle only one of the options for the following questions:	Rating Circle only one options for the following questions: 1 = Strongly agree; 2 = Agree; 3 = Somewhat agree; 4 = Unsure; 5 = Somewhat disagree; 6 = Disagree; 7 = Strongly disagree						
Q44	PU1 Using Collaborative eLearning software/platform improves (would improve) my (learning activities/work activities) performance.	1	2	3	4	5	6	7
Q45	PU2 Using Collaborative eLearning software/platform enhances (would increase) my productivity.	1	2	3	4	5	6	7
Q46	PU3 Using Collaborative eLearning software/platform enhances (would enhance) my effectiveness on my learning activities/work activities.	1	2	3	4	5	6	7
Q47	PU4 I find (would find) Collaborative eLearning software/platform useful in my learning activities/work activities.	1	2	3	4	5	6	7
Q48	PEOU1 It is easy for me to become skilful in using Collaborative eLearning software/platform.	1	2	3	4	5	6	7
Q49	PEOU2 I find Collaborative eLearning software/platform easy to use.	1	2	3	4	5	6	7
Q50	PEOU3 I find it easy to do whatever activity I want to do on Collaborative eLearning software/platform.	1	2	3	4	5	6	7
Q51	PEOU4 Learning to use the Collaborative eLearning software/platform is easy for me.	1	2	3	4	5	6	7
Q52	BIU1 I intend to make use of Collaborative eLearning software/platform during my studies.	1	2	3	4	5	6	7
Q53	BIU2 I intend to use Collaborative eLearning software/platform frequently during my studies.	1	2	3	4	5	6	7

Q54	SN1 My relative(s) think I should use Collaborative eLearning software/platform.	1	2	3	4	5	6	7
Q55	SN2 My friends believe I should use Collaborative eLearning software/platform.	1	2	3	4	5	6	7
Q56	SN3 My professors think I should use Collaborative eLearning software/platform.	1	2	3	4	5	6	7
Q57	SN4 My classmates at UWC will think I should use Collaborative eLearning software/platform.	1	2	3	4	5	6	7
Q58	MF1 It is preferable to have a man in high level position rather than a woman.	1	2	3	4	5	6	7
Q59	MF2 There are some jobs in which a man can always do better than a woman.	1	2	3	4	5	6	7
Q60	MF3 It is more important for men to have a professional career than it is for a woman to have a professional career.	1	2	3	4	5	6	7
Q61	MF4 Solving organisational problems require the active forcible approach which is typical of men.	1	2	3	4	5	6	7
Q62	MF5 Women do not value recognition and promotion in their work as much as men do.	1	2	3	4	5	6	7
Q63	IC1 Being accepted as a member of a group is more important than having autonomy and independence.	1	2	3	4	5	6	7
Q64	IC2 Being accepted as a member of a group is more important than being independent.	1	2	3	4	5	6	7
Q65	IC3 Group success is more important than individual success.	1	2	3	4	5	6	7
Q66	IC4 Being loyal to a group is more important than individual gain.	1	2	3	4	5	6	7
Q67	IC5 Individual rewards are not as important as group welfare.	1	2	3	4	5	6	7

Q68	IC6 It is more important for a manager to encourage loyalty and a sense of duty in subordinates than it is to encourage individual initiative.	1	2	3	4	5	6	7
Q69	PD1 Managers should make most decisions without consulting subordinates.	1	2	3	4	5	6	7
Q70	PD2 Managers should not ask subordinates for advice, because they might appear less powerful.	1	2	3	4	5	6	7
Q71	PD3 Decision making power should stay with top management in the organisation and not be delegated to lower level employees.	1	2	3	4	5	6	7
Q72	PD4 Employees should not question their manager's decisions.	1	2	3	4	5	6	7
Q73	PD5 manager should perform work which is difficult and important and delegate tasks which are repetitive and mundane to subordinates.	1	2	3	4	5	6	7
Q74	PD6 Higher level managers should receive more benefits and privileges than lower level managers and professional staff.	1	2	3	4	5	6	7
Q75	PD7 Managers should be careful not to ask the opinions of subordinates too frequently, otherwise the manager might appear to be weak and incompetent.	1	2	3	4	5	6	7
Q76	UA1 Rules and regulations are important because they inform workers what the organisation expects of them.	1	2	3	4	5	6	7
Q77	UA2 Order and structure are very important in a work environment.	1	2	3	4	5	6	7
Q78	UA3 It is important to have job requirements and instructions spelled out in detail so that people always know what they are expected to do.	1	2	3	4	5	6	7
Q79	UA4 It is better to have a bad situation that you know about, than	1	2	3	4	5	6	7

	to have an uncertain situation which might be better.							
Q80	UA5 Providing opportunities to be innovative are more important than requiring standardised work procedure.	1	2	3	4	5	6	7
Q81	UA6 People should avoid making changes because things could get worse.	1	2	3	4	5	6	7

Is there any other information on your use of Collaborative eLearning software/platform that you may like to add?

Would you like to receive a copy of the result of this survey?

Yes	**No**
1	2

If 'Yes' please provide your email address_____

Thank you for your time and participation.

Appendix D

Semi structured interview

Interview Number:
Duration:
Date:

A. Introduction

Introduction and greetings. The purpose of the interview will be stated

The interviewee will be briefed on the ethical measures put in place concerning the information gathered from the interview. The interviewee will be assured of anonymity and confidentiality concerns.

B. Rights of the interviewee

The interviewee is provided with the following information

1. The interviewee may decline the answer to any question
2. The interviewee may decline being recorded
3. The interviewee may provide information at a later time in order to be 100 percent sure of an answer
4. The interviewee may request a copy of the research findings
5. The interviewee will be forwarded the notes or recordings from the interview for confirmation

C. General information on the interviewee

Gender.....

Age Group.....

□ **<20** □ **21-25** □ **26-30** □ **31-35** □ **36-40** □ **41-45** □ **46-50**

▫ **51-55** ▫ **56-60** ▫ **≥61**

Please select one of the following

☐ Academic ☐ Non-academic ☐ Student

Please state your job function.....

D. General Theme Framework

1. What opinion do you have about the use of Collaborative eLearning software/platform?

2. Which Collaborative eLearning software/platform services do you use?

3. Why do you use these Collaborative eLearning software/platform services?

4. Do you find Collaborative eLearning software/platform easy to use?

5. Why do you not use other Collaborative eLearning software/platform services?

6. What extra skills or training do you require in order to use other Collaborative eLearning software/platform services?

7. In your opinion, what are the advantages of Collaborative eLearning software/platform?

8. In your opinion, what are the disadvantages of Collaborative eLearning software/platform?

9. What do you derive from using Collaborative eLearning software/platform services?

10. What are the main factors that influence the use Collaborative eLearning software/platform?

11. What factors do you consider to be the most important when using Collaborative eLearning software/platform?

12. Which factors discourages you from using Collaborative eLearning software/platform?

13. Which factors encourages you to use Collaborative eLearning software/platform?

14. How do you see the cost of Collaborative eLearning software/platform services?

15. Do you any bad experience with using any of the Collaborative eLearning software/platform services? If yes did it affect how you use it now?

16. What issues do you see surrounding the use of Collaborative eLearning software/platform among individuals?

17. How do you see the use of Collaborative eLearning software/platform at UWC?

18. In your opinion, what are the likely Collaborative eLearning software/platform services most used by individuals?

19. Is there anything else you would like to tell me?

E. Conclusion

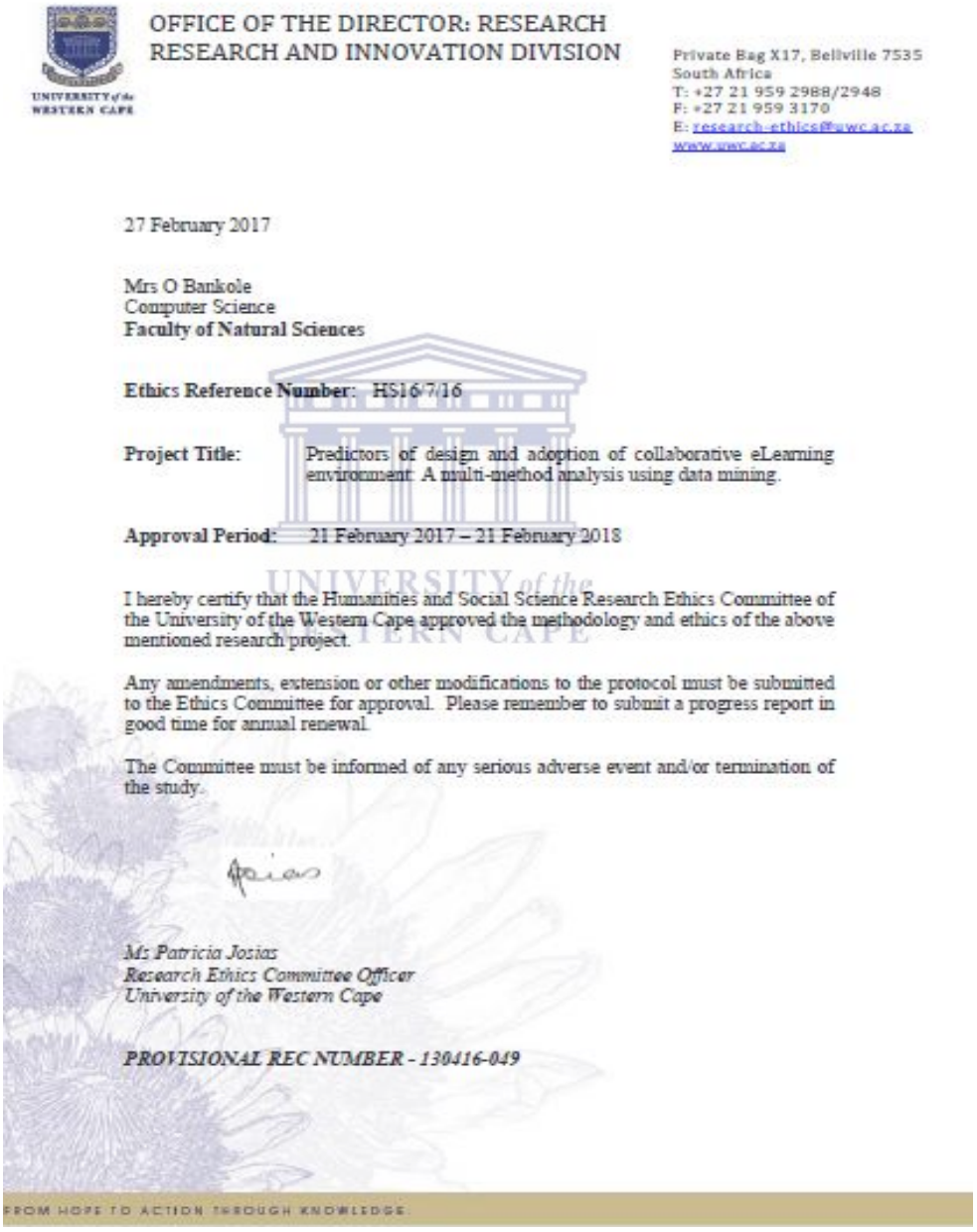
A brief review of the interview is discussed

F. Appreciation

Appreciate and thank the interviewee.

Appendix E

Ethics clearance



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27 February 2017

Mrs O Bankole
Computer Science
Faculty of Natural Sciences

Ethics Reference Number: HS16/7/16

Project Title: Predictors of design and adoption of collaborative eLearning environment: A multi-method analysis using data mining.

Approval Period: 21 February 2017 – 21 February 2018

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER - 130416-049

FROM HOPE TO ACTION THROUGH KNOWLEDGE

Appendix F

SAS program code

```
Note: Data set represented with "XXXXX" below:
options ls=132 pagesize=66;
data COMP_SCI_ELEARNING_DATA_2017A noobs ;
Title 'ELEARNING STUDY - 2017';
Input       ID    Group Q1    Q2_1  Q3    Q4    Q5    Q6_1
      Q7_1 Q8     Q10_1 Q11_1 Q12   Q44   Q45   Q46   Q47
      Q48   Q49   Q50
Q51   Q52   Q53   Q54   Q55   Q56   Q57   Q58   Q59   Q60
      Q61   Q62   Q63   Q64   Q65   Q66   Q67   Q68   Q69
      Q70   Q71   Q72   Q73   Q74   Q75   Q76   Q77   Q78
      Q79   Q80 Q81 @@;
Cards;
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
;
run;



data COMP_SCI_ELEARNING_DATA_2017A;
set COMP_SCI_ELEARNING_DATA_2017A;
/* ASSIGNING LABELS TO CORRESPONDING VARIABLES */
Label ID='Participant ID';
Label Group='Class year';
Label Q1='Participant status/designation';
Label Q2_1='Job function';
Label Q3='Age?';
Label Q4='Gender';
Label Q5='Do you make use of any collaborative eLearning
software(s)?';
Label Q6_1='Provide names of the collaborative eLearning
software(s)';
Label Q7_1='Why do you use these collaborative eLearning
software(s)?';
Label Q8='Planning to make use of any collaborative eLearning
software in the nearest future';
Label Q10_1='Provide other software(s)/application(s) you use
for collaboration';
Label Q11_1='Why do you make use of these
software(s)/application(s)?';
Label Q12='Which device(s) do you access these
software(s)/application(s) with?';
Label Q44='Using Collaborative eLearning improves my
performance';
```

```
Label Q45='Using Collaborative eLearning would increase my
productivity';
Label Q46='Using Collaborative eLearning would enhance
effectiveness on my learning';
Label Q47='I find Collaborative eLearning useful in my
learning';
Label Q48='It is easy for me to become skilful in using
Collaborative eLearning software/platform';
Label Q49='I find Collaborative eLearning software/platform
easy to use';
Label Q50='I find it easy to do whatever activity I want to do
on Collaborative eLearning software/platform';
Label Q51='Learning to use the Collaborative eLearning
software/platform is easy for me';
Label Q52='I intend to make use of Collaborative eLearning
software/platform during my studies';
Label Q53='I intend to use Collaborative eLearning
software/platform frequently during my studies';
Label Q54='My relative(s) think I should use a Collaborative
eLearning software/platform';
Label Q55='My friends believe I should use a Collaborative
eLearning software/platform';
Label Q56='My professors think I should use a Collaborative
eLearning software/platform';
Label Q57='My classmates at UWC will think I should use a
Collaborative eLearning software/platform';
Label Q58='It is preferable to have a man in high level
position rather than a woman';
Label Q59='There are some jobs in which a man can always do
better than a woman';
Label Q60='It is more important for men to have a career than
it is for women to have a career';
Label Q61='Solving organisational problems require the active
forcible approach which is typical of men';
Label Q62='Women do not value recognition and promotion in
their work as much as men do';
Label Q63='Being accepted as a member of a group is more
important than having autonomy and independence';
Label Q64='Being accepted as a member of a group is more
important than being independent';
Label Q65='Group success is more important than individual
success';
Label Q66='Being loyal to a group is more important than
individual gain';
Label Q67='Individual rewards are not as important as group
welfare';
Label Q68='It is important for Individuals in top management
to encourage loyalty than to encourage individual initiative';
Label Q69='Individuals in top management should make most
decisions without consulting subordinates';
```

```
Label Q70='Individuals in top management should not ask
subordinates for advice, because they might appear less
powerful';
Label Q71='Decision making power should stay with top
management and not be delegated to lower level employees';
Label Q72='Students/Employees should not question their
professor's/ manager decisions';
Label Q73='Individuals in top management should perform work
which is important and delegate lesser tasks to subordinates';
Label Q74='Higher level managers should receive more benefits
and privileges than lower level managers and professional
staff';
Label Q75='Individuals in top management should be careful not
to ask the opinions of subordinates too frequently';
Label Q76='Rules and regulations are important because they
inform students what the organisation (i.e. UWC) expects of
them';
Label Q77='Order and structure are very important in an
academic (work) environment';
Label Q78='It is important to have instructions for learning
activities given in details';
Label Q79='It is better to have a bad situation that you know
about, than an uncertain situation which might be better';
Label Q80='Providing opportunities to be innovative are more
important than requiring standardised work procedure';
Label Q81='People should avoid making changes because things
could get worse';
Run;

Proc format;
Value Q2_1f 1='Tutor' 2='Admin Assistant' 3='Programmes'
4='Lab Assistant';

Value Q6_1f 1='IKamva' 2='Piazza,Blackbackboard' 3='khan
academy,Code acad,Code Game,coursera,Github,Stack
overflow,w3school'
                  4='Google Docs-
drive,Trello,Dropbox,leankit,KanbanFlow'
5='WhatsApp,Slack,Telegram'
                  12='IKamva,Piazza,Blackbackboard'
                  13='IKamva,khan academy,Code acad,Code
Game,coursera,Github,Stack overflow,w3school'
                  14='IKamva,Google Docs-
drive,Trello,Dropbox,leankit,KanbanFlow'
                  24='Admin Asistant,Google Docs-
drive,Trello,Dropbox,leankit,KanbanFlow'
                  34='khan academy,Code acad,Code
Game,coursera,Github,Stack overflow,w3school,
                        Google Docs-
drive,Trello,Dropbox,leankit,KanbanFlow'
```

```
                  123='IKamva,Piazza,Blackbackboard,khan
academy,Code acad,Code Game,coursera,Github,Stack
overflow,w3school'
                  124='IKamva,Piazza,Blackbackboard,Google
Docs-drive,Trello,Dropbox,leankit,KanbanFlow'
                  145='IKamva,Google Docs-
drive,Trello,Dropbox,leankit,KanbanFlow,WhatsApp,Slack,Telegra
m'
                  1345='IKamva,khan academy,Code acad,Code
Game,coursera,Github,Stack overflow,w3school,
                        Google Docs-
drive,Trello,Dropbox,leankit,KanbanFlow,WhatsApp,Slack,Telegra
m';

Value Q7_1f 1='Information,Resources'
2='Colloborate,Communicate'

12='Information,Resources,Colloborate,Communicate';

Value Q10_1f 1='IKamva' 2='Piazza'
3='Whatsapp,Gmail,Skype,shareit,Facebook,Telegram,Slack,discor
d'
                  4='One drive,Google
docs,KanbanFlow,Dropbox,Trello,Wrike'
                  5='Github,Khan Academy,Code Chef,Stack
overflow,Share latex,Solo learn,w3school,
                        Youtube
tutorials,Netbeans,Python,edx,mathway,symbolab'
                  6='Turnitin'

      13='IKamva,Whatsapp,Gmail,Skype,shareit,Facebook,Telegra
m,Slack,discord'
                  14='IKamva,One drive,Google
docs,KanbanFlow,Dropbox,Trello,Wrike'

      23='Piazza,Whatsapp,Gmail,Skype,shareit,Facebook,Telegra
m,Slack,discord'

      34='Whatsapp,Gmail,Skype,shareit,Facebook,Telegram,Slack
,discord,
                        One drive,Google
docs,KanbanFlow,Dropbox,Trello,Wrike'

      35='Whatsapp,Gmail,Skype,shareit,Facebook,Telegram,Slack
,discord,
                        Github,Khan Academy,Code Chef,Stack
overflow,Share latex,Solo learn,w3school,
                        Youtube
tutorials,Netbeans,Python,edx,mathway,symbolab'
```

```
                  45='One drive,Google
docs,KanbanFlow,Dropbox,Trello,Wrike,
                        Github,Khan Academy,Code Chef,Stack
overflow,Share latex,Solo learn,w3school,
                        Youtube
tutorials,Netbeans,Python,edx,mathway,symbolab'
                  56='Turnitin,Github,Khan Academy,Code
Chef,Stack overflow,Share latex,Solo learn,w3school,
                        Youtube
tutorials,Netbeans,Python,edx,mathway,symbolab'

      135='IKamva,Whatsapp,Gmail,Skype,shareit,Facebook,Telegr
am,Slack,discord,
                        Github,Khan Academy,Code Chef,Stack
overflow,Share latex,Solo learn,w3school,
                        Youtube
tutorials,Netbeans,Python,edx,mathway,symbolab'

      1234='IKamva,Piazza,Whatsapp,Gmail,Skype,shareit,Faceboo
k,Telegram,Slack,discord,
                        One drive,Google
docs,KanbanFlow,Dropbox,Trello,Wrike';

Value Q11_1f 1='Collaborate,Communicate' 2='Convenience'
3='Ease of use' 4='Information or Resources'
                  5='Accessible' 6='User friendly'
                  12='Collaborate,Communicate,Convenience'
                  13='Collaborate,Communicate,Ease of use'
                  14='Collaborate,Communicate,Information or
Resources'
                    15='Collaborate,Communicate,Accessible'
                    23='Convenience,Ease of use'
                    34='Ease of use,Information or Resources'
                    35='Ease of use,Accessible'
                  45='Information or Resources,Accessible'
                    245='Convenience,Information or
Resources,Accessible'

1234='Collaborate,Communicate,Convenience,Ease of
use,Information or Resources';

Value Q4f   1='Male'          2='Female';

Value Q58f  1='Yes'     2='No';

Value Q12f  1='Desktop computers'   2='Laptop computers'
      3='Tablets' 4='Smart phones'  5='Other'
            12='Desktop computers,Laptop computers'
                  13='Desktop computers,Tablets'
                  14='Desktop computers,Smart phones'
```

```
                  15='Desktop computers,Other'
                  23='Laptop computers,Tablets'
                  24='Laptop computers,Smart phones'
                  34='Tablets,Smart phones'
                  123='Desktop computers,Laptop
computers,Tablets'
                  124='Desktop computers,Laptop
computers,Smart phones'
                 134='Desktop computers,Tablets,Smart phones'
                  234='Laptop computers,Tablets,Smart phones'
                  245='Laptop computers,Smart phones,Other'
                  1234='Desktop computers,Laptop
computers,Tablets,Smart phones';

Value Q4481f      1='Strongly agree'      2='Agree'
      3='Somewhat agree'      4='Unsure' 5='Somewhat disagree'
                        6='Disagree'      7='Strongly
disagree';

Value Q4481fg     1,2,3='Agree'     4='Unsure'
5,6,7='Disagree';


ods rtf file = 'C:\Users\lola\Dropbox\Lola\Data and
Questionnaires\Results\Factor_Eigen_Analysis.rtf';
/* FACTOR SCORES AND EIGEN VALUES ANALYSIS */
Proc factor data=COMP_SCI_ELEARNING_DATA_2017A
simple corr
method=prin
priors=one
mineigen=1.0
ev score;
var Q44 Q45 Q46   Q47   Q48   Q49   Q50 Q51     Q52   Q53
         Q54      Q55   Q56   Q57   Q58   Q59   Q60   Q61
      Q62   Q63   Q64   Q65   Q66   Q67   Q68   Q69   Q70
      Q71   Q72   Q73   Q74   Q75   Q76   Q77   Q78   Q79
      Q80 Q81;
Run;


ods rtf file = 'C:\Users\lola\Dropbox\Lola\Data and
Questionnaires\Results\Reliability.rtf';
/* RELIABILITY TEST - CRONBACH ALPHA ANALYSIS */

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q44 Q45 Q46   Q47;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q48 Q49 Q50   Q51;
```

```
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q52 Q53;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q54 Q55 Q56   Q57;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q58 Q59 Q60   Q61 Q62;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q63 Q64 Q65   Q66 Q67 Q68;
Run;

Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q69 Q70 Q71   Q72 Q73 Q74 Q75;
Run;
Proc corr data=COMP_SCI_ELEARNING_DATA_2017A alpha nomiss;
var Q76 Q77 Q78   Q79 Q80 Q81;
Run;


/*ods rtf file = 'C:\Users\lola\Dropbox\Lola\Data and
Questionnaires\Results\Chisqr_Analysis.rtf';
/* CHI SQR ANALYSIS - GOODNESS OF FIT */
Proc freq data=COMP_SCI_ELEARNING_DATA_2017A;
Title 'GenderQ4_Goodness_of_Fit_Computer_Science';
Tables Q4 / chisq testp=(50 25 25);
Run;

/* CHI SQR ANALYSIS - Q3 GOODNESS OF FIT */
Proc freq data=COMP_SCI_ELEARNING_DATA_2017A;
Title 'AgeQ3_Goodness_of_Fit_Computer_Science';
Tables Q3 / chisq testp=(50 25 25);
Run;

/* CHI SQR ANALYSIS - ASSOCIATION OF CATEGORICAL VARIABLES */
Proc freq data=COMP_SCI_ELEARNING_DATA_2017A;
Title
'GenderQ4_Association_with_CategoricalVariables_GroupQ3Q5Q8_Co
mputer_Science';
Tables Q4*Group Q3 Q5 Q8 / chisq;
Run;

ods rtf file = 'C:\Users\lola\Dropbox\Lola\Data and
Questionnaires\Results\Item_Combination.rtf';
```

```
/*DATA ITEM COMBINATION */
data COMP_SCI_ELEARNING_DATA_2017A;
set COMP_SCI_ELEARNING_DATA_2017A;
Title 'Item_Combination';
PU=.;
pu=(Q44+Q45+Q46+Q47)/28*100;
PEOU=.;
PEOU=(Q48+Q49+Q50+Q51)/28*100;
BIU=.;
BIU=(Q52+Q53)/14*100;
NB=.;
NB=(Q54+Q55+Q56+Q57)/28*100;
MF=.;
MF=(Q58+Q59+Q60+Q61+Q62)/35*100;
IC=.;
IC=(Q63+Q64+Q65+Q66+Q67+Q68)/42*100;
PD=.;
PD=(Q69+Q70+Q71+Q72+Q73+Q74+Q75)/49*100;
UA=.;
UA=(Q76+Q77+Q78+Q79+Q80+Q81)/42*100;
Run;

ods rtf file = 'C:\Users\lola\Dropbox\Lola\Data and
Questionnaires\Results\Gender Analysis.rtf';
   Title 'Gender and Usage Comparisons';
Proc freq data=COMP_SCI_ELEARNING_DATA_2017A;
Tables Q4*(Q2_1   Q5    Q6_1  Q7_1 Q8     Q10_1 Q11_1 Q12
      Q44   Q45   Q46   Q47   Q48   Q49   Q50  Q51 Q52 Q53
         Q54      Q55   Q56 Q57    Q58   Q59   Q60   Q61
      Q62   Q63   Q64   Q65   Q66   Q67   Q68   Q69   Q70
      Q71   Q72   Q73   Q74   Q75   Q76   Q77   Q78   Q79
      Q80 Q81) /chisq ;

Format Q4   Q4f. Q5      Q8 Q58f. Q12     Q12f. Q44 Q45
      Q46   Q47   Q48   Q49   Q50 Q51     Q52   Q53
         Q54      Q55   Q56   Q57   Q58   Q59   Q60   Q61
      Q62   Q63   Q64   Q65   Q66   Q67   Q68   Q69   Q70
      Q71   Q72   Q73   Q74   Q75   Q76   Q77   Q78   Q79
      Q80 Q81 Q4481fg.

         Q2_1 Q2_1f. Q6_1     Q6_1f. Q7_1 Q7_1f. Q10_1 Q10_1f.
      Q11_1 Q11_1f.     ;
run;
proc means data=COMP_SCI_ELEARNING_DATA_2017A maxdec=2 n mean
median std qrange clm min max;
   var  Q3 ;
   by Q4;
   format  Q4     Q4f.;
run;
```

```
proc univariate data=COMP_SCI_ELEARNING_DATA_2017A  plot
normal;
   var Q3 ;
   by Q4;
   format  Q4     Q4f.;
run;
Proc npar1way data=COMP_SCI_ELEARNING_DATA_2017A wilcoxon;
var Q3;
Class Q4;
format  Q4 Q4f.;
run;
```

Appendix G

SAS Output - Cronbach Coefficient Alpha for each set of items for all eight variables.

Perceived Usefulness (PU) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q44	0.889983	0.909309	0.889105	0.910029	Using Collaborative eLearning improves my performance
Q45	0.850419	0.922031	0.849236	0.922791	Using Collaborative eLearning would increase my productivity
Q46	0.822175	0.931365	0.822073	0.931346	Using Collaborative eLearning would enhance effectiveness on my learning
Q47	0.862820	0.918129	0.862394	0.918606	I find Collaborative eLearning useful in my learning

Perceived Ease of Use (PEOU) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q48	0.717825	0.847445	0.718303	0.848001	It is easy for me to become skilful in using Collaborative eLearning software/platform
Q49	0.785925	0.820152	0.786247	0.821034	I find Collaborative eLearning software/platform easy to use
Q50	0.770901	0.864840	0.771570	0.865991	I find it easy to do whatever activity I want to do on Collaborative eLearning software/platform
Q51	0.760887	0.830144	0.761843	0.830832	Learning to use the Collaborative eLearning software/platform is easy for me

Subjective Norm (SN) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q52	0.816119	0.820245	0.817619	0.821356	I intend to make use of Collaborative eLearning software/platform during my studies
Q53	0.812719	0.821176	0.819619	0.823867	I intend to use Collaborative eLearning software/platform frequently during my studies

Behavioural Intention to Use (BIU) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q54	0.722088	0.816420	0.723490	0.816952	My relative(s) think I should use a Collaborative eLearning software/platform
Q55	0.754367	0.849910	0.756049	0.848643	My friends believe I should use a Collaborative eLearning software/platform

Behavioural Intention to Use (BIU) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q56	0.839004	0.843147	0.779133	0.842336	My professors think I should use a Collaborative eLearning software/platform
Q57	0.642272	0.710725	0.638347	0.712056	My classmates at UWC will think I should use a Collaborative eLearning software/platform

Individualism/Collectivism (IC) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q58	0.707265	0.805885	0.704651	0.815028	It is preferable to have a man in high level position rather than a woman
Q59	0.729125	0.857740	0.724902	0.861819	There are some jobs in which a man can always do better than a woman
Q60	0.743555	0.765867	0.758343	0.771664	It is more important for men to have a career than it is for women to have a career
Q61	0.739160	0.769585	0.746923	0.774996	Solving organisational problems require the active forcible approach which is typical of men
Q62	0.779629	0.786453	0.786403	0.792357	Women do not value recognition and promotion in their work as much as men do

Masculinity/Femininity (M/F) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q63	0.718990	0.760694	0.716207	0.760939	Being accepted as a member of a group is more important than having autonomy and independence
Q64	0.737888	0.744534	0.710966	0.723931	Being accepted as a member of a group is more important than being independent
Q65	0.750492	0.692230	0.753324	0.790626	Group success is more important than individual success
Q66	0.743586	0.823052	0.750527	0.818733	Being loyal to a group is more important than individual gain
Q67	0.731452	0.826905	0.732017	0.823653	Individual rewards are not as important as group welfare
Q68	0.798588	0.858156	0.799919	0.857542	It is important for Individuals in top management to encourage loyalty than to encourage individual initiative

Uncertainty Avoidance (UA) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q69	0.774505	0.899796	0.727469	0.883223	Individuals in top management should make most decisions without consulting subordinates

Uncertainty Avoidance (UA) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q70	0.726232	0.872002	0.787384	0.853834	Individuals in top management should not ask subordinates for advice, because they might appear less powerful
Q71	0.713849	0.771361	0.642069	0.762353	Decision making power should stay with top management and not be delegated to lower level employees
Q72	0.552104	0.785375	0.591636	0.771655	Students/Employees should not question their professor's/ manager decisions
Q73	0.723683	0.794161	0.528989	0.782953	Individuals in top management should perform work which is important and delegate lesser tasks to subordinates
Q74	0.771823	0.826422	0.773175	0.826213	Higher level managers should receive more benefits and privileges than lower level managers and professional staff
Q75	0.720266	0.790731	0.751271	0.778967	Individuals in top management should be careful not to ask the opinions of subordinates too frequently

Power Distance (PD) Cronbach Coefficient Alpha with Deleted Variable					
Deleted Variable	Raw Variables		Standardised Variables		Label
	Correlation with Total	Alpha	Correlation with Total	Alpha	
Q76	0.819162	0.876866	0.812442	0.806514	Rules and regulations are important because they inform students what the organisation (i.e. UWC) expects of them
Q77	0.826239	0.834325	0.839642	0.868740	Order and structure are very important in an academic (work) environment
Q78	0.808519	0.840312	0.822437	0.874935	It is important to have instructions for learning activities given in details
Q79	0.835037	0.806110	0.839322	0.837761	It is better to have a bad situation that you know about, than an uncertain situation which might be better
Q80	0.854075	0.833904	0.858925	0.863600	Providing opportunities to be innovative are more important than requiring standardised work procedure
Q81	0.848011	0.851199	0.847095	0.849541	People should avoid making changes because things could get worse