



Instructor Approaches to Uptake and Sustain the Use of Emerging Technologies for Education

A thesis submitted in fulfilment of the requirements for the degree of Masters of Business
(Business Information Systems)

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June 2016

Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Anabianca Ananiev

June 2016

Acknowledgements

Firstly, I would like to thank my father, an inventor himself, for inspiring me to set my aims high and follow my chosen path. Thanks are also due to my mother, for always providing encouragement whenever I encountered difficulties. Lastly, but by no means least, a special thank you to my grandmother (who recently passed away) for instilling the thirst for learning in all our family.

Many thanks are due to Joan Richardson, my senior supervisor, for starting me on this journey and keeping me on track. I could not have done it without you. Thank you, Ian for taking the time to help me even when your time was short. To my research participants thank you for giving me your time. Thanks are due to Bradley Smith, the professional editor who provided proofreading and copyediting services, according to the guidelines laid out in the university-endorsed national 'Guidelines for editing research theses'.

My children, Chaska, Aiyana and Dyani I hope I inspired you to follow through with life's little or big challenges in everything you do and thank you for putting up with me when I was not a patient mother.

Illiya, my husband, how can I find words to thank you for getting me to start this journey, for silently supporting me all the way? I am even thanking you for not attending my review seminars because you knew that was the best for me.

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Glossary of Terms and Abbreviations

ALTC	Australian Learning and Teaching Council
Affordance	An affordance allows the users of a system to perform an action
API	Application Programming Interface
BML	Blackboard Mobile Learn
CSCL	Computer-Supported Collaborative Learning Area of learning sciences focused on how people can learn collaboratively using computers
CES	Course Evaluation Survey Student feedback delivered at the end of each semester
Constraint	Unlike affordances, a constraint limits what the users of a system can do
Convention	A convention is a constraint which allows some activities whilst prohibiting others
DOI	Diffusion of Innovation A theory which attempts to reason the spread of innovation spread through the use of technology
DSR	Design Science Research

A research method used to create innovative artefacts aimed at solving problems or producing improvements to current practices

ECM	Expectation-Confirmation model
	A model which attempts to correlate the post-adoption satisfaction with the expectations and perceived performance of technology
ETE	Emerging Technology for Education
	New technologies (but not necessarily) which will substantially change the educational environment
Gmail	Email system provided by Google
Grade Centre	A section of Blackboard Learn which allows for storage of students' marks, as results of test, surveys, assessments, as well as manually entered
HCI	Human Computer Interaction
	Area of study on how people interact with computers and the extent to which computers are developed for successful human interaction
Horizon project	An NMC initiative to chart emerging educational technologies to enable educators to build upon the innovations that happens at their institutions
Hotspot	An area on a computer screen that can be clicked to activate some functionality
ICT	Information and Communication Technology
Instructor	Teaching staff

IRC	Internet Relay Chat
IT	Information Technology The study or use of computers and telecommunications systems used for storing, processing and exchanging of electronic data
IS	Information System A collection of technical (hardware and/or software) resources that provides the storage, processing and distribution of information
ISS (model)	Information System Success model Also called the D&M model, is a theoretical model created to determine an IS implementation's success
ISO	International Organization for Standardization
MCQ	Multiple-choice question/s
NMC	News Media Consortium
Non-technocrat	The opposite of a technocrat
OH&S	Occupational Health & Safety
OLT	Office for Learning and Teaching
PDA	Personal Digital Assistant
Signifier	Represents the perceivable component of an affordance

Skype	Application that provides different communication tools: exchange of digital documents (images, text, video), voice call services and video chat
SMS	Short-Message Service
SQL	Structured Query Language
Stakeholder	A constituency of an organisation
TAM	Technology Acceptance Model A model to predict determinants of potential technology adoption
Taxonomy	A branch of science concerned with classification; a scheme of classification
Technocrat	A technical expert
TOP	Technology, Organisation and People framework
TPB	Theory of Planned Behaviour (model) A psychological theory which links beliefs and behaviour
TTF	Task-Technology Fit A theory which reasons that technology needs to be accepted willingly and to fit well with the task for which it is used
Turnitin	An electronic text matching system, which compares the text in students' assignment against a large database of various sources; it is used as a plagiarism checking tool
USB	Universal Serial Bus

UML Unified Modelling Language

VLE Virtual Learning Environment

Web A hypertext system that operates over the internet

Abstract

Emerging Technologies for Education (ETEs) have been defined by Veletsianos (2010) as “tools, innovations, and advancements utilized in diverse educational settings ... to serve varied education-related purposes”. As noted by Veletsianos (2010), “ETEs satisfy the ‘not yet’ criteria. ... [they] are not yet fully understood. ... [and] are not yet fully researched”.

The present research project attempts to address this challenge by conducting case-study research into the perspectives and behaviours of instructors, identified as relevant stakeholders within the tertiary education sector. The case studies examine instructors’ approaches when taking decisions to uptake and sustain use of a selection of learning ETEs.

Data collection was undertaken, through semi-structured interviews with case-study respondents, about the broad features of different ETEs, with the concept of perceived affordance facilitating the discussion. System acceptability theory and other Human-Computer Interaction (HCI) concepts underpin the design of the data collection instruments. Interpretation of data collected interrogates decisions to uptake and sustain use of ETEs. This research investigates beyond any particular technology and its specific features, as it looks at a number of technologies through their affordances. Data collected in the course of a case-study, at a major Australian university, is viewed through a design science lens. The interpretation of the collected data allows understanding of the processes employed by instructors, when deciding whether (or not) to uptake and sustain the use of an ETE.

The insights developed may inform future technology providers developing ETEs, increasing the likelihood of positive uptake and sustained use. As a result, instructors may improve the decision to uptake and sustain the use of an ETE via an appreciation of the perspectives and behaviours that impact on technology choices.

Chapter 1 Introduction

1.1 Background

Education can be characterised as an evolving open system for giving and receiving instructions to meet vocational, social and/or organisational goals, while seeking to address the competing requirements of multiple cohorts: students, instructors (teaching staff), educational institutions, content providers, technology providers, accreditation bodies, employers, etc. (Musiał 2010; Wagner, Hassanein & Head 2008). What is clear is that the education environment is evolving, and that it includes multiple stakeholder cohorts who might hold competing perspectives and perceive outcomes differently, when employing emerging educational technologies.

Information Technology (IT) is deeply embedded in any system of present and future learning, both supporting and enhancing students' present learning experience, and equipping them with future workplace technology expertise that they will require following graduation (Keppell, Suddaby & Hard 2011). The key users of IT within the education environment are students and instructors (including the key administrators and policy-makers in educational institutions who are charged with making institution-wide IT choices), and the content and technology providers who must design and deliver IT that will support the delivery of educational content to students.

Emerging technologies for education (ETEs) have been defined (Veletsianos 2010, pp. 12-3) as “tools, concepts, innovations, and advancements utilized in diverse educational settings (including distance, face-to-face, and hybrid forms of education) to serve varied education-related purposes” (e.g.

vocational, social, and organisational goals). These technologies can be defined and understood within the framework of the following five features (Veletsianos 2010):

- ETEs can be new technologies (but not necessarily);
- ETEs are evolving organisms that exist in a state of ‘coming into being’;
- ETEs go through hype cycles: according to the literature, technologies go through five hype stages of the Hype Cycle model developed by Gartner Inc.: “Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment, and Plateau of Productivity” (Veletsianos 2010, p. 15);
- ETEs satisfy the ‘not yet’ criteria: “... ETEs are not yet fully understood. ... ETEs are not yet fully researched or researched in a mature way” (Veletsianos 2010, p. 15);
- ETEs are “potentially disruptive but their potential is mostly unfulfilled” (Veletsianos 2010, p. 16).

The “diverse educational settings” (Veletsianos 2010, p. 12) highlighted above are populated by diverse, multiple stakeholder cohorts (students, instructors, educational institutions, content providers, technology providers, accreditation bodies and employers) (González-Martínez et al. 2015; Musiał 2010; Wagner, Hassanein & Head 2008), operating in various and sometimes competing primary, secondary and tertiary education sectors.

The research reported herein aims to take up the challenge put by Veletsianos (2010), seeking to contribute to building an understanding of stakeholder approaches to uptake and sustained use of ETEs, by conducting case study research into the perspectives and behaviours of relevant

stakeholders. The research focuses on instructors' uptake and sustained use of ETEs, within the tertiary education sector. Due to the dual nature of the Australian tertiary education system, with its higher education section and its vocational education component, there is a need to state that this research will encompass the higher education area only. The participants were all instructors in the higher education area of a large metropolitan dual sector institution. To further define the boundaries of this research, the study will evaluate a number of information technology, not technology in general (Orlikowski & Iacono 2006). The point made will be used when considering further research perhaps in the form of a PhD. Various contexts, technologies and stakeholder groups will expand on the capacity to build a sustained uptake model for ETEs.

An ETE would be deemed by at least one (possibly all) of the relevant stakeholder cohorts to have 'failed' if either it was not taken up on a trial basis or, if trialled, its use was not sustained and integrated into the ongoing educational practices of the stakeholder. The literature highlights a number of such 'failed' ETEs in higher education, mainly due to human factors rather than technological issues (Phillips 2007), although that literature does not report mature research that identifies reasons for such outcomes.

1.2 Research Motivation

In many cases the excitement at opportunities that seem to be offered by ETEs to deliver an educational curriculum needs to be moderated by the fact that such technologies have not been developed necessarily for education, and therefore they have to be adapted to the teaching and learning environment. However, when ETEs are trialled but not sustained for a longer time, the result can be the waste of time, money and resources.

Emerging technologies for teaching, learning, research and creative inquiry are the focus of the NMC's (News Media Consortium) Horizon Project. Launched in 2002, the Horizon Project epitomizes the mission of NMC, which is to help instructors and thought leaders across the world to build upon the innovation happening at their institutions by providing them with expert research and analysis. A report is published yearly, which follows six technologies, six challenges and six trends, in three educational environments: K-12, Higher Education and Museum.

As mentioned previously, emerging technologies for education “satisfy the ‘not yet’ criteria. ... ETEs are not yet fully understood. ... [and] ETEs are not yet fully researched” (Veletsianos 2010, p. 15). ETE research clearly offers many possibilities.

Recent developments in Information System (IS) technology have greatly informed and continue to influence the delivery of educational material and assessment: in increasing computer speed and much expanded memory capacity, online communication and delivery, cloud computing technology, and virtual machines. For example, vast amounts of data are now routinely trawled, checking for plagiarism. Furthermore, design paradigms, especially emphatic design and to some extent UML (Unified Modelling Language), have been much more focused on the user's experience in interaction with the IS interface. Thus, for example, the ubiquitous use of smartphones with intuitive interfaces requiring essentially no training attests to the strengths of modern design approaches, namely intuitive interfaces driving natural interaction.

To further motivate, the focus of the planned research, the notion of human-computer interaction is introduced. “Human-computer interaction (HCI) is a discipline concerned with the design, evaluation and implementation of

interactive computing systems for human use, and with the study of major phenomena surrounding them” (Hewett et al. 1992, p. 5). HCI focuses on interaction between one or more human beings and one or more computers. Whilst there has been some research into emerging technologies used in the educational environment from a HCI perspective, this has primarily focussed on some very specific aspects of HCI and their application to the use of a particular technology. In the present research, it is intended to explore the wider dimensions of HCI, investigate a range of technologies, and take a wider view of ETE applications; and to seek a more general theory from this analysis.

Continuous developments in IS and design, the knowledge domains delivered via educational programmes, and the technologies that might be employed to support their delivery, cause ongoing change. It may well be that changes in the knowledge domain and technologies have so substantially affected practice that research conducted more than two or three years ago has ceased to accurately reflect the present situation (Voogt et al. 2013).

One perspective on the decision to uptake and sustain ETEs is based on the usability of the technologies. If different cohorts do not perceive the technology to be easy to use, because the affordances of such technologies are difficult to use or invisible, the impact on end-users might be a negative attitude towards the technology and, ultimately, the non-adoption or rejection of the ETE.

The present research study looks at a major Australian university through multiple case studies. Instructors are the relevant stakeholders; and the research investigates instructors’ decision-making related to uptake and sustained use of emerging educational technologies. The relationship

between the changes to the context and the decision of stakeholders to uptake and sustain the use of emerging technologies for education have been investigated. The research seeks, to further understand the contemporary constantly changing emerging technology uptake context.

1.3 Research Question

The research seeks to answer the following research question:

What are the contextual and behavioural factors that influence the approaches of instructor cohorts, surrounding the decision to uptake and sustain the use of emerging educational technologies?

To apply an all-inclusive approach, consideration needs to be given to technological, organisational and human aspects together, as they all have a significant impact on the successful uptake and sustained use of ETEs. The research question will be broken down into the following sub-questions:

- How have the instructors approached their decisions to uptake and sustain the use of technologies to support the delivery of the target educational programs?
- From a design science viewpoint, what are the organisational, technological and human constraints / barriers to full, ongoing utilization of such technologies; and
- How might the experiences documented in the case studies inform a model to support instructors' uptake and sustained use of ETEs?

1.4 Research Method

The objective of this research study is to investigate instructors' approaches in regard to the decision-making process related to the uptake and the

sustained use of ETEs. The research was conducted by interviewing instructors, using a range of ETEs in multiple case studies.

The contextual and behavioural factors influencing instructors' decisions to uptake and sustain the use of ETEs, and in particular the types of research outcomes that are being sought, require an approach that offers the prospect of rich understandings. To investigate the research question that has been posed, rich data (Eisenhardt, KM & Graebner 2007) was gathered, that supports reflection on the decision drivers and the processes and behaviours of instructors when deciding to uptake and sustain the use of ETEs. A case study approach for data collected from multiple instructors a major Australian university in Melbourne has been used as the vehicle for this research.

The participants in this project are a number of instructors at a major university in Melbourne, and their selection has been based on their involvement as stakeholders with one or more technologies within core undergraduate courses at the university. The technologies under study are software application used at the university and each one is described in Table 1-1.

Technology	Description
Blackboard Learn	The Blackboard Learn application is a virtual learning environment and course management system developed by Blackboard Inc. It is a Web-based server software which features course management, customizable open architecture, and scalable design that allows integration with student information systems and authentication protocols. It may be installed on local servers or hosted by Blackboard ASP

	Solutions. Its main purposes are to add online elements to courses traditionally delivered face-to-face, and to develop completely online courses with few or no face-to-face meetings. (<i>Blackboard website</i>).
Google Apps	Google Apps is a service from Google that provides independently customizable versions of several Google products. It features several Web applications with similar functionality to traditional office suites, including Gmail, Hangouts, Google Calendar, Drive, Docs, Sheets, Slides, Groups, News, Play, Sites, and Vault (<i>Google Apps website</i>).
Facebook	Facebook is social networking system where users may create a personal profile, add other users as friends, exchange messages, post status updates and photos, and receive notifications when others update their profiles. Additionally, users may join common-interest user groups, organized by workplace, school or college, or other characteristics, and categorize their contacts into lists. It allows for file upload and exchange (<i>Facebook Inc</i>).

Table 1-1: Technology descriptions

This project employs a single-method data collection strategy, principally via semi-structured interviews. The data collection instrument design is underpinned by the concept of perceived affordance (Gibson 1977; Norman 2007).

Qualitative analysis of the collected data is informed by aspects of system acceptability theory (Nielsen 1993, 2012). Consistent with a design science lens, identification of the organisational, technological and human aspects surrounding decisions to uptake and possibly sustain the use of ETEs when

delivering educational curricula is reported (Hevner et al. 2004; Iivari & Venable 2009; Peffers et al. 2008; Venable 2006a). As the data was captured, the data analysis approach was refined, drawing upon one or more of the following methods: thematic analysis, narrative analysis and/or analytic induction.

The type of research question posed and the fact that the analysis is of interpretative nature point toward the need for interpretative rather than normative data analysis (Cohen & Manion 1995). The data interpretation stage applied a Design Science lens in order to identify the organisational, technological and human barriers or enabling factors surrounding decisions to trial and sustain the use of ETEs. The education environment is a complex open system, and interpretative data analysis may bring new insights and illuminate new aspects (Cohen & Manion 1995).

1.5 Anticipated Research Significance

1.5.1 Significance to Theory

At the end of the study, several aspects are analysed, and a model generated in regard to improved uptake, sustained use and productivity of emerging technologies used to deliver educational programmes (Iivari & Venable 2009). In order to see the big picture, the constraints need to be investigated: in terms of the organizational, technological and human aspects of the situation.

1.5.2 Significance to Practice

In addition to adding knowledge to theory by recognizing the organisational, technological and human factors that contribute to the uptake and sustained use of ETEs, the research endeavours to deliver improvements to the

process of the uptake and sustained use of ETEs. The study presents an attempt to use the data collected and documented from the case studies, and through the application of the design science research framework, to produce a model artefact (Venable 2006b). Out of this research, it is anticipated that a strategy could evolve to avoid or at least minimize the impact of barriers to the uptake and fulfilled use of emergent technologies in delivering educational curricula.

1.6 Structure of the Thesis

The present research comprises of five chapters, outlined below:

Chapter 1 (Introduction) First chapter provides the background to the research study, research motivation, research question, and significance of this research to theory and practice. This chapter concludes with an outline of the chapters for the thesis.

Chapter 2 (Literature Review) This chapter covers the following concepts: design science, affordance theory, system acceptability theory and other human-computer interaction (HCI) concepts. The literature review chapter is the basis of this research, by looking at previously developed models and theories (TAM (Davis 1989), DOI (Rogers 1983), TTF (Goodhue & Thompson 1995), ISS model (DeLone & McLean 2003)). The literature review chapter also compares different other theories and justifies the choice of the selected theories to underpin this research design.

Finally, the chapter looks at the uptake of ETEs in recent times, by looking at technologies which experienced success or failure in both uptake and sustained use.

Chapter 3 (Research Method) This chapter looks at the research process and methodology used in the study in the context of the research question. The data collection, data analysis and interpretation approach are presented and reasoned.

Chapter 4 (Data Collection and Analysis) This chapter presents data collection methods employed and their results. The analysis of the collected data is then used for the model generated in the discussion section of the chapter.

The discussion provides arguments to facilitate the answering of the research question.

Chapter 6 (Conclusions) The final chapter presents the conclusions of the analysis relating to the research question, with benefits and critiques of the research. It also highlights possible further directions of research to extend this study.

1.7 Chapter Summary

The introduction chapter sets up the background of this research, as well as the aim of the study, and articulates the research question: what are the contextual and behavioural factors which influence the approaches of instructor cohorts surrounding the decision to uptake and sustain the use of emerging educational technologies? The research question is then

decomposed into a number of sub-questions needed to provide a holistic answer to the research issue. The quest of this study is to identify the contextual and behavioural factors influencing instructors' decisions to uptake and sustain the use of ETEs. In order to answer the research question, instructors' approaches to their decisions have been explored, and identification of technological, organisational and human barriers to the successful uptake and sustained use of ETEs were pursued.

The research method proposed is a case-study approach, with participants being instructors at a major university in Melbourne (Benbasat, Goldstein & Mead 1987; Eisenhardt, K 1989; Yin 2003). The data collection phase used a semi-structured interview with the case-study participants, about a number of features of different ETEs, with the concept of perceived affordance facilitating the discussion (Gibson 1977; Norman 1988, 2007). The analysis of the collected data was informed by system acceptability theory (Nielsen 1993, 2012), and the data interpretation stage applied a design science lens to identify the technological, organisational and human factor acting as enablers or barriers to the successful uptake and sustained use of emerging educational technologies (Hevner et al. 2004; Iivari & Venable 2009; Peffers et al. 2008; Venable 2006a).

The anticipated research significance, to both theory and practice, was enunciated, before the structure of the thesis was detailed.

Chapter 2 Literature Review

2.1 Introduction

This chapter covers literature reviewed in various areas, including but not limited to theories that underpin this research. A number of theories and research models are briefly described, and combined in order to better explain the choice of method used in this research.

This chapter is structured as follows:

- Concepts and definitions of key terms used in the research;
- Research models and theories related to this research method, and background theories of the method;
- Research gap, highlighting the paucity of research analysing uptake and sustained use at the level of affordance rather than technology application;
- Presentation of theories and models directly pertaining to the research topic, such as technology acceptance model (Davis 1989; Venkatesh et al. 2003), diffusion of innovation (Rogers 1983, 2003), task-technology fit (Goodhue 1995) and information system success model (DeLone & McLean 1992). These theories and models have been analysed in terms of their benefits and weaknesses in regard to their suitability for this research;
- Affordance (Gibson 1977) and system acceptability theories (Nielsen 1993, 2012), as well as design science research (Hevner et al. 2004; Iivari & Venable 2009), and their application to inform the understanding of uptake and sustained use of emerging technologies for education, have been investigated. Sustained use

of emerging technologies for education is defined in terms of embedding them in individual work practice and organisational culture; and

- Research conducted to date related to ETE uptake in recent years.

The literature review chapter provides a review of a number of possible theories and models in order to support the background necessary for answering the research question and sub-questions.

2.2 Concepts and Definitions

To situate this research, some essential concepts have been outlined and key terms defined, and their relevance to individual and organisational uptake of ETEs have be highlighted. In addition to describing current uptake of ETEs, the research examines whether the affordances are integrated into ongoing work practices over time.

Education has been defined as an evolving open system (Wagner, Hassanein & Head 2008) with the role of providing and receiving instruction to meet various goals (vocational, social and/or organisational). The education system is seeking to address the competing requirements of multiple stakeholder cohorts, which Wagner, Hassanein and Head (2008) list as: students, instructors/teaching staff, educational institutions, content providers, technology providers, accreditation bodies, and employers. Although uptake and sustained use of ETEs is critical to all listed stakeholders, the researcher in the present study has a focus on instructors (teaching staff).

Thompson and Strickland (2001) define a stakeholder in any organisational context as a constituency of the organization. The stakeholder concept has been introduced in business science literature

by Freeman (1984, p. 16; 2010) who defines a stakeholder as “any group or individual who can affect or is affected by the achievement of the firm’s objectives”. Flak and Rose (2005) argue that IT infrastructure impacts on the relationship between stakeholders, the organisation and the technology. Wagner, Hassanein and Head (2008) broaden that definition to include all who are affected by e-learning as stakeholders. They also compile a list of stakeholder cohorts (Wagner, Hassanein & Head 2008, pp. 28-32). Each stakeholder group is described in relation to their use of learning resources delivered by technologies. Stakeholder motivation to use technology to support the learning experience for students, as well as barriers to ETE uptake, are discussed. For the purpose of the current study, we propose to focus on arguably the most central of these stakeholders, the instructors.

Information Technology (IT) has been deeply entrenched in any system of present and future learning. IT has the dual role of supporting and enhancing students’ present learning experience, as well as preparing students for future workplace technologies that they will need to use subsequent to their graduation (Keppell, Suddaby & Hard 2011; Watson & Tinsley 2013).

A subset of information technologies is Emerging Technologies for Education (ETEs), which have been defined by Veletsianos (2010) as tools and improvements utilized in various educational settings to achieve education-related purposes, which satisfy the ‘not yet’ criteria (“... ETEs are not yet fully understood. ...[and] ETEs are not yet fully researched or researched in a mature way” Veletsianos 2010, p. 15).

A technocrat is a technical expert, as defined by Merriam-Webster (1982), as opposed to a non-technocrat who is not a technical expert. The

relevance of both technocrat and non-technocrat terms is in relation to the participants of this research. The participants' technical expertise could possibly influence the trialled and sustained use of emerging technologies.

2.3 Research Conducted to Date

A number of models widely used when researching information systems are here investigated. The applicability of each theory to underpin the research method, is addressed. These models are:

- Technology Acceptance Model (Davis 1989; Venkatesh et al. 2003);
- Diffusion of Innovation (Rogers 1983, 2003);
- Task-Technology Fit (Goodhue 1995); and
- Information System Success model (DeLone & McLean 1992).

The literature for each of these models is explained briefly below. The description focuses particularly on the ability of the model or theory to identify the contextual and behavioural factors that influence the instructors' approaches to the uptake and sustained use of emerging technologies for education.

2.3.1 Technology Acceptance Model (TAM)

A significant stream of ETE research has used the Technology Adoption Model (TAM) to predict determinants for potential ETE adoption (Grosch 2011). TAM focuses on an individual or typical 'user' of a computer. Perceived 'usefulness' and 'ease of use' require that a number of factors are interrogated to explain how a user 'perceives' said 'usefulness' and 'ease of use'. Analysis of the user perceptions of 'usefulness' and 'ease of use' in a particular context enable predictions of emerging technology

adoptions, which then could be used to guide resource allocation in an organisation. TAM usually employs a quantitative approach, mainly through the use of the statistical analysis of data obtained from a questionnaire instrument (Davis 1989; Venkatesh 2000).

The Technology Acceptance Model has been one of the most extensively used models to gauge technology adoption potential within information system research (Fisher 2010; Huang, Rauch & Liaw 2010; Peffers et al. 2008; Wang, Xia & Fang 2007). TAM is considered to be simple and trustworthy as a model for predicting stakeholder's acceptance or adoption of technology (Venkatesh, Davis & Morris 2007).

The Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003) is an extension of TAM, which proposes four determinants be used to guide predictive analysis of the acceptance of technology. The four determinants are: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). Venkatesh et al. (2003) propose an extended new research model for determining emerging technologies' potential for adoption, where the four named determinants are influenced by four key moderators: gender, age, experience, and voluntariness of use (Venkatesh et al. 2003, p. 447).

The widely employed TAM and extended TAM research approaches have been criticised for not recognizing the important social processes and consequences of information system (IS) development, implementation and use (Bagozzi 2007). Another critique of TAM is that, while it is excellent at predicting the intention to use an information system, its capability for predicting the actual use is much weaker (Dishaw & Strong 1999). In the present research, it is intended to collect richer qualitative

data, of the type not typically collected in TAM-based studies. The present study thus yields a deeper appreciation of decision-making determinants for uptake and continuing use of an ETE. The organisational processes and individual instructor behaviours surrounding the decision to adopt and use an ETE were examined.

2.3.2 Diffusion of Innovation (DOI)

Diffusion of Innovation (DOI) is another stream of research that has been used as a theory to underpin studies that explain the reasons for innovation spread through the use of technology (Rogers 1983, 2003). DOI theory uses five determinants to assess the potential for adoption of technology: relative advantage, complexity, compatibility, trialling, and observation (Rogers 1983, 2003). The theory describes an S-shaped curve (Allaby 1999) for the increased number of adopters over time, defined as cumulative adopters, but a bell-shaped curve (*Distribution, Normal* 2008) for their distribution. The adopters of technology can be grouped into five categories: innovators, early adopters, early majority, late majority, and laggards; as depicted in Figure 2-1 (adapted from Rogers 1983, p. 247). Laggards was a term used by Rogers (1983, 2003); and it was later replaced by the term “Luddite” or “neo-Luddite”, used by Postman (2004, p. 6) to refer to a group of users who reject and refuse to use technology.

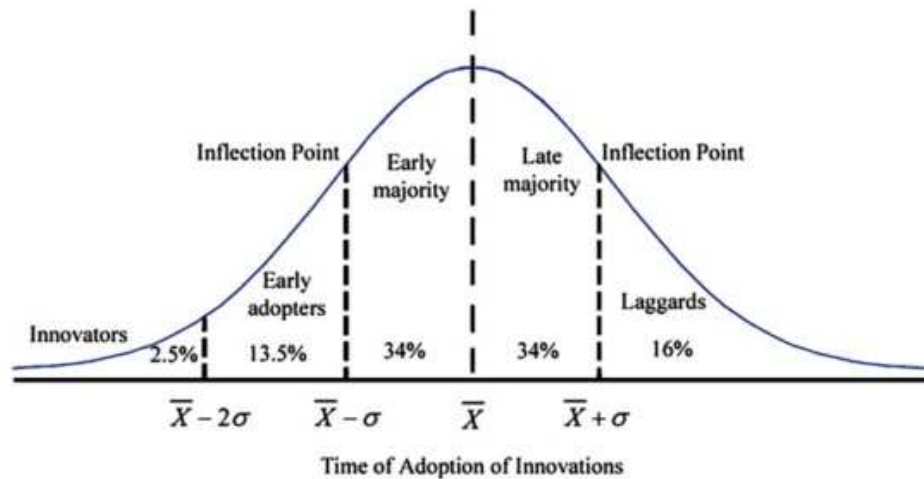


Figure 2-1- Adopter categories

The DOI theory has been used widely and quite successfully in regard to predicting the adoption of various information systems. Studies using DOI theory employ both a quantitative and/or a mixed methods approach to research design.

According to Elgort (2005), in order for technology to be effective when used as an educational and technological innovation to assist learning, traditional learning paradigms need to be re-thought. The requisite changes to learning environments needed to effectively use ETEs are important with reference to the roles of instructors and students, and interactions between the stakeholders. In order for technology to achieve its full potential, effective environments that assist learning need to be created, where the instructors need to precisely define their objectives and beliefs (Elgort 2005).

The major limitation of the DOI theory, which deems it unsuitable for use in this study, is its exclusive focus on both organisational and human social aspects of technology adoption (Newell, Swan & Galliers 2000). DOI fails to consider the influence of the technology itself on adoption (Drury & Farhoomand 1996).

2.3.3 Task-Technology Fit (TTF)

Task-Technology Fit (TTF), as defined by Goodhue (1995), is a “user evaluation construct” (Goodhue 1995, p. 1827), which “focuses on the degree to which systems match user task needs” (Goodhue 1995, p. 1827). Goodhue and Thompson (1995) proposed a TTF model to evaluate technology use, consisting of the following four constructs:

- Task characteristics;
- Technology characteristics;
- Utilisation; and
- Performance.

The ‘task’ and ‘technology’ characteristics impact on the ‘utilisation’ and ‘performance’ characteristics.

More recent research involves integrating the TTF model and other models, such as the Technology Acceptance Model (TAM), to explain the link between software utilisation and user performance (Chang 2008; Dishaw & Strong 1999; Hsin Chang 2010; Yen et al. 2010).

One of the main shortcomings of the TTF model is that it focuses on the appropriateness of the technology relative to the task (Dishaw & Strong 1999), and does not consider the direct interaction between the user and technology; nor are organisational variables considered. Boontaree, Ngwenyama and Osei-Bryson (2006) affirm that TTF does not have the power to separate the characteristics of information systems that lead to a higher level of user performance. The TTF model is not adequate to explain the success or user satisfaction of any information system (Despont-Gros, Mueller & Lovis 2005).

The TTF model is unsuitable for the present study, because it focuses only on the relevance of technology. The model does not consider all three aspects, technological, organisational, and human, which are all needed to properly analyse the research question of this thesis.

2.3.4 Information System Success Model

DeLone and McLean (1992) created the Information System Success model, also known as the D&M (DeLone & McLean) model, built from a review of the academic literature describing empirical studies from 1981 to 1987. The focus of their research was to provide a cohesive view for the concept of IS success. The D&M model deems that there is not one but six major factors that influence the IS success: system quality, information quality, use, user satisfaction, individual impact, and organisational impact (DeLone & McLean 1992). Based on these categories, a total of 180 studies are reviewed, and many aspects of IS success are distilled into a descriptive model that analyses both the categories and the interactions amongst them to determine the IS success. The D&M model has never been empirically tested by the creators of the model (Sabherwal, Jeyaraj & Chowa 2006). However, many studies have attempted to test the model (Iivari 2005; Rai, Lang & Welker 2002), and even to improve the D&M model (Sabherwal, Jeyaraj & Chowa 2006). For example, the study by Iivari (2005), which tests the D&M model, shows that the perceived system quality, as well as the perceived information quality, are good predictors for the user satisfaction but not for the use of the system. The use of the system can be predicted by the perceived system quality of an IS. Overall, the model is validated by the empirical tests (Rai, Lang & Welker 2002; Sabherwal, Jeyaraj & Chowa 2006); but the study by Iivari (2005) raises uncertainties

about the D&M model and its causal explanatory abilities, as the model is able to predict the user satisfaction rather than actual use of the system.

A decade after the introduction of the D&M model, DeLone and McLean (2003) reviewed and updated their model after another literature review study of more than 100 articles of empirical concepts derived from the original model. The improved model removes individual and organisational impacts and replaces them with service quality. The net benefits to uptake of ETEs is presented as new interdependent categories used to measure IS success.

Seddon (1997) argued that the complexity of the D&M model created confusion, as the model endeavoured to combine the process and the causal explanation for IS success in terms of technology uptake. The importance of Seddon's study needs to be highlighted, as it differentiates between the expected impact predicted by the D&M model and actual impact of technology.

2.4 Research Opportunity

Previous researchers have investigated emerging technology adoption, diffusion, 'fit-for-purpose', system-technology alignment, and success, using the models/theories listed in Table 2-1. Each model/theory use has its limitation, and its inadequacy for use in the present study is highlighted in the problem/s column in Table 2-1.

Research has used a single theory or a combination of theories to underpin the research design. For example, TAM has been used in conjunction with the theory of planned behaviour (TPB) and the expectation–confirmation model (ECM), to explain and predict the users' intent for continued e-learning use (Lee 2010). This approach would not

be suitable for the present study as it focuses on predicting user intent to use, not on the actual use.

Reviewed studies have focussed on understanding ETEs use with a particular focus on technology. The opportunity for further study was addressed, as the present research focuses on similar affordances in a number of representative emerging technologies for education.

Furthermore, it should be noted that the challenges being faced by tertiary institutions in Australia, wrestling with ETE choices, have motivated the Office for Learning and Teaching (OLT) to commission projects looking into technology enabled learning (OLT - 2013 Commissioned Projects). The focus of these projects has been on: curriculum; pedagogies and their adaptation to fit the new technology enriched classrooms; e-Portfolio use; student retention and online education; but not necessarily in the direction of sustained use of emerging technologies (OLT - 2013 Commissioned Projects).

Apart from emerging technologies for education being worthy of research, recent studies have discussed important areas for future study, as follows:

- Benefits, such as enhanced learning, problem-solving aid and enabled creativity, that increased technological options can offer are highlighted; but there are still “... barriers to the successful integration and usage of emerging educational technology within educational environments ...” (Ball & Levy 2008, p. 433). These barriers require further research.

Theory	Example of use	Advantages	Disadvantages
TAM	Fisher (2010); Huang, Rauch and Liaw (2010); Peffers et al. (2008); Wang, Xia and Fang (2007)	Adoption of technology can be predicted based on users' perception of the usefulness and the ease of technology use.	Capacity for predicting the actual use of technology is much weaker.
DOI	Dearing (2009); Doyle, Garrett and Currie (2014); Greenhalgh et al. (2008); Low, Chen and Wu (2011); Lozano (2010)	Explains the reasons for the spread of innovation through the technology use.	Focuses on organisational and human aspects of technology adoption, but does not consider the influence of the technology itself on its adoption.
(TTF)	Dishaw and Strong (1999); Hsin Chang (2010); Yen et al. (2010)	Focuses on the degree to which technology matches user task needs.	Focuses on the relevance of technology to the task to be done, but the model does not consider the organisational and human aspects.
D&M model	Iivari (2005); Rai, Lang and Welker (2002); Sabherwal, Jeyaraj and Chowa (2006)	The D&M model uses six factors influencing the IS success: system and information quality, actual system, organisational and individual impacts, and user satisfaction.	There is a difference between the impact predicted by the model and actual impact of technology.

Table 2-1: Summary of models used for research technology uptake

- “ ... ETs will be a key research area in education in the next 5 years. Some of the key themes likely to shape research include the following:
 - Assumptions and beliefs underpinning effective uses of ETs
 - Understanding institution-wide adoption and use of ETs in higher education ...” (Ng'Ambi & Bozalek 2013, p. 534).

Getting users to adopt emerging technology is challenging, as is understanding system implementation success and failure (Mendenhall & Johnson 2010, p. 274). In summary, the present research takes a rich qualitative approach to the investigation of the uptake and sustained use of ETEs. A case-study approach has been undertaken to explore the instructors' behaviours and perspectives concerning the taking of decisions to (or not to) uptake and sustain the use of ETEs. Design science informs the design of the research model, which supports the application of a wide selection of ideas from present affordance and system acceptability theories and HCI concepts to the interpretation of the data. An affordance is a capability of a system/ application which allows the users to perform an action.

2.5 Human-Computer Interaction Theories, Models and Concepts

The investigated theories are as follows:

- Human-computer interaction (HCI) concepts (Hewett et al. 1992; Kaptelinin & Nardi 2012) underpins the design of the semi-structured interviews used to collect data. HCI concepts allow the present research to explain what drives the interaction between

users and any system they are using, hence intrinsically considering human and technological factors, with the organisational aspects considered as well.

- Affordance theory (Gibson 1977; Norman 1988, 2008) brings the point of discussion to a more granular level. By discussing at the affordance rather than systems level, this study is able to investigate the use of aspects of a range of technologies rather than one particular technology.
- System acceptability theory (Nielsen 1993, 2012; Norman 2007; Shneiderman 1998) drives the data analysis stage, enabling identification of common themes to provide a deep analysis of the rich data collected.
- Design science research (Hevner et al. 2004; Iivari & Venable 2009; March & Smith 1995) provides a lens to identify technological, organisational and human factors that act as barriers to, or facilitating factors for, the uptake of emerging technologies for education.

2.5.1 Affordance Theory

The affordance concept was introduced by Gibson (1977), who described 'The Theory of Affordance' as the possibility of action between an actor (person or animal) and the world. Gibson (1977) saw affordances as relationships. Affordances do not have to be visible, known or desirable, but they are part of nature. Some affordances are yet to be discovered, some could be dangerous, and some could be useful; for example, water can afford drinking and swimming but also drowning (Kaptelinin & Nardi 2012).

The term affordance has been discussed in the design field by Norman (1988), and its meaning has been extended by distinguishing between affordances that are 'real' and 'perceived' (Norman 2007). A real affordance is, for example, that the mouse cannot be moved outside the screen, while a button on the screen allows the perception that clicking on a 'Cancel' button on the screen will result in the current action being cancelled. In design, it is arguably more important to understand what the user perceives than what is actually true. In product design, where we deal with real objects, there can be both real and perceived affordances, and they do not need to be the same. However, in screen-based interfaces, all that the designer has control over are the perceived affordances. Because any graphical object on the screen can be clicked any time, this means that it affords clicking; however, the real question is about perceived affordance: does the user perceive that clicking on that location is an action that is meaningful or useful?

Norman (2008) revised the concept of perceived affordance, arguing that, for an affordance to be useful for its purpose, there is a need for signifiers: "Any physically perceivable cue, whether it is incidental or deliberate" (Norman 2008, p. 18) represents a signifier. Norman (2008) states that a signifier represents the perceivable part of an affordance. If the designer of a system deliberately places a signifier on an interface, the signifier is seen as a social signifier. A scroll bar in a document, which indicates that you can scroll up and down the page and that what is displayed is not all that you can see, is an example of a social signifier. The scrollbar's position proportional to the content already displayed represents a social signifier for the reader, informing the reader what percentage of the document has been perused.

In order to deem affordances as useful for purpose, their feedback and perceived status, which are independent of each other and can be manipulated independently of one another, need to be understood. The dynamic interplay between affordance feedback and status is critical to the technology implementation design process (Norman 1999).

Affordances allow users to perform actions, and constraints limit what they can do. Therefore, we need to understand constraints as complementary to affordances. According to Norman (1999), constraints can be categorised as:

- Physical constraints limit the actions that the user can take. They are closely linked to real affordances;
- Logical constraints relate closely to natural mapping; which, when followed closely, will allow the user to logically deduce what are the next the required step(s);
- Cultural constraints depend comprehensively on the users' backgrounds.

A convention is defined by Norman (1999) as a constraint that prohibits some activities whilst encouraging others. Physical constraints cannot be ignored, as they make some actions impossible. On the other hand, logical and cultural constraints are weaker in the sense that they can be ignored or even violated. However, logical and cultural constraints are valuable aids for navigating the unknown and complexities that surround us. A logical constraint is, for example, asking the user to click on three locations when only two are immediately visible, but the user knows that there is one more location on the screen that they need to click because it makes sense. Another example of a logical constraint is the acknowledgement that a task, for instance an online registration process,

has been completed. Culturally, the cross at the top right corner of a window is for closing the window. “Conventions are not arbitrary: they evolve, they require a community of practice. They are slow to be adopted, and once adopted, slow to go away.” (Norman 1999, p. 41).

We should not confuse affordances with feedback and constraints. The difference between affordances, constraints, and the feedback provided by them, needs to be clear, as they have different functions (Norman 1999). An affordance allows the user to perform an action, while a constraint prohibits or encourage actions. Both affordances and constraints will provide feedback to highlight that there is an option for action, either for the availability of an affordance or, in case of a constraint, to warn the user that an action is forbidden or encouraged.

When discussing computer-supported collaborative learning (CSCL) environments, Bonderup Dohn (2009) distinguishes between three types of affordances:

- Technological;
- Educational; and
- Social.

Regardless of whether an affordance is technological, educational or social, the user must perceive its use accurately in order to complete an action.

Gaver (1991) describes affordances for complex action as follows:

- Sequential affordances, which are affordances that, when acted upon, lead to another perceivable affordance. Sequential affordances are grouped in time; and

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- Nested affordances, which “are grouped in space” (Gaver 1991, p. 82).

Gaver (1991) emphasises that any system is discovered by exploring its perceived affordances. The role of a well-designed interface is to guide the user through a group of perceived sequential and nested affordances. For example, when looking at a menu, we see a ‘File’ option, but only when we click on it do we see all the possible options, for example ‘Open file’ as a nested affordance. However, when a user chooses to print a file, the user is asked to choose the printer and other printing preferences, which serves as a classic example of a sequential affordance.

Conole, Grainne and Dyke (2004b) created an initial taxonomy of Information and Communication Technology (ICT) affordances. Further research concluded that affordances are useful tools when assessing technologies for use (Boyle & Cook 2004; Conole, Grainne & Dyke 2004a). The taxonomy proposed by Conole, Grainne and Dyke (2004b) focussed on attributes of technologies and not on capabilities of the system, as this research was proposing to be more in line with Gibson (1977); and Norman (1988).

In recent times, the educational literature has seen an increased use of affordances as the basis for research studies, especially in areas of technologies, in particular online technologies. Those studies look at educational affordances in new and emerging technologies (Churchill & Churchill 2008), explain how concepts derived from affordance theory can help understand the role of online technologies in learning (Day & Lloyd 2007) and how educational affordances can provide pedagogical developments (Liu et al. 2011), or explore high school students’ beliefs and attitudes to new technologies (Mao 2014). However, none of these

studies relate to the complete uptake and sustained use of ETEs in the higher education sector.

The present research investigates a number of technologies to understand instructor reasoning when the decision whether (or not) to uptake and sustain the use of an ETE was made. Rather than focusing on one particular technology and associated features, the research uses the notion of complex affordance as the discussion point in the process of analysing data. As this research analyses similar affordances in different systems, the implementation of each affordance is different and impacts positively or negatively on the success of the uptake and sustained use of each ETE.

2.5.2 Human-Computer Interaction (HCI)

The notion of human-computer interaction is central to this research, as the study seeks to understand the human and technological constraints on the uptake and sustained use of emerging technologies for education. Both technological and human constraints can be determined by using HCI concepts, as they describe how humans use technological tools (Kaptelinin & Nardi 2012). Both human and technological aspects, and to some degree organisational constraints, impact on the uptake and sustained use of ETEs. Policies and procedures set up by the university in the present case studies, as well as budgetary constraints, impact on which technologies are used.

Researchers have attempted to use HCI when studying emerging technologies for education and their use in the educational environment (Belkhirer et al. 2003; Conte et al. 2007; Mendoza, Stern & Carroll 2010). However, their application of HCI has been limited to very specific HCI

concepts: usability, and learnability. It has to be noted that the application of those studies was typically limited to only one technology, as in the case of Mendoza, Stern and Carroll's (2010) – EndNote and Algorithms in Action systems as software applications. Their study looks at the learnability positive impact on the use of technology.

2.5.3 System Acceptability Theory

In order to assess the affordances in a range of ETEs as useful for their purpose, we have to understand their usability. The International Organization for Standardization (ISO) defines usability as the “[e]xtent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” (ISO/IEC. 1998, p. 2).

Usability is a component of the larger system acceptability model (cf Figure 2-2). There are other characteristics of a system that influence overall system acceptability (Nielsen 1993, 2012; Shneiderman 1998).

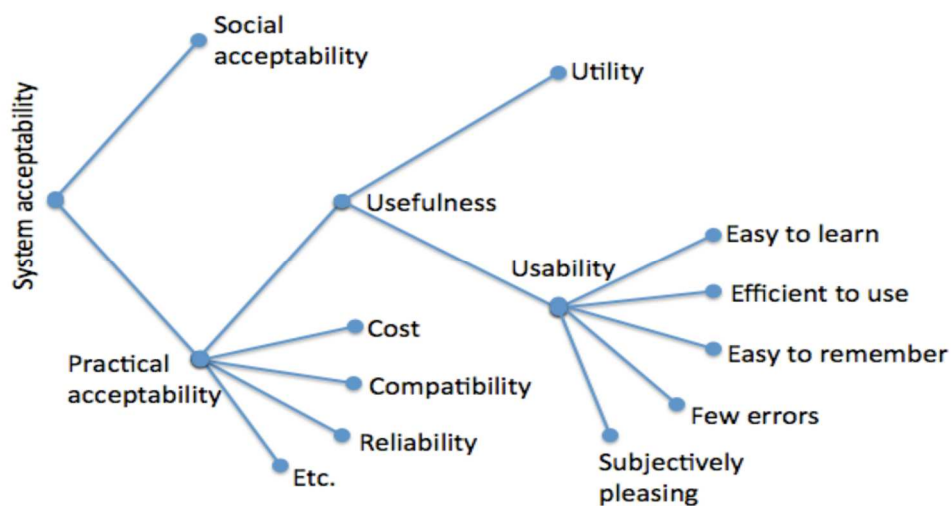


Figure 2-2: Model for system acceptability (Nielsen 1993, p. 25)

The usability of a system cannot be measured as a whole (Nielsen 1993, 2012); but there are a number of usability attributes that can be measured. Specifically, these include:

- learnability – ease of learning to use the system;
- memorability – retention of how to use the system over time – an hour, a day or a week;
- efficiency of use – speed of performance for a task or a set of tasks;
- errors – the frequency and types of errors encountered while carrying out a task or a set of task, and the manner of recovering from errors; and
- subject satisfaction – user attitude, how this affects their performance when handling a task or a set of tasks (Nielsen 1993, 2012; Shneiderman 1998).

The usability of a system impacts on the efficiency of a HCI and, therefore, on the successful use of a system. Evaluation of the usability of a system to assure improvements is conducted at the design stage of development. Testing includes assessment of heuristics or a cognitive walkthrough. Usability testing often uses the following methods (Nielsen 1993, 2012), individual or combined:

- Observation – “the simplest of all usability methods since it involves visiting one or more users and then doing as little as possible in order not to interfere with their work” (Nielsen 1993, p. 207);
- Questionnaires and interviews – “are useful methods for studying how users use the systems and what features they like or dislike” (Nielsen 1993, p. 209). Questionnaires and interviews are both

indirect methods when they study the users' opinion about the HCI, and direct methods when it comes to measuring user satisfaction;

- Focus groups – “somewhat informal techniques that can be used to assess user needs and feelings both before the interface has been designed and after it has been in use for some time” (Nielsen 1993, p. 214);
- User feedback – shows immediate and pressing concerns and any changes in users' needs or opinions as changes to the system occur (Nielsen 1993).

The usability attributes and other aspects of system acceptability theory, as depicted in Figure 2-2: Model for system acceptability (Nielsen 1993, p. 25), are human and technological factors that need to be considered when analysing the determinants of stakeholder decisions to uptake and sustain the use of an ETE.

2.5.4 Design Science Research (DSR)

Design Science as a systematic form of design was first introduced in 1963 by R. Buckminster Fuller. This concept was extended by Gregory, SA (1966), who stated that design was not a science but, however, that science referred to the scientific study of design. Simon (1996) initiated the development of systematic design methodologies relevant to a number of schools or disciplines, such as architecture, business, education, law and engineering. DSR has been applied to the field of education to create, for example, a framework for a computer-supported peer assessment system (Babik, Iyer & Ford 2012), and to the engineering discipline to design an electricity system as a demand-response system, to balance supply and demand by shifting the load to the demand side (Bodenbenner, Feuerriegel & Neumann 2013), to name just two. Iivari

and Venable (2009) define Design Science Research (DSR) as a research method appropriate to creating new, innovative artefacts that solve problems or achieve improvements in current practices. The focal research in DSR is in creating something new that does not yet exist (Iivari & Venable 2009).

Research in DSR focusses on the ‘design’ of artificial artefacts (different types of design processes and design outcomes). March and Smith (1995) classify the main artefacts that are delivered as outcomes of research using DSR as either: constructs; models; methods or instantiations; or a combination thereof; as depicted in the Table 2-2.

Design Artefact	Definition based on March and Smith (1995)
Construct	...or concepts form the vocabulary of a domain. They constitute a conceptualization used to describe problems within the domain and to specify their solutions.
Model	...is a set of propositions or statements expressing relationships among constructs. In design activities, models represent situations as problem and solution statements.
Method	...is a set of steps (an algorithm or guideline) used to perform a task. A method is based on a set of underlying constructs (language) and a representation (model) of the solution space.
Instantiation	...is the realization of an artefact in its environment. IT research instantiates both specific information systems and the tools that address various aspects of designing information systems.

Table 2-2: Types of design artefacts

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Artefacts designed and developed in IS research are not necessarily computer-based systems, but are methods, techniques, notations, and tools for IS/ IT development, planning, and management (Venable 2006a). Well-known examples of these include procedures for database normalisation (e.g. Codd 1970) and the Unified Modelling Language (UML) (e.g. Rumbaugh, Jacobson & Booch 1998).

The view that Design Science Research (DSR) will produce an IT artefact is supported by Hevner et al. (2004). Any artefact is not independent of people and their organisational and social contexts. The perception of and fit within an organization are as crucial to the artefact's successful implementation as are the capabilities of the artefact.

Gregory, RW (2010) defines DSR in terms of two different types of deeply intertwined design processes:

- The building of the design artefact through a sequence of activities to produce 'something new', an innovative product; and
- Evaluation of the created artefact to provide feedback and generate new knowledge about the problem at hand.

The newly generated insights serve to improve both the quality of the artefact and the design process (Hevner et al. 2004). The two intertwined processes are not conducted only once during the life time of a design science process: each design process is iterated until the outcome, the design artefact, is produced to the researchers' satisfaction (Markus, Majchrzak & Gasser 2002). Any utility theory generated at the end of a DSR process must improve the status quo in terms of system performance.

Baskerville, R, Pries-Heje and Venable (2009) described the DSR process as being composed of four iterative activities, listed below:

- I. Search
- II. Ex Ante Evaluation
- III. Construction
- IV. Ex Post Evaluation

This approach includes the identification and specification of the problem, as part of the first activity – ‘The Search’ process. The two major outcomes are: (1) the design; and (2) the artefact. Figure 2-3 below displays the representation of the general process of DSR (Baskerville, R, Pries-Heje & Venable 2009, p. 2).

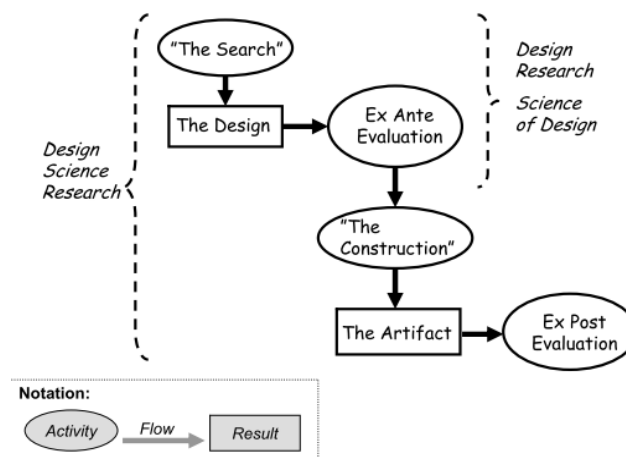


Figure 2-3: Iterative design science research method (Baskerville, R, Pries-Heje & Venable 2009, p. 2)

Nunamaker, Chen and Purdin (1991) proposed another framework for contextualising the role of system development in IS Research. Although their paper was on Design Research, they did not use that term, but described instead the ‘instantiation’ of information systems. Their research framework includes four research activity areas: (1) theory

building; (2) system development; (3) experimentation; and (4) field studies.

The typical outcome of a DSR project can be a computer-based system as their design artefact (Nunamaker, Chen & Purdin 1991). Design artefacts or utility theories also include system development methods, and add 'action research' to the field studies component and 'role playing simulations' to the experimentation component (Figure 2-5) (Venable & Travis 1999). They report, as a method of research in their 1999 study, that they used role-simulation when designing a fictional IS used to provide information in support of the forests' usage and forest-use policy in a fictitious region.

Hevner et al. (2004) developed an overall framework for DSR, as depicted in Figure 2-4, as well as a set of guidelines for the conduct and reporting of DSR. The dual cycle of March and Smith (1995) was revised by renaming the two main processes: 'Develop/Build', and 'Justify/Evaluate'. The framework proposed by Hevner et al. (2004) allows for DSR to be informed by both business needs and applicable knowledge (existing theoretical knowledge). The products of design science in IS research include both applications of the new instantiations to business/organisational environments and additions to the theoretical knowledge. The quality of these two products corresponds, respectively, to relevance and rigour. However, Venable (2006a, p. 184) notes that "that none of the above authors addressed the form of theories or theoretical knowledge or how they are developed during the research process". The synthesis of behavioural science and design science models is exemplified in Figure 2-4, which embodies the understanding, implementation and assessment processes of IS research. The

significance of the framework proposed by Hevner et al. (2004) is that it allows the present research to apply a Technology Organisation People (TOP) approach, to broaden the relevance to the research question of what are the behavioural and contextual factors influencing instructors decisions to uptake and sustained the use of emerging educational technologies. In addition, the IS research framework provides rigour by using foundation theories such as system acceptability and affordance theories to answer the overarching research question.

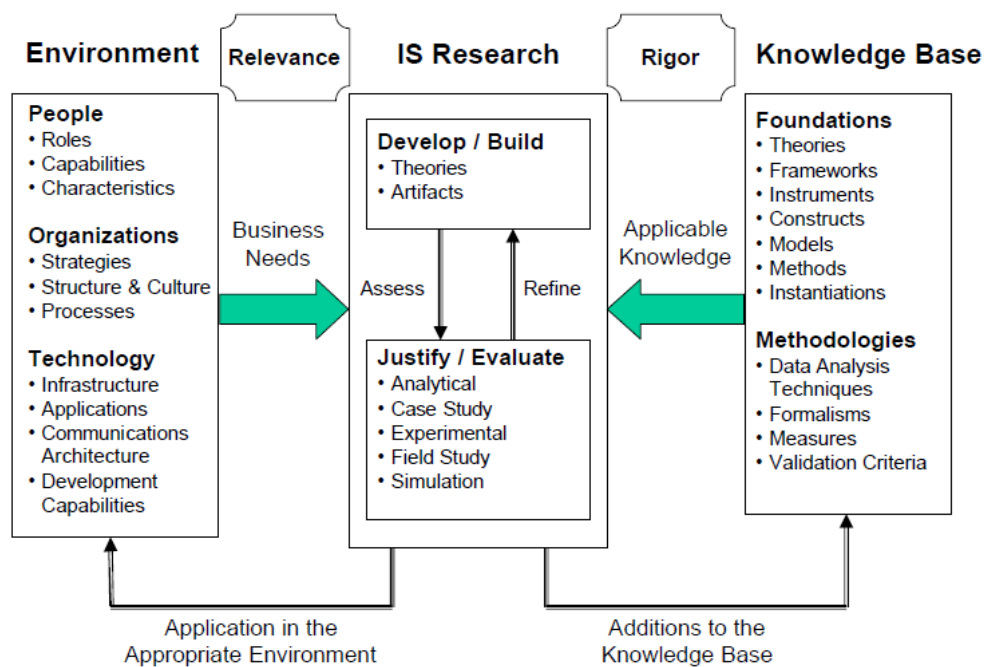


Figure 2-4: IS research framework (Hevner et al. 2004, p. 9)

A set of seven guidelines has been recommended by Hevner et al. (2004) to be used when conducting design science research. The guidelines can provide assistance to researchers, reviewers, editors, and readers in order to understand what is required to conduct effective DSR. Hevner et al. (2004) recommend, however, that each of these guidelines, listed in

Table 2-3, needs to be addressed in order for the DSR to accomplish rigour and relevance.

Guideline	Description
1: Design as an Artefact	Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
3: Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
5: Research Rigor	Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.
6: Design as a Search Process	The search for an effective artefact requires utilizing available means to reach desired ends, while satisfying laws in the problem environment.
7: Communication of Research	Design science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

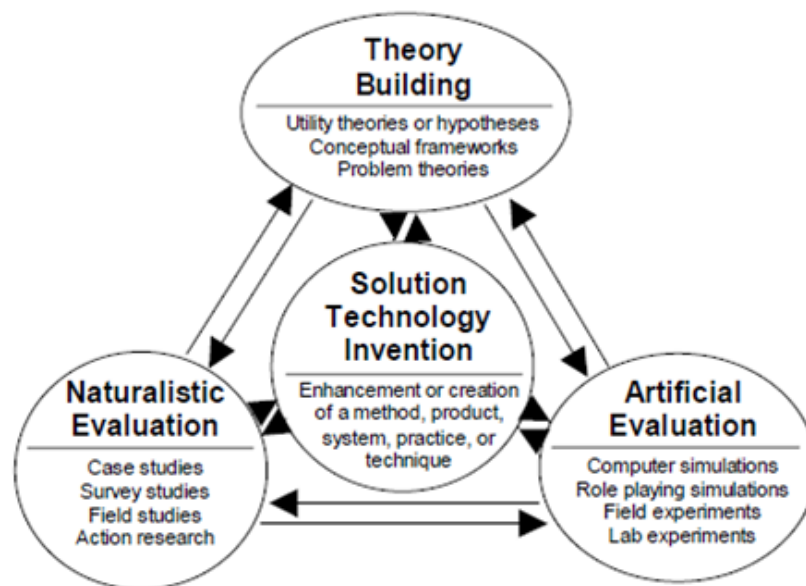
Table 2-3: Design science research guidelines (Hevner et al. 2004)

The major benefit of using DSR is the construction of an IT artefact that achieves organisational goals and improves performance (Hevner et al.

2004; March & Smith 1995). Possible drawbacks of using DSR are as follows:

- Underlying structure is not deep enough to support a theory of IT;
- Artefacts, and therefore the results of the research, are volatile/perishable.

The concept of DSR formulated by Venable and Travis (1999), and which underpins the present research, is presented in Figure 2-5.



(adapted from Venable & Travis, 1999 after Nunamaker et al, 1991)

Figure 2-5: Framework and context for DSR

The role of affordance in the current research is as a concept that has been used to facilitate discussions with case-study respondents about ETEs, as generalised features of different technologies rather than as specific features (Naturalistic Evaluation in Figure 2-5).

DSR should produce constructs, models, methods, or instantiations, that add to the field of knowledge (Iivari & Venable 2009). In order to gain a

deeper understanding of instructor's decision-making process to uptake and then sustain ETEs, we have applied the following theories within a DSR approach:

- Affordance theory – to facilitate discussions with case-study respondents as generalised features of different emerging technologies for education;
- System acceptability theory – to support understanding of the decisions that are taken based on the perceived affordances of the ETEs.

2.6 ETE Uptake in Recent Years

Following the Horizon reports from 2004 to 2010, Martin, S et al. (2011) compiled a bibliometric analysis of the forecasted technology trends and the actual outcomes of those technologies. Bibliometric analysis serves the dual purpose of understanding the past as well as projecting the future (Daim et al. 2006).

Personal Web technologies, such as e-Portfolios, have been reportedly patchy in terms of the extent of their use in the Australian tertiary education system (Hallam & Creagh 2010). This is in line with the finding of the bibliometric analysis by Martin, S et al. (2011), which deemed that the forecasted impact of such technology was not achieved in terms of uptake, according to the very few articles being published about it. The prediction by the 2010 Horizon Report shows a steep downward trend for the use of personal web technologies in the future.

Social network technologies such as Facebook have been deemed to make the deepest impact in education (Martin, S et al. 2011). As seen also in the present study, Facebook is incorporated into the tertiary education sector

when the purpose of technology meets the pedagogical outcome. Social technologies have had a positive impact on higher education (Martin, S et al. 2011).

TriggerThat, a pilot application using SMS (Short Message Service), m-technology has been trialled at RMIT University in 2006 (Richardson, Lenarcic & Wilkins 2008). The application required students to register for the service and then receive notifications, as an example of push-pull access to information. The *TriggerThat* application has been replaced by weekly emails sent by subject tutors to achieve similar push-pull information access, using Learning Management systems such as Blackboard Learn.

E-Book has been seen by the 2011 Horizon report as an emerging technology and, coupled with the following year's Horizon report, it's rise should have been aided by the rise of tablet computer use in higher education. However, despite the widespread availability of e-Books, some students still reportedly prefer using the hard copy version (Lenarcic et al. 2008; Martin, R 2012): adoption rates did not meet the predictions of the 2011 Horizon report.

Thus, some of the predictions offered by the Horizon report have been achieved (social networks, games and mobile devices technologies), whereas others have fulfilled their potential only with a delay of one to two years (collaborative web technology) (Martin, S et al. 2011). There are still other technologies (personal Web and open content technologies) that have failed to achieved the predictions of the Horizon report (Martin, S et al. 2011).

2.7 Chapter Summary

The present chapter introduced and defined key concepts that are relevant to the research problem, setting up the background of this research. The literature review also covers various models used widely in the Information System research field, such as the Technology Acceptance Model (TAM)(Davis 1989; Venkatesh et al. 2003), and Diffusion of Innovation (DOI)(Rogers 1983, 2003), Task-Technology Fit (TTF) (Goodhue 1995), and Information System Success models (the latter also known as the D&M model) (DeLone & McLean 2003). Each of these models was described in detail and analysed in terms of the research question, and a decision was made in regard to the applicability of each of these models to the present research. None of these models address all of the constraints or facilitators to the successful uptake and sustained use of ETEs that are investigated in this study: organisational, technological, and human.

The literature review in this chapter also highlights the gap created by theories and models previously used, which are unable to reason all factors impacting on the use of technology. Theories such as TAM, DOI, TTF and the D&M model are incapable of reasoning all technological, organisational and human factors impacting on the uptake and sustained use of technology, which this research is addressing. Following the highlighted gap, the chapter presented a review of a number of possible theories and concepts that can provide a much needed new angle for addressing the uptake and sustained use of emerging technologies for education. Review of the two theories and concepts that can potentially provide the much needed new angle are:

- Affordance theory (Gibson 1977; Norman 1988, 2008), as a discussion point with case-study respondents, to allow this research to span over a number of emerging technologies for education rather than being specific to one technology; and
- System acceptability theory (Nielsen 1993, 2012; Norman 2007; Shneiderman 1998), to underpin the analysis and interpretation of the collected data.

Design science research (Hevner et al. 2004; Iivari & Venable 2009; March & Smith 1995) informs the present research model to ensure rigour and relevance of the analysis process. It also supports the case-study approach planned, though naturalistic evaluation, as discussed in Chapter 3 – “Research Method”.

The present chapter examined a number of emergent educational technologies that have been trialled, such as SMS and Twitter, and the presence or absence of their sustained use. Facebook, as a social network technology, has been shown to have been sustained in its use; but the e-Book, as an emerging technology, has not achieved its forecasted potential.

Chapter 3 Research Method

3.1 Introduction

This chapter provides an argument for the methodology used in this study. The methodological approach chosen is driven by the need to answer the research question, of what are the contextual and behavioural factors that influence instructors' approaches to the uptake and sustained use of emerging educational technologies; and to assure the rigour and relevance of the study. A number of methods have been examined, and the most appropriate methods chosen for this research presented; and the reason for each choice has been discussed.

Based on the research goal, of finding the technological, organisational and human factors that impact on the uptake and sustained use of IT, the best research approach is of an interpretive nature. The researcher must consider the paradigm carefully, and paradigm align the methodology and research question/s correctly. When this alignment is achieved, the adopted methods compatible with the researcher's stance will be presented, and the final work thus ensured to be of high coherence. The interpretive researcher's role is to develop theories and create (a) solution(s) to the research question, by choosing appropriate methods to "enable people to learn how to discover and change their own reality" (Jonker & Pennink 2010, p. 30). Research situated within a method underpinned by an interpretive paradigm aims to define and understand the context, which affects and influences the interpretations of the situations by different individuals or groups deemed important. Each stakeholder's interpretation constructs a differing perspective on reality.

In order to understand these different points of view, therefore, an interpretive researcher aims to understand and extend meaning from and supported by these several perceptions of reality. Interpretation is thus a range of narratives describing various interpretations of reality, through the defined framework chosen by the researchers' academic knowledge (Mackenzie & Knipe 2006).

3.2 Revisiting the Research Question

This chapter provides an argument for the methodology used in this study. The methodological approach chosen is driven by the need to answer the research question, of what are the contextual and behavioural factors that influence instructors' approaches to the uptake and sustained use of emerging educational technologies; and to assure the rigour and relevance of the study. A number of methods have been examined, and the most appropriate methods chosen for this research presented; and the reason for each choice has been discussed.

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the context, which affects and influences the interpretations of the situations by different individuals or groups deemed important. Each stakeholder's interpretation constructs a differing perspective on reality. In order to understand these different points of view, therefore, an interpretive researcher aims to understand and extend meaning from and supported by these several perceptions of reality. Interpretation is thus a range of narratives describing various interpretations of reality, through the defined framework chosen by the researchers' academic knowledge (Mackenzie & Knipe 2006).

3.3 Candidate Research Methods

3.3.1 Ethnography

In an ethnographic research study, the researcher is involved extensively in the day-to-day activities of an organisation, allowing the researcher "to build a rich understand of the issues that the organisation faces from an insider's viewpoint" (Bryman & Bell 2011, p. 425). In accord with an emphasis on gaining a deeper understanding from the participants' points of view, the researcher must become profoundly engaged in the context of the studied phenomenon over an extended period of time (longitudinal approach), usually at least one year (Cavaye 1996). Researchers enter the field with no pre-defined constructs, and attempt to make no assumptions about the reality or the collected data, as the aim is to interpret the reality and the collected data through the participants' eyes (Cavaye 1996).

Ethnographic research places the researcher in dual positions: amply immersed in the context of the study to gain understanding of the participants' points of view; while remaining sufficiently disconnected to

retain the full capacity to review events in a critical way. Apart from this dual role that the researcher needs to take in an ethnographic research, a major issue with this approach is that it requires lengthy periods of time in the field. Ethnographic research would also allow a very good view from an organizational perspective, but it might miss the technological and human aspects. In the present research context, where the research question is seeking to find the technological, organisational and human aspects impacting on the uptake and sustained use of ETEs, the ethnographic approach is thus not feasible, and has not been applied here.

3.3.2 Phenomenology

Creswell (2007) defines phenomenological research as “the meaning for several individuals of their *lived experiences* of a concept or a phenomenon” (Creswell 2007, p. 57). Creswell (2007) highlights two phenomenological study types:

- Hermeneutic – researchers first focus on a phenomenon that is of interest to them, and then they interpret the lived experiences and their meaning;
- Empirical (transcendental or psychological) – is a description of the lived experiences without the researcher’s interpretation of the phenomena.

Hermeneutic phenomenology is the most used type of phenomenological studies, as it is hard for the researcher to complete detach from the study of phenomena that is of interest to them (Creswell 2007).

Flood (2010) asserts that, epistemologically, phenomenology focuses on inducting meaning rather than on deducting theories. Data collection in a

phenomenological study is primarily through interviews (Creswell 2007; Flood 2010; Lindseth & Norberg 2004). Phenomenology is more suited for the following fields in health and social science: sociology, psychology, nursing, health science and education (Creswell 2007); with nursing and health science being the most popular fields (Flood 2010; Lindseth & Norberg 2004). Phenomenology is considered not to be an appropriate approach for the present study, as it focuses on revealing meaning but does not go as far as developing theory, which the present research aims to do.

3.3.3 Action Research

Action research is defined as a “set of self-consciously collaborative and democratic strategies for generating knowledge and designing action in which trained experts in social and other forms of research and local stakeholders work together” (Greenwood & Levin 2007, p. 3). Action research engages with the stakeholders differently than other methods of research do, as it focuses on “... doing ‘with’ rather than doing ‘for’ stakeholders and credits local stakeholders with the richness of experience and reflective possibilities that long experience living in complex situations brings with it” (Greenwood & Levin 2007, p. 3). Action research has a strong focus on people, with less emphasis on organisational and technological influences, and can support the collection of both qualitative and quantitative data (Bryman & Bell 2011, p. 415).

The key difference between action research and other type of approaches is in the role that the researcher plays in the research. The researcher in action research is actively involved, seeking to create outcomes that will benefit the organisation (Baskerville, RL & Wood-Harper 1996, p. 239).

The researcher must follow a number of phases, such as: formulate theory; plan the necessary action, followed by the step of taking the action; and finally, evaluate it in an iterative approach to produce valuable outcomes for the organisation while contributing to theory (Baskerville, RL & Wood-Harper 1996). A limitation of action research is that the active involvement of the researcher may compromise research rigour, due to the researcher lacking the required discipline to remain impartial (Baskerville, RL & Wood-Harper 1996). Action research requires that the researcher has the ability to prescribe, or at least influence, actions in the occupational space, and to observe responses to those directions. For this reason, in the present research context, which requires exploration not action, action research is considered unsuitable.

3.3.4 Case study

A case study research approach explores a system or a number of systems (cases) through exhaustive data collection (interviews, observations, focus groups, documents), in order to understand a problem or issue that affects the bounded system/s (Creswell 2007). Case-study research is appropriate where the researcher intends to deliver a comprehensive understanding of the cases within their boundaries, or possibly compare different case studies (Creswell 2007). Case-study research enables observation of a system (in the present case, the emerging technologies under study) in its organisational setting, and allows the generation of theory from practice (Benbasat, Goldstein & Mead 1987, p. 370). During the analysis of collected data, the focus is on a number of key issues ('analysis themes'), to gain a thorough understanding of the case study; but not aiming to generalise the findings (Cavaye 1996; Creswell 2007). Although case-study research allows the study of a large number of

variables, it does not have the ability to control those variables (Cavaye 1996); and even when the relation between variables can be established, the direction of causation may not be determined (Cavaye 1996). When weighing the advantages of case-study research against their disadvantages, adoption of a case-study strategy was considered viable for the present study. A case-study approach also fits with the design science research framework planned for this project as a basis for a qualitative exploratory study within the research problem, providing a naturalistic evaluation of a number of technologies supported by system acceptability theory.

3.3.5 Content Analysis

Unlike the previous methods, content analysis does not require collection of new data, but instead comprises the analysis of existing documents and printed or visual texts, in order to quantify their content into categorical groups, in a “*systematic*” (where rules are applied in a consistent way) and “*replicable*” (anyone could employ the same rules and arrive at the same result) manner (Bryman & Bell 2011, p. 289). Content analysis is based on creating a coding scheme as a tool for research, following the Weber Protocol, to avoid researcher bias. The Weber Protocol is an eight-step process, which includes definition of “recording units” (words, phrases, sentences and paragraphs) and of coding categories, and additionally an iterative testing process of the coding rules to ensure reliability and accuracy of the method (Bryman & Bell 2011, p. 290).

Content analysis research is mainly, but not limited to, the analysis of journal articles and corporate documents, as they are unbiased by human perspective or intervention in the events that they report and the data they contain. One suitable application of content analysis is for cultural

organizational studies, which allow the researcher to analyse organizational values, traces of which can be found in the organization documents; and the frequency of these values occurring would be an indicator of their importance (Bryman & Bell 2011).

One limitation of the content analysis method is that it can only be as good as the documents upon which the analysis is based. Furthermore, the design of the coding manuals, even when following the Weber Protocol, involves some coders' interpretation; and if the coder is not the researcher, the validity of the analysis might be affected. Content analysis alone cannot answer "Why?" research questions, they can only offer speculations for the reason(s) (Bryman & Bell 2011).

The application of content analysis to the present study was considered to have the potential to identify the organisational approaches when it comes to educational IT policies. Educational institutions are one of the main stakeholders in the education environment; but their representatives, educational IT policy makers, are not specific to a course, which is the unit of our case study analysis; hence, they cannot be part of the case study planned for this research. Ultimately, the IT policies they set up can be used for content analysis to determine their stance, and to possibly identify the organisational enablers or barriers to the uptake and sustained use of emerging technologies. Content analysis was not used, due to the time constraints of this study and the decision to include only instructors as relevant stakeholders.

3.4 Research Method Selection – Case Studies

In summary, the consideration of the candidate research strategies above recommends a multiple case studies method, to investigate instructors'

approaches to uptake and sustained use of ETEs. The rationale for the decision is summarised in Table 3-1.

	Case Study	Action Research	Phenomenology	Ethnography
Use of case method	Yes	Yes	Yes	Yes
Aims to understand the context	Yes	Yes	Yes	Yes
Does not define a priori constructs	Yes	Yes	Yes	Yes
Topic defined by researcher	Yes		Yes	Yes
No intent to interfere in phenomenon	Yes		Yes	Yes
Attempts contribution to knowledge	Yes	Yes	Yes	Yes
Relates findings to generalizable theory	Yes	Yes		
Interpretation from researcher's viewpoint	Yes	Yes		

Table 3-1: Candidate research strategies comparison (based on Cavaye 1996, p. 231)

The content analysis research method is not included in the above table as it is different to the four methods compared in Table 3-1, and its use in this research would complement the chosen, multiple case studies method. The emergent theory is developed inductively by recognising patterns (Eisenhardt, KM & Graebner 2007) and is supported by a DSR

framework. The final product of this research is the result of an appropriate use of theory, upon which a thorough investigation of case studies situated in a real higher education environment was undertaken. An artefact describing instructors' uptake and sustained use of ETE in a higher organisation setting was the result of the DSR research approach utilised (Walsham 1995).

3.5 Research Design

In accord with the discussion above, the research study can be conceived as shown in Figure 3-1. Specifically:

- Research Question – what are the contextual and behavioural factors that influence the approaches of instructor cohorts surrounding the decision to uptake and sustain the use of emerging educational technologies; the research question has been divided into three sub-questions to achieve a holistic answer;
- Case Studies – The case studies have been identified with instructors as the focus of the investigation of the impact of technology, the organisation and people on ETE uptake and sustained use at a major Australian university in Melbourne;
- Data Collection – Data collection takes place using qualitative data collection tools and techniques, specifically, semi-structured interviews;
- Data Analysis – Data has been analysed in terms of system acceptability and affordance theories and HCI concepts;
- Data Interpretation – Data has been interpreted using a DSR lens to identify human, technological and organisational factors impacting

on instructors' decision to uptake and sustained use of emerging educational technologies.

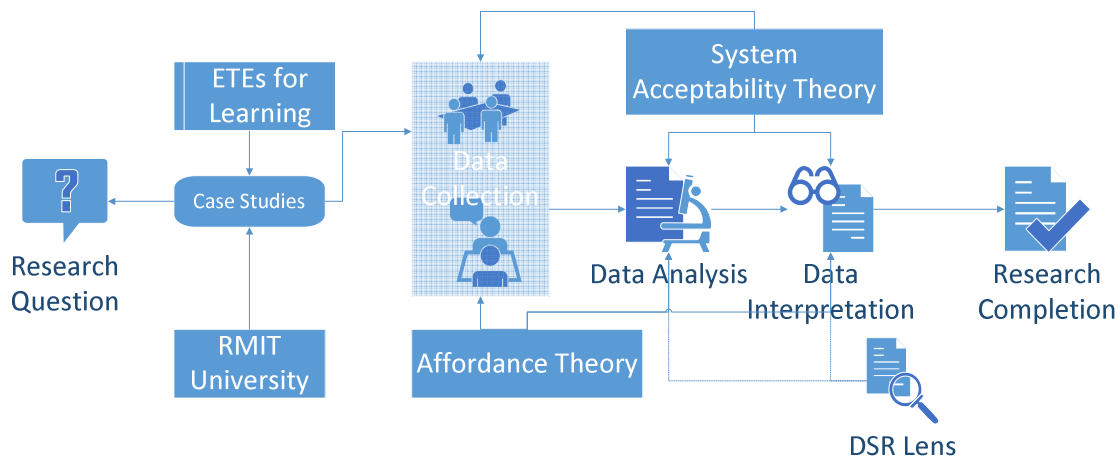


Figure 3-1: The research framework

3.5.1 Case Studies Description

The research question, of what are the contextual and behavioural factors influencing instructor decisions to uptake and sustain the use of ETEs, and in particular the types of research outcomes that are being sought, require an approach that offers the prospect of rich understandings. Given the research question that has been posed, rich data is required that supports reflection on the decision drivers, the processes and instructors' behaviours when taking decisions to uptake and sustain the use of ETEs. Six case studies at a major Australian university in Melbourne were undertaken. Each case study focussed on instructor uptake and sustained use of an ETE. Instructors have been determined to be relevant stakeholders. The case studies focussed, on the instructors due to their impact on the uptake of technology with respect to technological and organizational settings.

The educational institutions, represented by educational IT policy makers as stakeholders, have not been involved in any case studies for the present research, as they are not specific to the unit of research required for the planned research. Each case study undertaken involved an instructor delivering various courses offered at a major Australian university. The participants' selection for this study has also be influenced by their experience with one or more technologies within a particular course. The technologies, IT software applications used at the university selected for this research, are: Blackboard Learn, Google Apps, and Facebook.

Discussion about Blackboard Mobile Learn (BML) has been contained within the Blackboard Learn discussion, as BML is the mobile application available on both Android and Apple platforms. For the purpose of this research, Blackboard Mobile Learn is seen as a subset of Blackboard Learn functionality.

3.5.2 Data Collection

Yin (2003) lists six possible sources of evidence that can be used when collecting data pertinent to a case-study research strategy. Each of the six possible data collections techniques (Yin 2003) is listed in Table 3-2, with its own strengths and weaknesses.

Technique	Strengths	Weaknesses
Interviews (typically open-ended, but also focused, structured; and surveys are possible)	Focus is on the topic/s of the case study Insightful perceptions into issues	Bias if questions are improperly designed or in responses Inaccuracies caused by poor/incomplete recall
Documents (letters, agendas and progress reports)	Can be reviewed at any time Not produced as a result of the case study Contain exact details Can span over a long period of time	Might not be easily retrievable and access to documents might not be allowed Selection of documents for collection might be biased Reporting bias
Archival records (Service records, organisational charts, budgets, etc.)	Can be reviewed at any time Not produced as a result of the case study Contain exact details Can span over a long period of time Quantitative and precise	Might not be easily retrievable and access to documents might not be allowed or be restricted due to privacy issues Selection of documents for collection might be biased Reporting bias
Direct observation (formal or casual; useful to have multiple observers)	Reporting of events in real time Reflects the context of the observed events	Time consuming and costly due to human observers Bias in selecting (or not selecting) events to be observed Events might be different if observed
Participant observation (assuming a role in the situation and getting an inside view of the events)	Reporting of events in real time Reflects the context of the observed events Perception into interpersonal motives and behaviours	Time consuming and costly due to human observers Bias in selecting (or not selecting) events to be observed and generated by the researcher's position Events might be influenced if observed
Physical artefacts	Understanding into cultural features and technical operations	Selection can be biased Artefacts might not be available

Table 3-2: Data collection techniques summary

The present project employs semi-structured interviews as the data collection strategy, with the data collection instrument design being underpinned by the concept of (perceived) affordance. Other possible data collection approaches (such as documents, records and physical artefacts) might be accessed, as available, to triangulate insights drawn from the data collected

The design of the semi-structure interview instrument is tightly linked to the system acceptability theory. The questions listed in the Interview Outline in the Appendices, all target different aspects of the underpinning theory. The alignment of the interview questions and the system acceptability nodes is summarised in Table 3-3.

System Acceptability Theory - node		Interview question/s
Overall Perceived Acceptability		A, B
Social Acceptability		C, E
Practical Acceptability		F, G, I, J, K
Utility		7
Usefulness		1
Compatibility		11
Reliability		6, 10
Usability	Learnability	D, 2
	Memorability	3
	Efficiency of use	4, 9
	Error handling	5
	User satisfaction	8

Table 3-3: Questions targeting system acceptability theory nodes

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A series of face-to-face interviews were conducted with six teaching staff at a major Australian university in Melbourne, as representatives of the instructors' stakeholder group. An initial discussion was held with Program Directors and/or Major Coordinators to identify courses and course coordinators willing to participate in the study.

The way each instructor uses technology differs greatly in large higher education institutions that underpinned the decision to drive the choice of case studies from the human apex of the technology, organisation and people triad of impact factors with respect to ETE uptake. All case studies used the sending email affordance as means of communications with students. Some staff conducting study tours used Facebook tools (Ben), for day-to-day communication with students. Online students also used Facebook to communicate (Joy).

All participants used the 'posting assignment upload details' for their case study assessments. A dynamic version of the assessment upload functionality was used in one case study (Ben), while others used a set of predefined quizzes to implement a flipped classroom model (Amy, Ace and Sam).

Having all participants from the same institution was a limitation of the research design. However, the data collection process being located in one institution facilitated an ability of the researcher to go back and ask further questions during the analysis phase. As each instructor driven case focussed on the use of different technologies and implementation pedagogies the limitation was also a positive factor that enabled a depth of analysis that would otherwise have been impossible.

Each interviewee was asked if they use a particular technology/system, and the response was the basis for their selection to participate in the research. Most interviewees were asked only about one technology; but some were iteratively asked about a number of technologies, with the focus being on affordances of the investigated technologies. The technologies are those presented in Table 1-1: Technology descriptions: Blackboard Learn, Google Apps and Facebook; and they were all being used at the university, and will henceforth be referred to in the present work as applications.

The interview addresses each selected affordance (Table 3-4) relevant to the applications experienced by the interviewee (some affordances are not relevant for some applications). The use of affordance as a more granular level of discussion allows this study to explore a number of applications that comprise similar affordances. For example, the Sending Email affordance is available in Blackboard Learn and Google Apps applications; however, the implementation and functionality differs greatly. Meanwhile, although in both the Google Mail and the Blackboard Learn the user can send an email to one recipient or a group, the interface is different, with different formatting facilities, and the ability to follow a thread of message is only available in the Google Mail application. Blackboard Learn offers only the option of initiating an email conversation; which can then be followed in the Google Mail application only.

A number of affordances have been selected to be studied. The selection includes affordances of different types: communications, content, and collaborations; and ensures that similar affordances are available in at least two of the three applications under study. Two affordances allow

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communication: discussion threads, and sending emails. Two are content based: setting up assessments, and posting assignment upload details. There is one collaboration affordance: collaborating spaces.

<i>Selected</i>	<i>Communication</i>	
✗	<i>Posting Announcement</i>	This capability allows instructors to post announcements for students to read.
✗	<i>Online Chatting</i>	This capability allows those students who are online to chat in real time with other students in their class section.
✓	<i>Discussion Threads</i>	This capability allows students and instructors to create a discussion thread and reply to ones already created.
✓	<i>Sending email</i>	This capability allows students and instructors to send mail to one another and also mass emailing to students in a course.
	<i>Content</i>	
✗	<i>Upload Information Content</i>	This feature allows instructors to post articles, assignments, videos etc.
✗	<i>Setting Calendar Reminders</i>	Instructors can use this function to post due dates for assignments and tests.
✗	<i>Online Learning Modules</i>	This feature is often used for strictly online classes. It allows instructors to post different lessons for students to access.
✓	<i>Setting up Assessments</i>	This feature allows instructors to post quizzes and exams and allows students to access them via the internet.
✓	<i>Posting Assignment Upload Details</i>	This feature allows assignments to be posted, students to submit assignments online, and instructors to mark and provide feedback to the students.
✗	<i>Managing Grade Book</i>	Instructors may post grades on Blackboard for students to view.
✗	<i>Uploading Media Library</i>	Videos and other media may be posted under this function.
	<i>Collaboration</i>	
✓	<i>Collaborating Spaces</i>	This feature allows students and instructors to keep in touch with the academic community.
✗	<i>Building Wikis</i>	This feature is a web-based collaborative authoring application.

Table 3-4: Affordance descriptions

Some of the interview questions refer to the application overall, and others refer to particular affordances. In the course of the interview, the term affordance has been replaced by capabilities to ease participant understanding. The questions inquire about usability attributes (learnability, memorability, efficiency and accuracy) at the affordance level, and other influencing factors (trust, usefulness, satisfaction and like) at application level (Nielsen 1993, 2012). Appendix 2 – Interview Outline contains details. Where the application under investigation is Blackboard Learn or Google (Mail/Drive), an application-related question is: ‘How long have you been using the application?’ However, irrespective of the application being Blackboard Learn or Google (Mail/Drive), an example of a question relating to an affordance/capability such as sending emails would be: ‘How easy was it to find the capability when first using the application?’ The interview questions flow is depicted in Figure 3-2.

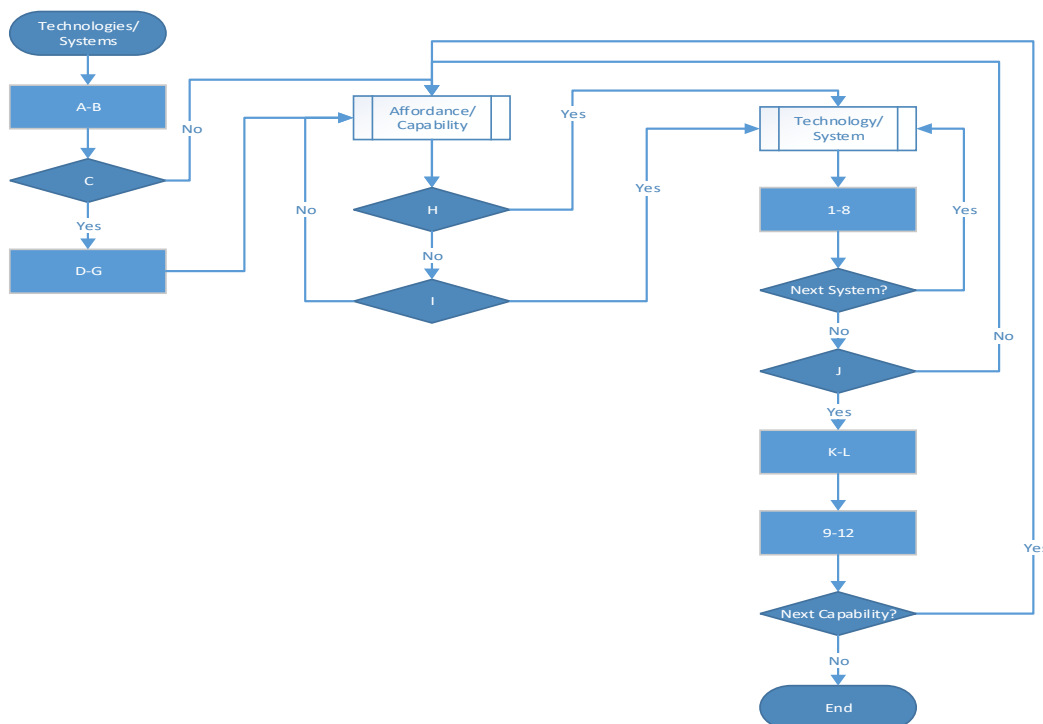


Figure 3-2: Application-capability questions - interview flowchart

3.5.2.1 Interview Respondents

The participants' selection in the project was based on the researcher's knowledge of their involvement with ETEs, specifically the applications selected for study. Their technological confidence varied from non-technocrat (Merriam-Webster 1982) to expert level, and at least half of them have experienced all three applications to various degrees. All interviewees have been involved with undergraduate courses at the same large metropolitan university in Australia, but some have also been and are still involved with postgraduate courses. The participants were given aliases to conceal their identity.

Participant 1 – Ace

Ace is a sessional lecturer and tutor in Information Technology at the university. He is not involved in developing content or ETEs choices, but he perceives himself as an expert with technology. He has eleven years of teaching experience at his current university, and previously worked at two other Australian higher education institutions. His teaching experience follows his previous industry experience, with a highly technical and managerial background. The interview focussed only on his experience with respect to uptake and sustained use of ETEs at the university.

Participant 2 – Amy

Amy is a sessional tutor in Information Technology and Logistics at the university, involved in setting up content using ETEs. She has worked for eighteen years at the university under study, and has also worked as a sessional staff for other universities. Her first degree is in education. She feels confident and comfortable with technology. The interview focussed

only on her experience with respect to uptake and sustained use of ETEs at her current university.

Participant 3 – Ben

Ben is a full time academic staff member in Information Technology and Logistics at the university. He works as a lecturer and tutor in both undergraduate and postgraduate courses. He is involved in designing the delivery of content. He sees himself as an expert with technology, who likes pushing boundaries using ETEs. His experience at the university spans two decades.

Participant 4 – Joy

Joy is a sessional tutor in Information Technology and Logistics at the university, responsible primarily for content delivery. She has worked at the university for five years, and has also been employed at another Australian university. She furthermore works professionally as a librarian. The interview focussed only on her experience with respect to uptake and sustained use of ETEs at the university.

Participant 5 – Mel

Mel is a full time academic staff member at the university in Melbourne in Management, despite her first degree being in education. She works mainly as a lecturer, designing, developing and uploading curriculum resources using ETEs. She considers herself a non-technocrat.

Participant 6 – Sam

Sam is full time academic staff member in Information Technology and Logistics at the university, working both as a lecturer and tutor. He is involved in designing, developing and delivering academic content. As he has previous industry experience, with a highly technological

background, he considers himself an expert with technology. The interview focussed only on his experience with respect to uptake and sustained use of ETEs at the university.

The sampling of the interviewees can be perceived as purposive or judgemental (Adams, Khan & Raeside 2014; Blaikie 2010; Bryman & Bell 2011; Cohen & Manion 1995; Collins & Hussey 2014; Quinlan 2011). The sample size of six interviews can be seen as small, but it is consistent with qualitative research (Benbasat, Goldstein & Mead 1987; Yin 2003). The sample size is deemed to be enough due to the depth and richness of the collected data and the roles of the interviewees, which cover a wide range. Crouch and McKenzie (2006, p. 496) claim that a small number of respondents is ideal for exploratory, analytic studies such as the one employed here.

3.5.3 Data Analysis

Data analysis of the collected data is of qualitative, aligned with the research question, and informed by aspects of system acceptability theory (Nielsen 1993, 2012). In line with the design science lens, the identification of the organisational, technological and human factors that impact on the decision to uptake and sustain the use of ETEs when delivering educational curricula were identified. As the data is captured, the data analysis approach were refined, drawing upon options including thematic analysis, narrative analysis, analytic induction. All the following named analysis methods were investigated, and the most appropriate selected.

Following the identification of impact factors, a triangulation process (Bryman & Bell 2011) will be employed using the extant literature to

support findings. To validate the identified factors, they have been cross-checked against several studies in the literature. The validity of each factor was assessed and those found to be weakly supported by the literature were referred for further study.

3.5.3.1 Thematic Analysis

Thematic analysis requires that the researcher identifies themes and uses the data collected as supporting evidence for elements of the selected themes, somewhat analogous to coding in quantitative research (Bryman & Bell 2011, pp. 571-2). One limitation of such an approach lies in the possibility of bias arising from the selection of themes, and also dealing with themes which were not envisaged at the time when the data collection tools were designed. An additional limitation is that the method can create data fragmentation (Bryman & Bell 2011, p. 571). Miles and Huberman (1995) propose a number of steps when applying thematic analysis (Morse & Richards 2002), with the focus being on minimising the analyst's bias as well as aiming to eliminate the differences of different people collecting data.

3.5.3.2 Narrative Analysis

Narrative analysis, a more recent approach, does not produce data fragmentation, and the narrative flow is preserved (Bryman & Bell 2011, p. 588). If, when the collected data is to be analysed, it becomes obvious that by doing thematic analysis the data becomes fragmented, a narrative approach might be adopted. A potential limitation of the method is that the researcher could become nothing more than a "mouthpiece" (Bryman & Bell 2011, p. 589).

3.5.3.3 Analytic Induction

Analytic induction is an iterative process wherein the initial data is collected and analysed, and then the next stage of data collection is shaped by that initial analysis. Each stage seeks to prove or disprove hypothetical explanations of the research question(s). This iterative process continues “until no cases that are inconsistent with the hypothetical explanation (deviant or negative cases) of a phenomenon are found.” (Bryman & Bell 2011, p. 575). A limitation of the method is that it rarely determines the “necessary conditions” for a phenomenon to occur and it does not have a clear guideline as to how many iterations are needed for the hypothetical explanations to be confirmed (Bryman & Bell 2011, p. 576). A phenomenon is a fact or situation that is known to exist or happen but for which the cause or explanation is in question.

3.5.3.4 Data Analysis Method Selection

The data analysis employed the thematic analysis method as the most appropriate, as it aligns with the type of research question posed and the methodology. Thematic analysis identifies common occurring themes within the collected data, and by doing so helps to provide an answer to the research question, of what are the technological, organisational and human factors influencing the instructors’ approaches to the uptake and sustained use of ETEs. The data analysis stage started before completion of the data collection phase. In order to support the amount of data that was be collected for this study and to minimise potential bias, NVivo 10 was used as an analysis tool when analysing the rich data collected. NVivo allows the researcher to manage and query large amount of data, to identify themes emerging from the analysis of the collected data, and to create graphical models and dynamic reports. This tool allows the researcher to analyse the collected data in a more organized, systematic

manner, as well as creating prospects for connecting data and themes that emerge from the interviews. Using nVivo in the analysis process enhances the rigour of the research by adding validation (or not) “to some of the researcher's own impressions of the data” (Welsh 2002, p. 7).

3.5.4 Data Interpretation

In contrast to the data collection phase, which seeks to assemble the collected data, interpretation seeks meaning from the data. When interpreting the data, the researcher attempted to find what is important about the data and why, and more significantly what can be learnt from the analysed data.

The case studies were interrogated using interviews of instructors. The questions are underpinned by system acceptability theory to ascertain affordance/capabilities used for a sustained period of time.

A Design Science approach (Figure 3-3) is used in this study as it offers the potential to underpin the research design with more than one theory, and has the potential to develop an artefact that improves system utility (Iivari & Venable 2009). The framework provided by the use of a DSR approach enables interpretation of the data collected. Naturalistic Evaluation and Theory Building enabled a rigorous research design whereby the questions asked of chosen stakeholders facilitated the creation of a research outcome that improved our understanding of ETE uptake and sustained use in higher education. The analysis of the case studies provided underpinned by the use system acceptability theory assured the data collected would enable the creation of an artefact to guide institutional and individual uptake of ETEs (Walsham 1995). The framework also has the ability to provide (Solution Technology

Invention) understandings to underpin a Utility Theory designed to improve instructors' current practices when it comes to ETE use.

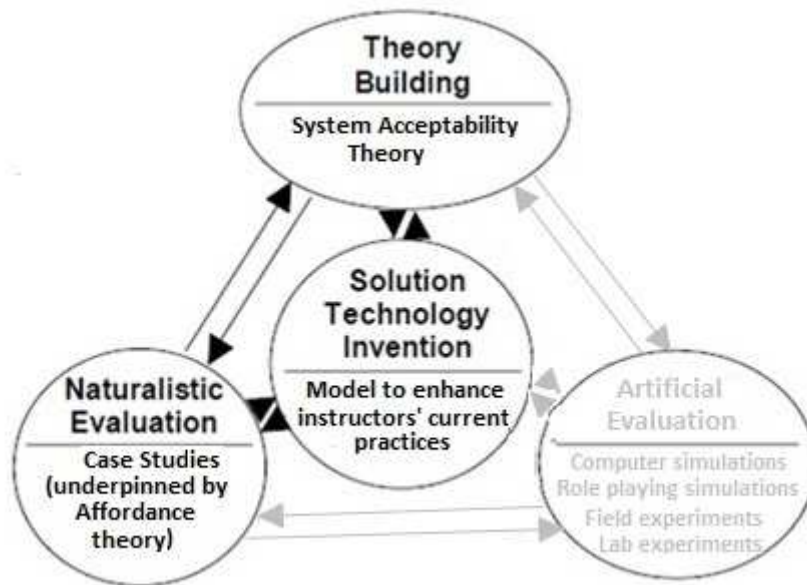


Figure 3-3: DSR framework contextualised (adapted from Venable & Travis 1999)

The research takes a Naturalistic Evaluation form, specifically six case studies at an Australian university, using interview instruments informed by the concept of perceived affordance. The role of affordance in this research is as a concept used to facilitate discussions with case-study respondents about ETEs, concerning broad features of different ETEs rather than specific functions.

Artificial evaluation was not employed in this research as none of the possible candidates, computer simulations, role playing simulations, and field and lab experiments, are suited for this type of research.

Theory building emerged based upon the analysis of case-study data and reflection against frameworks drawn from the body of HCI and system acceptability theories. The Solution Technology Invention under study is

the enhancement of educational practice supported by the use of ETEs. In this research, the model proposed enhanced the instructors' successful uptake and sustaining the use of ETEs.

3.6 Limitations of the Research

This study has a number of limitations, suggesting further study:

- Only one stakeholder type, specifically six instructors, were involved in the research;
- All participants were from the same institution;
- Not being open ended, the focus is on three particular educational technology applications and five particular affordances of these applications;
- It is an exploratory qualitative study in line with the research question, which seeks to explore the factors rather than validation process.

Possible further research could be a large study through mixed methods to validate findings and the model proposed.

3.7 Chapter Summary

This chapter provides the map of the research process in terms of the methodology for this study and justification for this choice. Starting with the research question and its aim, an interpretive stance with a qualitative approach was recommended.

Five qualitative methods were then examined, and after weighing the advantages and limitations of each one, the most suitable method was

recommended: six case studies at a major Australian university involving six participants, all instructors.

Data collection planned for the case studies was through semi-structured interviews and focus groups. The recruitment method for the participants was detailed in this chapter. Thematic analysis was recommended, aided by the use of NVivo as an analytical tool to avoid bias and to assist in analysing the rich qualitative data collected. The interpretation of the analysed data applied a design science lens in order to identify the technological, human and possibly organisational constraints and enablers to the uptake and sustained use of emerging technologies for education.

Chapter 4 (Data Collection and Analysis) presents the findings for this research, which include coding concepts and analysed themes. Those themes have been interpreted to develop a model for the improved uptake and sustained use of emerging technologies for education.

Chapter 4 Data Collection and Analysis

4.1 Introduction

This chapter describes the contextual and behavioural factors that influence instructor decisions to uptake and sustain the use of ETEs, as they are revealed through the analysis of the data collected. The case studies background and the interview respondents have been described in Chapter 3 (Research Method) and have been briefly re-iterated before presenting the data analysis. The interviews have been transcribed, and have been analysed with the help of NVivo 10/11. The employment of NVivo 10/11 as an analysis tool is to enable description of an unbiased answer to the research question and a summary of findings.

4.2 Case Studies – Instructors at a Major Australian University

A case-study approach has been taken to collect data, which enables a description of factors that influence instructor decisions to uptake and sustain the use of ETEs. The data collection instrument chosen is a semi-structured face-to-face interview. As the nature of this study is exploratory, the number of respondents have been limited to six. The respondents are all academics involved with undergraduate and/or postgraduate courses at a major Australian university in Melbourne. Full details about the interview participants are available in Interview Respondents in Chapter 3, and a summary is provided below.

The six selected interviewees were given aliases to conceal their identity. Their selection in the project was based on the researcher's knowledge of their involvement using ETEs in a higher education learning

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environment. Their technological confidence varies from non-technocrat (Merriam-Webster 1982) (Mel) to expert level (Ace, Ben and Sam), and at least half of them have experienced all three applications to various degrees. All interviewees have been involved with undergraduate courses, but Ace, Ben, Mel and Sam have also been and are still involved with postgraduate courses. The following is a short description of the interview respondents, listed in alphabetical order:

- Ace is a sessional lecturer/tutor; he does not develop content nor does he choose ETEs and associated delivery modes; he sees himself as an expert with technology, having a highly technical and managerial background; he has extensive experience in the industry and also the education sector;
- Amy is a sessional tutor, involved in setting up content using ETEs; her experience is only in the education sector; her first degree is in education;
- Ben is a full time academic lecturer/tutor and is involved in designing the delivery of content; he sees himself as an expert with technology, and he likes pushing boundaries using ETEs;
- Joy is a sessional tutor, responsible primarily for content delivery; she has experience in the tertiary education field as well as in industry;
- Mel is a full-time academic staff member who works mainly as a lecturer; she designs, develops and uploads curriculum resources; she considers herself a non-technocrat; her first degree is in education;
- Sam is a full time academic staff member who works both as a lecturer and tutor; he is involved in designing, developing and delivering academic content; he has previous industry experience,

with a highly technological background; he considers himself an expert with technology.

4.2.1 Applications

The first level of analysis presented looks at participant experiences and involvement with each of three different applications as instances of IS applications: Blackboard Learn (and Mobile Learn), Google Apps, and Facebook.

The three applications explored have been fully described in Table 1-1: Technology descriptions; and a brief description is presented below:

- Blackboard Learn is a virtual learning environment and course management system used to add online elements to traditional face-to-face courses and to improve online access for students. Blackboard Mobile Learn is considered part of Blackboard Learn;
- Google Apps consists of several Web applications available from Google, which provides independently customizable products. It provides similar functionality to traditional office suites, including but not limited to Gmail, Google Hangouts, Google Calendar, Google Drive, Google Docs, Google Sheet and Google Sites;
- Facebook is social networking system where users may create a personal profile, add other users as friends, exchange messages, post status updates and photos, and receive notifications when others update their profiles. Additionally, users may join common-interest user groups, organized by workplace, school or college, or other characteristics; and may categorize their contacts into lists. It allows for file upload and exchange.

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Firstly, both Blackboard Learn and Gmail are embedded in the case-study university (hereafter referred to as ‘the University’) infrastructure, and therefore used by all respondents. According to the University teaching policies, all undergraduate and postgraduate courses provide Blackboard shells to assure a consistent interface for all of the students (Teaching Policies, the University). In addition, every student and staff member has a free email account provided by Google Mail (Gmail). The degree to which each application has been used has been explored in more detail than the generalised use of a particular technology application, through the use of affordances concept.

4.2.1.1 Blackboard Mobile Learn

Blackboard Learn has a mobile version called Blackboard Mobile Learn, which is accessible to both Apple and Android users as long as they are University students or academics. The interviews revealed that Blackboard Mobile has not been used by any of the instructors in the participants’ pool due to limitations of the delivery mechanisms offered by the mobile Learning Management System endorsed by the University. When questioned on the reasons for not using Blackboard Mobile, two respondents revealed that they did not know about it. The other four respondents had tried it purely to see the student’s view when they use Blackboard Mobile Learn.

Blackboard Mobile Learn lists all courses that the instructors have taught and been provided access to by the University. The difference between students and staff members is that students usually have up to four courses per semester, and their university life lasts around four years, whilst staff members are involved in a number of courses for a number of years. The application seems to be designed with students in mind. There

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were a number of usage problems identified by the instructor's interviewed. Instructors cited getting overwhelmed by the large number of course code entries being listed. Issues raised were that instructors were not able to identify the current semester's entry easily:

'I connected to it... but when I saw the number of entries that came up of Blackboard shells... I decided not to continue using it. Especially when I could not easily see which semester's entry was which!' (Ben)

'When it was first introduced I logged in and found every course I had ever taught listed. It was difficult to find the current course and I didn't find any other advantages over simply using Blackboard via the website. Spoke to a couple of others who felt the same and have never attempted to use it again!' (Amy)

'Have installed it but never needed to use it on the mobile as I mainly use the Blackboard when at [University] and using a desktop PC. I did not continue using the mobile application because it had so many options on the screen, entries from previous semesters, that it'd overflowed the screen and the labelling was confusing. Labelling had no differentiation for the current semester's entries' (Ace)

Supported by interview responses, Blackboard Mobile Learn does not add value, as it is a limited version of Blackboard Learn that is not streamlined properly from an instructor's point of view.

4.2.1.2 Facebook

The third application explored, Facebook was used by only three respondents, for:

- overseas study tour;
- online studies; and

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- students' requests to communicate with instructors.

All participant instructors concurred that students and staff used Facebook as a communication tool rather than using the affordance of threading discussions offered by Blackboard Learn. The reason for the choice of Facebook over Blackboard Learn by the student cohort is outside the scope of this research; but this behaviour needs to be explored further in a study that involves students as stakeholders.

4.2.2 Affordances Used in Blackboard Learn, Google Apps and Facebook

Further analysis of the collected data is deepened to the affordance level. Five affordances have been considered (Table 3-4: Affordance descriptions), and a summary is described as follows:

1. Discussion threads – allows students and instructors to create a discussion thread and reply to ones already created;
2. Sending email – allows students and instructors to send mail to one another and also mass emailing to students in a course;
3. Setting up assessments – allows instructors to post quizzes and exams and allows students to access these via the internet;
4. Posting assignment upload details – allows assignments to be posted, students to submit assignments online, and instructors to mark and provide feedback to the students; and
5. Collaborating spaces – allows students and instructors to keep in touch with the academic community.

The affordances that the present research focuses on, and their availability across the three technologies in question, are labelled in Table 4-1.

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Applications ->	Blackboard Learn	Google Apps	Facebook
Affordances			
Discussion Threads	✓	✓	✓
Sending Emails	✓	✓	N/A
Setting up Assessments	✓	N/A	N/A
Posting Assignment Upload Details	✓	N/A	N/A
Collaborating Spaces	✓	✓	✓

Table 4-1: Availability of affordances in the investigated applications

The use of affordances by the research participants in the investigated technologies are compiled in Table 4-2. The first figure represents the number of participants who actually used the affordance of the technology, and the second represents the total possible respondents who could use the affordance of the technology. For example, the collaborating spaces affordance has been used by four participants out of a possible six in Blackboard Learn, five out of six participants in Google Apps, and none of the three respondents who used Facebook have used the collaborating spaces affordance in Facebook.

Applications ->	Blackboard Learn	Google Apps	Facebook
Affordances			
Discussion Threads	5/6	0/6	3/3
Sending Emails	5/6	6/6	N/A
Setting up Assessments	4/6	N/A	N/A
Posting Assignment Upload Details	6/6	N/A	N/A
Collaborating Spaces	1/6	5/6	0/3

Table 4-2: Use of affordances in the investigated applications

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4.2.2.1 Blackboard Learn

Firstly, in Blackboard Learn discussion threads, sending emails, setting up assessments, and posting assignment upload details have been used and experienced by between four and six participants (as displayed in Table 4-2). Collaborating spaces in Blackboard Learn has been experienced by only one respondent, Mel, who used it and reported an unpleasant experience:

'I used it last year in an academic workshop that I deliver every year for the Office of Learning and Teaching and it was an absolute nightmare. Hopeless. Would never touch it again in its current form. Everyone got really angry ... we lost a lot of traction ... we lost a lot of trust, I think. They thought it was a waste of their time, it was shambolic, it made us look technically, technologically illiterate. Yeah, I hated it.' (Mel)

The other interviewees did not appear to know about Blackboard Collaborate, the collaborating spaces affordance available in Blackboard Learn, with only Sam reporting that he had used it previously. He considered Blackboard Collaborate to be more appropriate for a set teaching piece than for an ad-hoc collaboration scenario:

'Ad-hoc stuff is not so good. ...I have used it, and for a set piece lecture, it's good. I would use it again, but I am not doing set piece lectures virtually anymore.' (Sam)

Blackboard Learn is used by all participants as its use is governed by the University policy, but it is clear from the participants' responses that the collaborating spaces affordance has hardly been used, and when it was used, it did not yield a good experience.

4.2.2.2 Google Apps

Discussion threads are not commonly used in Google Apps, as no respondents have used the affordance in the named application. It would be interesting to identify upgraded features of Google Apps that may be used instead of discussion threads, in a further study.

Discussion threads in Google apps are facilitated by Google+, which is new to the University and therefore not known and included in current practice. Sam reported experimenting with Google+, but admitted that the use of social networking to facilitate learning in higher education curriculum was new.

Not surprisingly, assessment-related tasks were not performed by participants in Google Apps, as a Learning Management system with associated assessment delivery, upload, marking and effective recording features was available (Blackboard Learn).

Despite only one respondent using collaborating spaces on Blackboard Learn, five out of six (Amy, Ace, Ben, Joy and Sam) have used these collaborating spaces features available in Google Apps:

'I am using collaborative groups and Google Hangouts; it's called Google Hangouts. Particularly in relationship to Google Calendar, they work really well together.' (Sam)

'With Google we are using it in a number of ways. I use it in a number of ways. I use it to share documents with the online and face-to-face students. So quite often what I will do is have it if I'm running a tutorial around the face-to-face class and also the online class. I put up one document that they can all contribute to. So it sorts of blurs the boundary between the online and face-to-face...' (Joy)

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Sam and Joy described the convenience of the integration of Google functions, including Google Hangouts. The affordance that stood out as being available but not used by participants was the discussion thread, which is mainly facilitated by Google+, a Google application recently added to the University's domain of application. Google offers another application, Google Hangouts, to afford discussion threads, which has been used sporadically by some of the study's participants.

4.2.2.3 Facebook

Collaborating spaces on Facebook have not been used; and the reason behind that behaviour is that both Blackboard Learn and Google Apps offer collaboration spaces, as well as respondents having reported that they use Skype as a collaborating space. For that reason, we can conclude that there is no need to go to Facebook to collaborate whilst in an educational environment. Students are reportedly using Facebook as a collaborating space, as some participants (Mel, Amy and Ace) pointed out:

'My students use Facebook actually to set up discussion groups, group assignment meetings, a whole lot of things. They communicate by Facebook.' (Mel)

It is interesting that no instructors have used the collaborative spaces within Facebook, as this is such a popular feature in use in the private personal social networking activities of students (Roblyer et al. 2010).

4.2.3 Interview Questions

The research question targets the contextual and behavioural factors influencing instructors' approaches to their decision to uptake and sustain the use of emerging educational technologies; but in order to have an all-inclusive approach, consideration has been given to technological,

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organisational and human aspects. The design of the semi-structured interview aims to target all relevant nodes in the system acceptability theory diagram, as illustrated in **Error! Reference source not found.** Some of the instructors might not know anything about the cost of the system/application that they are using, therefore the node(s) associated with cost have been omitted.

The total number of main questions included in the semi-structured interview is ninety-four. As the data collection instrument is a semi-structured interview, more questions can be asked; the main questions are the first prompting questions. This minimum of ninety-four questions is asked for all participants who have used all affordances available in all the applications explored. If a participant hadn't used all affordances in all applications, they were not asked all ninety-four questions, but a subset relevant to their experience.

The questions interrogating affordances of applications, presented in Appendix 3 (Number of Questions Asked Relative to all Possible Questions,) reveal the coverage of questions by respondents in regard to each application explored, as well as percentage of total questions asked.

Mel's percentage of questions covered is the lowest, because she has not used Facebook in an educational environment. In addition, she has used only Gmail out of Google Apps, for educational purposes. However, Mel stated that she used Google Drive/Docs on a personal basis for her research. All other participants answered most of the questions: between 70% and 80% of the main interview questions.

4.2.4 Participant Use and Non-use of ETEs

The analysis has followed a top-down approach, starting with all available applications (Blackboard Learn, Google Apps and Facebook), and then look at the following affordances within the applications:

- Discussion Threads
- Sending Emails
- Setting up Assessments
- Posting Assignment Upload Details
- Collaborating Spaces

In the following sections the reasons for respondent uptake of application/affordance, a discussion of the impact of uptake in terms of usability, and finally an explanation of why use of a particular affordance within an application was sustained, are presented. Instructors were asked to dissect their experience of application affordance use, to describe the reasons for continuing or stopping usage.

4.2.5 Results by Applications

4.2.5.1 *Blackboard Learn*

The first application explored, Blackboard Learn, is embedded in the University infrastructure. All courses use the Blackboard Learn shell to deliver content (Teaching Policies, the University). The participants in this study (Ace, Amy, Ben, Joy, Mel and Sam) had all used the Blackboard Learn application for between five and eighteen years.

The overarching attitude towards Blackboard Learn as a Learning Management System was negative; but this research only focusses on particular affordances available within the application, not the whole

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application. The commentary about Blackboard Learn application as a whole is described in the following quotations:

'Feelings are slightly changed, but I still don't like using the system.' (Ace)

'I also find Blackboard Learn is not very ... what I call organic. Students don't engage with it that much. They might retrieve the lecture slides and other than that input all the resources known to mankind on there and the uptake views are very ... don't reflect the student cohort numbers.' (Mel)

'Because it was University policy, we had to use it, so in the beginning it was very cumbersome.' (Mel)

'Not that I liked it that much. I used it because it's there and it is a good delivery system even if it's got some problems.' (Ben)

However, all participants (Sam, Mel, Joy, Ben, Amy and Ace) acknowledged the benefit to cohorts of students in being exposed to a single interface, as there was a level of familiarity for students when accessing learning material from courses. As well as a common interface design increasing ease of use for students, they were also required to sign into the application only once, which was also considered to be a benefit. Participants' comments highlighting the benefits of using Blackboard Learn are summarised as follows:

'Blackboard - efficient because once again is the integration thing, centralising. That why, it's a central point for everything that you, all your access, everything that you're supposed to need for the courses.' (Ace)

'Students can access Blackboard from anywhere, they all access the same version. ... one central point that we can use.' (Amy)

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'One of the strengths of Blackboard is that it sits there, as open access to every student in the cohort so they are getting the same information. So in terms of continuity and consistency is very important.' (Mel)

'I used Blackboard because it was there and the official delivery system for the University. That's why I use it.' (Sam)

'Yes Blackboard's the first point of call, so every student ... I think it's important that students have a one place to go that's the same for everybody. ... we got to make it easy so the student experience is a good experience. I suppose at the end the student experience is what means that my resistance has to be more futile.' (Ben)

'Blackboard, with all the security and the login and moving from one security to another you feel like, my god this must be ultra-secure.' (Ben)

'Blackboard is just a lovely way of making sure you can disseminate things very simply. So once everyone's pathway into it, then I feel very confident that I'm communicating effectively and not missing people.' (Joy)

The integration of extensive affordances available within the Blackboard Learn application was appreciated by Sam and Amy. A negative perception of using Blackboard Learn was the feeling of being restricted by simple affordances and not always being able to access ETEs in a timely manner. Most reasons for being dissatisfied with the Blackboard Learn application were associated with the interface design and the technology application at affordance level. Dissatisfaction with Blackboard Learn is described in the following commentary:

'The only reason I still don't like Blackboard is because it's still in archaic mode, it hasn't changed with time, the user interface.' (Ace)

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'Blackboard is isolated you can't use anything else.' (Ace)

'... the Blackboard interface I don't like, it's a sort of archaic ...'
(Ben)

'And that's the problem with Blackboard Learn: I don't feel that with Blackboard Learn I can easily put a picture or a link or ... it feels like I can just put text. Feels texty! One dimensional.' (Ben)

'Blackboard feels like older software; it feels like it hasn't quite evolved to the point that the others have had.' (Joy)

'My biggest problem probably here would be with Blackboard Learn, because if I had to send a file to a student I literally have to say import/export/attach. I can't drag and drop a file into a message and say send that file to that student.' (Joy)

All respondents have been using Blackboard Learn; but the extent to which each of the respondents has used each affordance in each application differs. The most used affordance in the Blackboard Learn application is the affordance of posting assignment upload details. All subjects reportedly have assessments where students have to critically analyse a proposed case study, and the students upload their reports to Blackboard Learn. The least-used affordance is collaborating spaces: this has previously been used by Mel and Sam, but they have had a poor experience due to the affordance's limitations, and technological problems with hardware compatibility.

Blackboard Learn: Resistance to Use

Ben, Ace and Mel indicated that their antipathy towards the Blackboard Learn Application was based on technical issues. Mel also added that her

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perception of the resistance to using the Blackboard Learn application stemmed from a lack of formal training in the system. Ben and Ace openly admitted that they were reluctant to use the Blackboard Learn application, with Ben providing his reason for changing to an acceptance of the inevitability of using Blackboard Learn, and eventually changing his mind about the usefulness of the affordances under discussion:

'... Blackboard resistance... Resistance was futile. ... I've changed my mind in it so far as yes it's the first point of call so every student ... I think it's important that students have a one place to go that's the same for everybody. ... suppose at the end the student experience is what means that my resistance has to be more futile.' (Ben)

Blackboard Learn has integration with the official emailing system (Gmail) and Turnitin, which was previously used independently. The application and associated affordances felt isolated to the respondents, as the interactions were only within the application and awkward to use with the outside environment. However, that does not appear to have been an important factor, as instructors understood the limitations and worked around them.

Reliability of the application has improved; but because of its history the perception of reliability is quite low:

'... but I always have to carry USB backup on everything I have sitting on Blackboard Learn, because frequently you go to class and always when you are offshore teaching, but more frequently here in Melbourne, the system just collapses on us.' (Mel)

Training at an organisational level has not been reported in the interview. Ad-hoc and requested training has been reported. Amy has in fact asked for training in particular features of Blackboard Learn, but the training

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was very general and did not answer the specific questions she had. Ace, Joy and Mel reported having peer training when needed, which was quite successful in answering their questions.

Mel reported that expectations as instructors are high when it comes to students knowing how to use Blackboard Learn effectively and finding the content they make available for student use:

'We want to be seen that we're providing students with a lot of resources cause it's electronic, but I think we're overwhelming them. At undergraduate level. ... I think we have a lot of assumptions about students' ability to use Blackboard very effectively. I would like to see in Orientation week or week 1 a "how to use Blackboard" workshop. Cause we make a lot of assumptions.' (Mel)

System security seems to be reasonable, as all respondents believe that the Blackboard Learn application is secure.

4.2.5.2 Google Apps

Google apps is a number of seamlessly independent applications which can be accessed together. Almost all participants had a Gmail account, which compared to previous email systems offered flexibility and improved accessibility. The technology application was available on mobile devices.

Google apps is an ETE, and relatively new to the University's infrastructure. The main capabilities used were Gmail, Google Calendar, Google Drive and Google Docs. In addition, participants reported using a combination of the application affordances on offer.

Amy, Joy and Mel were reluctant to use the Google Apps system. Joy had to try Google Apps privately before committing to using it for educational

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purposes. Amy found the Gmail interface a lot different to the email system she used at home, and needed time to get used to the discussion threads used in Gmail. Mel distrusted Google as the private enterprise that it is. Ace, Ben and Sam were never reluctant to use the application, as they had previous Gmail personal accounts and were already familiar with the usage aspects of functionality for discussion threads.

Sam was overly enthusiastic about using Google apps, as he was a certified Google 'guru', being the only participant to do the required formal training. Not much informal or peer training has been reported for Google Apps.

However, even with the application being part of the University's infrastructure, it was not disliked. All participants (Amy, Joy, Mel, Ace, Ben and Sam) used Gmail for their digital communication with students.

The applications, as much as they are meant to be seen as a package, do not allow easy connection between applications. When using applications in the Google Apps package respondents reports having the need to constantly start from a main menu and then go to a specific application rather than navigating between applications, as Ace noted:

'What Google's doing instead of saying 'here's Google' and then you run though a menu saying this integrates with that or your right-click here and it goes into some other integrated application, you have to go to a front-end application which sits there on your quick launch or toolbar and then you have to go to the specific app, you can't just go oh, I'll go into Google drive, right click on this document and say set a calendar appointment for that set of minutes of whatever, which just happen to be a Google doc, right. You can't do that, you have to go one application to do that specific and then you have to go to another application to do another specific.' (Ace)

4.2.5.3 Facebook

Facebook has only been used by Joy, Ben and Ace for an educational purpose. Their reasons for using Facebook were to create the opportunity for students to build a community of practice within a social network, whilst both onshore and offshore. In the courses delivered face-to-face and online, communication with students was via Facebook at the student cohort's request.

Facebook is typically not the preferred application of universities, but more a social networking application dominant in the personal space (Roblyer et al. 2010). However, staff use Facebook, in conjunction with official applications available via the infrastructure with an official email address, to allow for better security and recognition of students or staff members as part of groups.

Ace, Ben and Joy were never reluctant to use Facebook for enabling students to communicate with each other and with instructors, even when they were studying at different international geographical locations, as occurs for example with study tours. This however does not mean that they like the application.

Pedagogical arguments were used by Mel, Sam, Ben, Ace and Amy to underpin their decision to use Google Apps affordances. Mel stated that she did not use Facebook for enabling student conversations outside the boundaries of the traditional classroom for the following reasons:

'Look, I have colleagues that are using both Google and Facebook. My first degree is in Education and then I got subsequent degrees. But I believe a lot of it only contributes to a surface learning. I think it's a tool that adds the spark..., doesn't even add the sparkles. I think it's tokenistic. ... In actual fact even if I don't use

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Facebook and Google Apps I really look forward to change, transformational change, technological change because I think it opens up a whole new wave of possibilities, but unless I can justify it pedagogically I don't use it because it's the new thing tool that everyone's using. (Mel)

As no formal, organisationally-supported professional development, informal or peer training was reported by participants, self-efficacy may have been an issue in using the technology. In addition, staff need to be aware of ongoing pedagogical developments, for example flipped classrooms (Kim et al. 2014) and peer teaching (Kearney et al. 2012), needed to successfully embed the ETE in their courseware and associated activities. Ace, however, reported that students showed him how to set up a closed group, to enable community of practice, threaded discussions to use the application, which can be seen as a form of peer training:

'Students had to, in the class, had to guide me on how to create the so called group or whatever it was called.' (Ace)

4.2.6 Results by Affordances

The affordances chosen (discussion threads, sending emails, setting up assessments, posting assignment upload details, and collaborating spaces) have different capabilities and implementations in each application. Not every affordance is available in Blackboard Learn and Mobile Learn, Google Apps, and Facebook. Each affordance is now briefly introduced, and typical usage has been described in each of the three applications. A discussion, of each participant's reasons for uptake and sustained use or refusal to adopt affordances to support the delivery of courseware in higher education, has been presented.

4.2.6.1 Discussion Threads

Discussion threads are present in Blackboard Learn and Mobile Learn, Google Apps, and Facebook; but the way they are implemented in each application is different. The most complex implementation of the discussion threads is within Blackboard Learn and Mobile Learn. Blogs and forums, which can be topic based, are available, and the selected group of users are allowed to post and read posts. When a course is conducted using teams, each group can have their own discussion specific to the work setup. Amy reported teaching a course where groups were created in Blackboard Learn, and discussion boards allowed for each group. The instructor facilitated the discussion group. Students that used the discussion thread found it to be effective. However, staff reported a large, time-consuming volume of reading, when posts were assessed every week. The pedagogical implementation was critical to easing workloads whilst assuring acquisition of learning outcomes facilitated by the instructor. An example from another university is a two-year Web 2.0 project funded by the Australian Learning and Teaching Council (ALTC), reported by (Gray et al. 2010), and papers associated with the project (Waycott et al. 2010). It should be noted that discussion threads are not to be confused with the blog feature available in Blackboard Learn and Mobile Learn.

Google Apps have Google Hangouts, and recently Google+, as discussion thread tools. During the period of the present research, ETEs rapidly evolved: for example, Google Apps. Google Hangouts, Google Talk and Google+ Messenger were replaced by Google+. The affordances available in Google+ are similar to those in Facebook:

- Discussion threads;

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- Private or group chat; and
- File upload and sharing.

Google+ does not have topic-based forums that support more efficient structured communication between students and instructors. Ben mentioned that Google+ has just been added to the Google Apps available. The length of time that the application was available severely restricted the capacity of participants to commence using the application, let alone to consider sustained use:

'... the Google+ has only just been added to the University domain. I think there's not many people on the Google+.' (Ben)

Facebook, similarly to Google+, lacks the facility to create a discussion thread with the ability to create topic-based forums. In addition, a group needs to be set up so that members can post messages and upload photos and files to be shared within the group. The settings for the group can be set up for an open group or a closed group or even a secret group. Universities have acknowledged that Facebook is part of the students' learning experience. A Facebook account can be associated with the official University email address, and therefore the members of the group are vetted by the university for security compliance with no extra administrative work employed.

Figure 4-1: Discussion threads – interviewees' experience shows the distribution of participants using discussion threads in the Blackboard Learn, Google Apps, and Facebook applications.

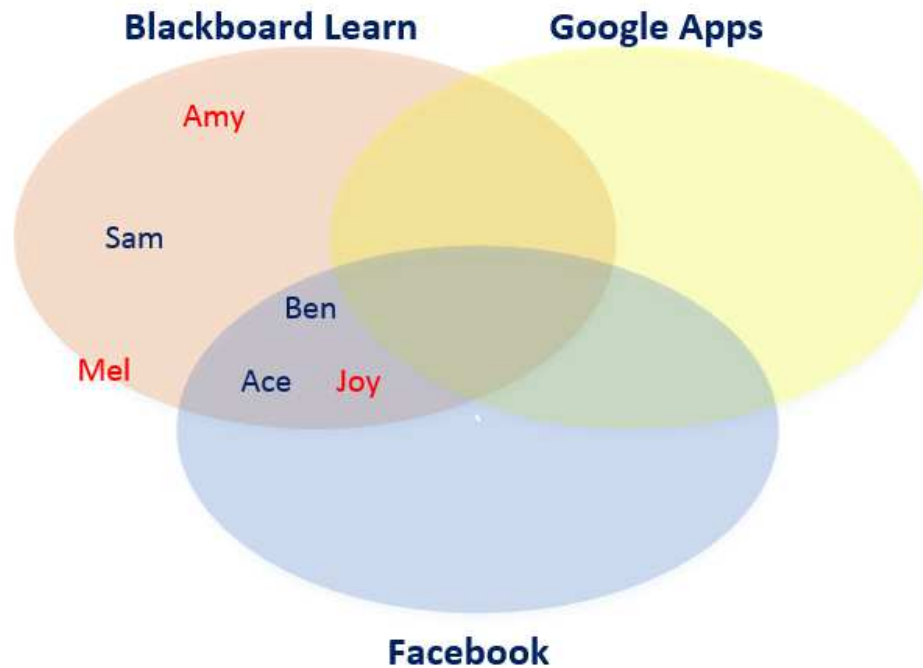


Figure 4-1: Discussion threads – interviewees’ experiences

Discussion threads on Blackboard Learn have been used by all respondents to some degree. Interestingly, although all participants reported using the discussion thread affordance at some point in time, the use had not been sustained.

The main feature of a discussion thread is that it is a (digital) conversation where the participants exchange thoughts through posts and documents. The students appear to see the discussion thread affordance as a way to get answers to assist them in preparing for assessment tasks. Answers were quicker to access through the use of the Blackboard Learn application using disseminated exemplars of assessment task components. Discussion threads within Blackboard Learn are only available where connectivity is available. Communication capabilities available in discussion thread and email affordances have the potential to confuse usage choices. Both instructors and students can become

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confused as to which channels of communication are available or which should be used. Available infrastructure impacts on the use of the affordance, in addition to a lack of knowledge with respect to technical capability and pedagogical changes required:

'From a teaching and learning perspective, I don't think, well the actual idea of discussion board is good because it provides the students an avenue to go to. The problem is that I found that students double-dip and it wastes my time because if they don't get a response within a minute or two on a discussion thread then they send me an email. Then I'll get spammed twice so it uses up my time twice on two different channels. So the more channels I give to my students the more time that it seems like it uses up.' (Ben)

'...it's connecting; it's linking up with other environments. You know, having a connectable or set up on a mobile device or sort of being able to seamlessly go to it without having to log in, log in, click, another window, there's you know 6 or 7 clicks to get to it rather than just bang, straight to it!' (Ben)

'Discussion threads for that, but I found the email solution easier. Then I remembered: "I did not look at the bulletin board so I need to go look at it"; and I guess that because students get the information from the email, they tend to not look either.' (Sam)

Ben also noticed that once the number of students dropped in a course the use of discussion threads became impractical. The threads became long and cumbersome, and the students started contacting their instructors via email as a first port of call to get assistance.

As there was a lack of notification ability, students were often unaware that the answer to their question had been posted in the discussion thread. When student numbers exceeded approximately sixty, the

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instructors could only act as facilitators and could not answer every student question directly. Dissemination of information from one to many users is better via email, according to Ben. However, in groups of around forty it became counterproductive, as Ben stated:

'The emails seem to work OK, but jeez when you've got 100 -120 people, discussion board! Because you've got a lot more people, there are a percentage of people that are switched on, that can answer and sort of support the learning environment and I can sort of be more of a facilitator rather than the dictator or the answerer of every single question cause no one else feels comfortable in the group to answer it.' (Ben)

As Gmail accounts became the default emailing system, availability improved. As this application was available on all devices, the uptake levels increased and the use over time was sustained. Two-way conversation is needed for large groups of students. The ability to chat on mobile devices has reduced the use of discussion threads as a Blackboard Learn affordance suitable for getting students to ask and answer questions:

'But in the database subject I used it as well and then I stopped after that, because the engagement by students was lower and lower and lower. It was a waste of my time. This is like the same 2 students, may as well have an email conversation with them.' (Ben)

'It was not in my normal routine; it did not develop in my normal routine to keep going looking at it. Whereas I found email, it pops up in front of you ... When somebody sent me an email, which they seem to prefer, I will deal with it.' (Ben)

'I don't think, well the actual idea of discussion board is good because it provides the students an avenue to go to. The problem

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is that I found that students double-dip and it wastes my time because if they don't get a response within a minute or two on a discussion thread then they send me an email.' (Sam)

'But to add to that, it's the emailing which helped there...' (Ace)

Discussion threads on Facebook were mainly used as a secondary form of communication; and it must be noted that, unlike the Blackboard Learn version of the same affordance, they are unstructured and not just text: the ability to upload photos, text and images has improved uptake, particularly in personal environments (Roblyer et al. 2010).

One of the biggest factors for the stalling uptake of the discussion thread affordance on Blackboard Learn was the lack of student uptake, mentioned by most participants, (Ace, Amy, Ben, Mel and Sam). Only Joy mentioned student uptake as a driving force for instructor uptake and sustained use. She had observed that:

'When the students are doing assignments they quite often have to work in groups so we set up a discussion forum for the group, for each group. And they interact with each other through that group.' (Joy)

Efficiency and ease-of-use were facilitating factors in student and staff adoption and sustained use of affordances to facilitate communication. The evolution of email has hindered the communication affordance use in Blackboard learn, Mobile Learn, and Facebook. Students and, more importantly in this study, instructors use both discussion threads and email to facilitate students asking assessment guidance-related questions and providing answers in manner that is not workload intensive (Waycott et al. 2010).

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Two other factors that might influence uptake negatively are the complexity of the affordance and the lack of integration with other applications. Instructors and students do not like the requirement for several sign-ins and switching between available applications. Students and staff like an application integration to be seamless (Abrams 2012). Technology infrastructure issues are caused by organisational guidance, policy and training.

The present research indicates that the most important enablers for the successful uptake and sustained use of discussion threads affordance are, firstly, if the use of an affordance enhances pedagogy, followed by the student culture acceptance of ETE.

4.2.6.2 Sending Emails

Sending emails is an affordance available actually only in Google Apps, via their web-based and mobile versions of the application. Facebook does not allow email to be sent, as it is a discussion-based application. The Blackboard Learn and Mobile Learn applications allow only the initiation of email; and it then goes through the official university email system, Gmail. Integration between the Learning Management System and organisational email system was thus in place:

'Apart from maybe the fact that it has integration, supposedly has integration to the school directory system, you know to say which students apply to it.' (Ace)

The advantage of using the Blackboard Learn and mobile Learn to initiate the emails was that you can use the groups which were already set up in the system:

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'... the groups ... it was basically a contact list for each group within the session and that's all it was, it was a contact list and all I would do was go into, I think its tools, groups, go to the particular group, select all the students, didn't even look at the students, just said add all the students then send the email, sent right? So it's just a different way of using an email program.' (Ace)

'I do it. I use it to contact groups of students or individual students, so I go into the Blackboard and I see them listed there. You can click on them, you can put together a selected list of students and then email just that list. So I use that with the online students, each week or fortnight I'll email them just to say just checking in make sure that everything's alright.' (Joy)

The Blackboard Learn and Mobile Learn email affordance fails to deliver a message only when a student/instructor is not registered for a group. However, previously, when students had to manually log into the groups to receive emails, inaccuracies would happen due to students moving groups but not altering the online group to which they belong. In the current system, the students had the choice to leave their old group, and they would get an email for the old group but not for the new group, unless they enrolled in the new group. The structure of each course dictates the need for groups and if a subject does not need the creation of groups. The easiest way to send email to all students enrolled in the subject is either via an announcement on Blackboard Learn or by using the course distribution list in the email application. Discussion threads can become quite long and, depending on student contribution, can often shift off-topic. Sending emails is preferable as a tool for one-to-many dissemination of information:

'When somebody sent me an email, which they seem to prefer, I will deal with it, and what I do, I can see the distribution list if I

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thought that it was an issue that was going to be worthwhile for everybody.’ (Sam)

‘I haven’t looked at it [sending emails via Blackboard Learn] since then [2007] ... I use the distribution list ... That’s what I normally do.’ (Ben)

‘I think that any discussion I facilitate is face-to-face in class and also through the announcements on the Blackboard Learn.’ (Mel)

Mel was the only participant who had not used the email system available on Blackboard Learn, even though it allowed communication with students on any device, which includes phones. Mel stated that she did not know the affordance existed. She has posted announcements on Blackboard Learn and Mobile Learn, which resulted in emails sent to all students enrolled in the course.

Figure 4-2: Sending emails – interviewees’ experience shows the distribution of participants sending emails in the Blackboard Learn, Google Apps, and Facebook applications.

Gmail is embedded in the university infrastructure. Institutional policy dictates the boundaries around its use in terms of ethical conduct, and uptake by both staff and students. All respondents (Ace, Amy, Joy, Mel, Ben and Sam) had used Gmail previously, so the transition to using it for educational purposes rather than only for personal communications was reported, as seamless.

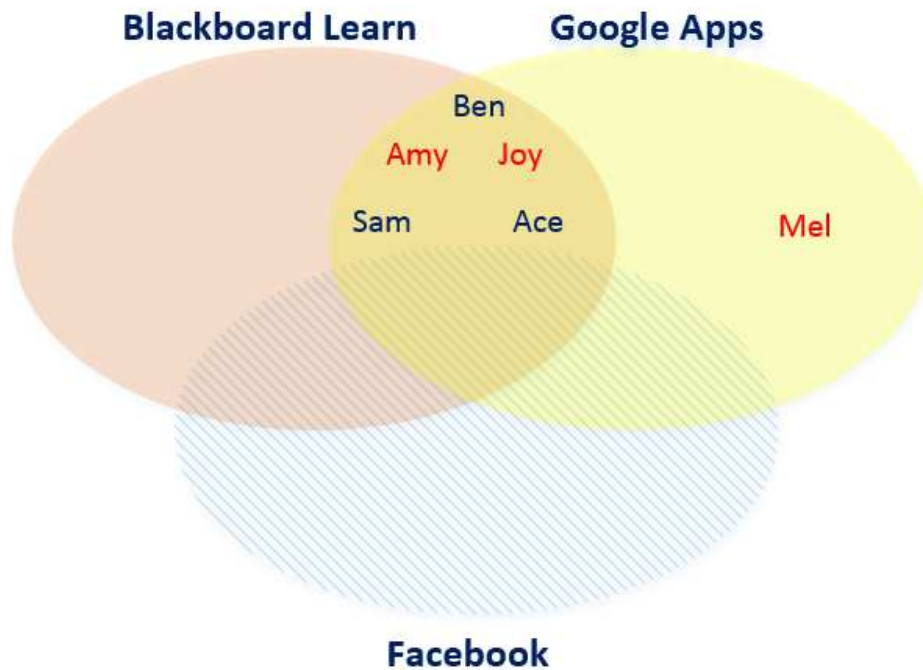


Figure 4-2: Sending emails – interviewees’ experiences

However, Amy and Ace found Gmail was cumbersome. They felt that actions such as archiving, retrieving archived emails, and creating groups and email threads were difficult to operate. All participants saw the pedagogical importance of sending emails regularly to students, to create a channel of communication, starting with a ‘push’. Amy and Joy reinforced the importance of initiating communication with students, as expressed in the following:

‘Yes and also I think by answering it personalises it too. I think they are much happier with us now...’ (Amy)

‘I was a bit reluctant about that! ... I’m actually really positive about it. I quickly became positive. I don’t think they necessarily read the email, but it gives them weekly contact with us and then they email us back and it’d developed this ...oh, it’s not personal I think now, so I think it’s been successful.’ (Amy)

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'I'll email them just to say just checking in make sure that everything's alright, just general hey, how you're going... Keep in touch with them... I'll also use it to chase up people, that's my main way of contacting the students.' (Joy)

Mel has never used emails via Blackboard Learn because she did not know that the feature, and its associated functions, was available. The reason Mel did not know the affordance existed was due to a lack of training at an organisational level. Ace, Amy and Joy have sustained the use of Blackboard Learn to send emails, as they see its pedagogical value. The affordance was needed for delivery of their courses. Ben and Sam used to send emails, and stopped because the use of sending emails affordance does not fit with their subjects' setup.

One of the biggest barrier factors for the uptake of sending emails was reported as the cumbersome operations, irrespective of whether the application was Blackboard Learn or Gmail. It seemed that, the more complex an affordance was to use (Nelson & Stolterman 2012), the less likely that it would be adopted and that use would be sustained over time:

'...you want things to be simple rather than more complex with technology, right?' (Amy)

'Yes, because we do everything at the last minute.' (Amy)

Another factor that seemed to be both an enabler and a barrier to affordance uptake and sustained use was extra functionality offered by an affordance. Whilst additional functionality generated a positive response, limited functionality has a negative effect on uptake and sustained use.

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Amy, Ben and Sam found sending emails through Gmail to be preferable to the affordance offered by the Blackboard Learn application, as they could personally communicate with their small group of students:

'[Blackboard Learn] is not difficult to use, but...So if I want to add in the lecturer, they are not listed in Blackboard Learn, I have to type in... there is another little window in the form 'do you wish to add an additional recipient?' and then you have to type their address in and it doesn't come up with the address automatically, you know when you start typing your name and it will pop up with all the options of what that ... and the you can choose which ... It does not have that function, so you have to be able to cut and paste the email or remember it off by heart. Which I usually remember, which is fine but it's just an extra step I have to take, it would be nice...' (Amy)

'No [I don't use the email option]. Only because I like my email server to have a record of everything I've sent out and a record of everything that comes in. I don't want to be disjointed, you know I suppose I could send them to myself. I haven't looked at it since then [2007] ...' (Ben)

'It was easy enough, though the lack of formatting of messages I found it was a bit of a put off. Just plain text, not HTML. And I tend to dress up my emails a little bit so. That is probably the major impediment ...The limited control. You have some control [Blackboard Learn emails].' (Sam)

The usability in the design of the interface was deemed to be flawed, by Amy, Ben and Sam. In terms of Nielsen's practical acceptability theory, the following can be concluded:

- Participants use recall rather than recognition of email (lack of memorability);
- Reduced functionality (reduced efficiency of use);

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- Subjectively not pleasing (reduced user satisfaction).

The most positive influence on the use of ETE-type applications, which in this case are Blackboard Learn, Goggle Apps, and Facebook, and on the affordances available in those systems, is their efficiency. With Gmail being available almost anywhere, anytime, anyplace and on any device, it becomes easy to adopt by students and staff, who are not reliant on interacting with the tools to efficiently communicate. Efficiency, coupled with an intuitive interface and integration to other desktop productivity applications, especially other Google Apps and independent applications, make Gmail a popular tool.

Blackboard Learn does not provide the opportunity for instructors to integrate to other ETEs as they become available, as it is part of the University infrastructure, and available functionality is negotiated, implemented and enabled by the Information Technology Services department rather than individual instructors.

The last positive factor that enhances pedagogy is that of sending regular emails to students and creating a channel of communication starting with a 'push' (Amy and Joy). By creating and keeping open channels of communication, the instructors are more likely to build a stronger relationship with the students.

The findings of this research indicate that the most important enabler for the successful uptake and sustained use of sending emails affordance is, firstly, affordance's efficiency of use and then the degree to which an affordance enhances pedagogy.

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4.2.6.3 Setting up Assessments

Instructors can set up the semester's formative and summative assessments within Blackboard Learn and Google. Depending on the type of assessment in question, the use of Facebook may be problematic. The affordance that enables instructors to set up assessments provides for the upload of alternative test types, such as multiple choice (MCQ), short answer, matching, hot spot, and filling in the blank questions. Tests are used for students to self-diagnose their learning and for instructors to gauge performance against specified learning outcomes. The participants in the study all used the setting up assessments affordance via the Blackboard Learn application. The functionality and associated professional development training was provided at an institutional level for permanent staff. Sam had started to use Google Apps, but this meant that the GradeCentre functionality available in Blackboard Learn had to be mirrored in spreadsheets created by staff. Development of all of the tools required for student assessment and storage of formative and summative marks by all instructors are, organisationally, resource intensive.

As the marking of online multiple-choice questions (MCQ) does not require instructor moderation, supported by the organisation. When tests are marked, the result got recorded in Grade Centre. An affordance is more likely to be sustained for the subjects in which the tool can be applied to achieve their pedagogical set outcomes; more likely where the student numbers are large.

Figure 4-3: Setting up assessments – interviewees' experience displays the distribution of participants' setting up of assessments in the Blackboard Learn, Google Apps, and Facebook applications. Mel has not

used the setting up assessments affordance available in the Blackboard Learn application assessment setup, as she does not see the pedagogical value of quizzes, or multiple choice questions:

'Well again, the way we set up the assessments in these courses, again it depends on what the learning outcomes are. Because we have face-to-face tutorials I don't like multiple choices pedagogical assessments learning and I think it disadvantages the majority of our cohort where English isn't their first language. I prefer to look at problem solving, critical analysis rather than multiple choice.' (Mel)

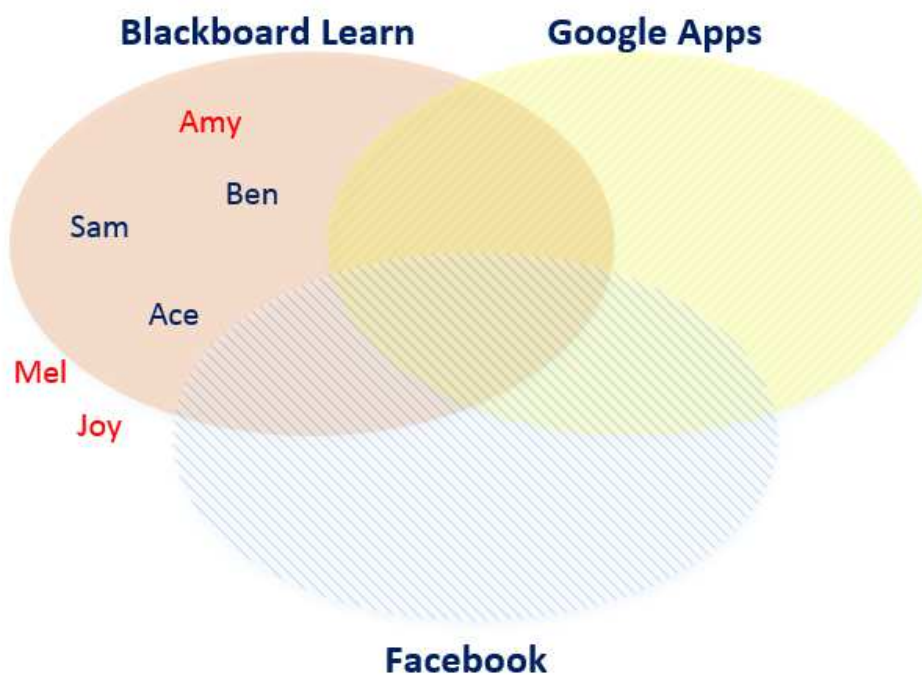


Figure 4-3: Setting up assessments – interviewees’ experiences

Joy is another participant who has not used the assessment setup affordance within Blackboard Learn, because the course she teaches does not require this kind of an assessment. Joy is not a course coordinator or involved in the course delivery decision making. As she has not used the setting up assessment affordance, she was not aware that the affordance

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existed. Training at an organisational level would possibly expose the knowledge that the affordance is available. Ace has used the Blackboard Learn assessment setup affordances as a tutor, but has not been involved in setting up assessments for the course delivery or uploading results to Grade Centre.

Amy, Ben and Sam have set up assessments content for the courses they teach. Amy is involved in a subject that uses formative assessments to diagnose the understanding of concepts taught in lectures and tutorials. Effective resource allocation is dependent on learning and teaching initiatives that provide opportunities for students to receive learning feedback that uses available technological communication tools and does not require instructor marking time allocation. Online summative assessments have also replaced the previous form that was marked.

Barriers to sustained uptake were caused by poor infrastructure, as the Internet dropped out frequently. The Blackboard Learn setting up assessments affordance also behaved differently depending on the Internet browser used. For example, Amy reported that pressing the back navigation button would sometimes result in the student being thrown out of the test. In addition, there were compatibility problems for students using a MacBook. This highlights a people issue, as students do not use the available infrastructure provided to them by the University:

'There were certainly some problems to begin with if they use the mouse to backtrack, that threw them out.' (Amy)

Sam uses the Blackboard Learn online assessments as formative diagnostic tools. Feedback is provided for students as an incentive to study. Ben has pushed the Blackboard Learn assessment setup test

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functionality further by programming an add-on, so that an infinite number of questions could potentially be created from the standards provided. The innovation tests the same concepts, but each student is automatically given a different question generated by the program algorithm to minimise the risk of plagiarism.

The biggest barrier factor to the uptake of the setting up assessments affordance was due to untrained staff and a difficult, unintuitive interface causing errors. Students accessing erroneous material about their marks results in a negative attitude towards the course: for example, students finding 0 recorded in the GradeCentre when results were released; and not all marking being yet completed. Resultant poor staff performance, assessed according to student satisfaction, creates another barrier to uptake and sustained use of the affordance.

Compatibility with other hardware or software systems can also inhibit the use of the affordance due to the resulting limited functionality. Integration of the tools available within the Blackboard Learn improves the functionality, especially in terms of the diagnostic tools delivery to any device anywhere at any time. It has to be noted that an organisational and technical barrier to the successful uptake and sustained use of an ETE is the fact that the organisation pays for a limited number of available tools, depending on University policy.

The most positive influence on the uptake and sustained use of an ETE is the enhancement of pedagogy and the quality of teaching offered by the subject. Improved student satisfaction has been reported by Amy, Sam and Ace. Evidence was reported as an improved Course Experience Survey (CES):

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'So it [online assessment] makes it much fairer for the students and it also assesses a wide range. Bit more complex to do. But at the end of the day it's better for the students.' (Amy)

This research found that the most important enablers for the successful uptake and sustained use of setting up assessments affordance is, firstly, the capability of an affordance to enhance pedagogy, followed by the affordance's compatibility with other systems, both hardware and software.

4.2.6.4 Posting Assignment Upload Details

Posting assignment details and student upload of completed assessments is the next the Blackboard Learn functionality that was interrogated. Typically, the type of assessment uploaded related to analytical thinking activities requiring essay type reporting and upload by students. As the University has decided that no paper-based assessment submissions is to be administratively supported, all reports and essays are submitted to Blackboard Learn using Turnitin. Once the assignment is completed, students upload their work through a Turnitin link. This plagiarism tool provides information such as an originality report. Each course provides a link with assignment requirements on the course website via the Blackboard Learn shell. The assessment gets marked online with or without the use of rubrics, depending on the assessment settings determined by the course coordinator. For example, in a programming subject where the answer is more likely set, the use of rubrics is not required:

'Rubrics are useful. I like them for more qualitative type markings, so for essays and discussions areas, but for SQL, for programming it's black, it's white, nothing in between. ... I don't know how useful the students would find it.' (Ben)

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As well as the provision of student feedback via rubrics, instructors can make short comments throughout the document and an overall summary statement. The summary comment can be provided to the students in a textual or audio form. The result of the marked assessment is made available to students through the Blackboard Learn Grade Centre. Students are required to access their assessment via the Turnitin link that they used to upload their assignment into the system, in order to get their feedback. All participants have used the affordance to varying degrees. As the University policy stipulates that assignment submission must be online and that the Turnitin plagiarism software must be used, staff are compelled to use the Blackboard Learn and Mobile Learn. Assessment should go through University official channel – Blackboard Learn - and that would be the reason why both Facebook and Google Apps are not being used for this affordance. The University infrastructure is, then, a barrier to Google and Facebook uptake for assessment purpose (posting assignment upload details affordance).

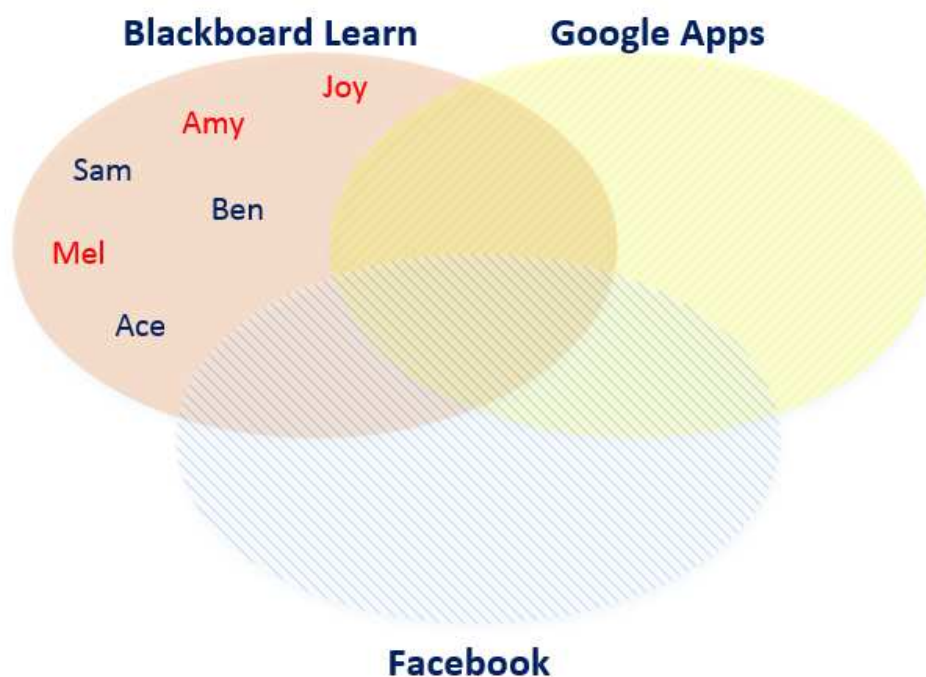


Figure 4-4: Posting assignment upload details – interviewees’ experiences

Figure 4-4: Posting assignment upload details – interviewees’ experience shows the distribution of participants in posting assignment upload details in the Blackboard Learn, Google Apps, and Facebook applications.

All respondents (Sam, Ben, Mel, Amy, Joy and Ace) confirmed that the Turnitin component was a valuable tool:

‘I like Turnitin, because you can go and look at the originality reports and also Turnitin has become far more sophisticated now ... the fact that you can request original documents and stuff like that, when it's high similarity I find it fantastic.’ (Mel)

The rubric also has an important place in the suite of tools available to ensure that marking across a number of assessors or instructors was automatically moderated. Rubrics also ensure a minimum level of feedback is needed to be provided to each student. Instructors require training in Learning and Teaching and technology use to design and set up rubrics. The complexity of the set up procedure and the repetitive nature of the task were barriers to uptake and sustained use. Each time a rubric is required, the setup procedure must be repeated, as there is no provision for import or export. The functionality requires a larger amount of people resources than should be necessary in a functionally well-designed application, which constitutes a technical barrier to uptake and sustained use. The constraint operates at an institutional as well as individual level:

‘Setting the rubric up, it was a lot of work. ... I mean I had to find instructions, so I ended up finding on the Internet, I ended up

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finding a Turnitin guide book, about 100 and something pages and I printed it out.' (Amy)

'The electronic rubric I found very hard, I actually had to get a colleague who's very skilled at it to do it, cause the attempt I put up didn't respond.' (Mel)

The way Sam uses rubrics is more complex than the posting assignment upload details affordance offered by Blackboard Learn. Due to the rubrics being more complex than the functionality offered by the posting assignment upload details affordance available in Blackboard Learn system, Sam set up a custom rubric in an Excel spreadsheet rather than via Blackboard Learn:

'I do use rubrics but I can't use the Turnitin facility for the rubric. So I use a spreadsheet.' (Sam)

There are a number of Learning Management Systems in the Higher Education landscape. Moodle is an example of a system where the rubric import and export functionality has been available for several years. Institutions using Moodle can potentially require all academics to use rubrics, to moderate assessment feedback and assure students of a minimum standard of quality feedback. Uptake and sustained use of the affordance is impacted on by the capacity of the technologies available.

A recent update of the Blackboard Learn application allows importing of assessment rubrics from Excel, but not exporting. The granularity of the rubric assessment performance requires detailed criteria to be quite fine to enable an accurate measure of student's efficacy on the basis of each item. The level of granularity determines the type of feedback that the student receives. Ace and Amy reported that sometimes the rubric items lose their assigned mark and appear as not being marked. This type of

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technical error in Blackboard Learn acts as a barrier to uptake and sustained use of the posting assignment upload details affordance. Ace and Amy highlighted the difficulty of effective use imposed by the clumsy and difficult-to-use interface:

'The only unwanted side effect is if staff members are forgetting to click on one of the boxes. But if students actually check their work, they then pick it up. And when I followed up with team members, they've said that they ticked the box, but the student said the box wasn't ticked. So I don't know if it didn't save it or what.' (Amy)

'I found that I would mark an entire assignment and on a number of occasions I would tick in the rubric, definite that I ticked all the rubric items. ... I would go back, let's say few days later or even a week later and someone would show me that one of the rubric items was 0, gone.' (Ace)

The quality of feedback in electronic marking, even with the use of a rubric, mark up on the assessment piece submitted, and summary comments, is reported as not being as high in quality as with the affordances of the traditional paper system. The same findings are determined as a reason for poor uptake of e-Book functionality. The HCI needs to mirror current practices:

'Personally I was very sad to see the end of paper. ... But I like the neatness of it [e-assessment].' (Amy)

'I prefer hard copies. Reason is the pen and paper is ... just feels better and the fact that you don't have to have this silly terminal in front of you no matter where you are.' (Ace)

'I like how I can put just plain text in feedback box, I can't put screen dumps or anything in there, which sometimes you think it

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would be nice to be able to get screen dumps and stick it in there, because it would contextualise it.' (Mel)

'I prefer giving feedback on a document where I can sit there and circle and show grammar very easily and whatever. No, in terms of feedback on the assignment ... I would prefer something more organic.' (Ben)

'You can't give the quality of feedback that you do with hardcopy.' (Ben)

Technical barriers to the uptake of electronic marking include:

- Required connection to the internet;
- Instructor must mark assessment online and have access to the appropriate hardware and software at offsite and onsite locations;
- Offsite equipment and staff must adhere to Occupational Health and Safety (OH&S) guidelines to assure health and wellbeing (back and eye problems);
- Instructors are restricted to the use of rubrics, audio- or text-based feedback, and marking up the submission;
- No graphical representations of feedback are enabled; and
- Retrieval of the feedback is more cumbersome for students than in traditional paper-based assessment submissions.

Barrier factors reported by Amy and Ace are the way Blackboard Learn deals with errors, such as missing marked items in the rubric. The flexibility of the assessment system is limited, as there is typically only one way of performing each process and to deal with issues:

'Actually I found the Moodle marking a ton better than the Blackboard Learn marking because with the Blackboard Learn marking you go from one and you're instantly feeling you're in

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another dark room with another student's assignment and you couldn't see across. It's fine for the students to be in there because they're doing their thing.' (Ben)

'What happened in this case it was because it's out of semester; student disappeared. All they needed was that subject to be marked and they are just waiting for the mark for this subject but some automatic process discontinued them and all of a sudden these 4 discontinued students got removed from the list.' (Ben)

'It can be a little bit restrictive because it's only those things you can look at. And sometimes it's kind of not flexible, not very flexible. So it's kind of ... but for most of the assignments it's actually, it does seem to be a very useful tool.' (Joy)

'And then what Blackboard Learn does not allow me to do is to put an attachment with the assessment. That would be really nice. So what I have to do is email them the spreadsheet.' (Sam)

Health issues, arising from changing practices from traditional offsite marking practices to all assessment tasks being completed online, is the last but not least barrier-to-uptake factor.

Facilitating factors for uptake of Blackboard Learn assessment affordances included:

- Improved integrity of assessment through the institutional requirement that all submissions be vetted for plagiarism by Turnitin, to increase the reputation of the academic institution;

'I like Turnitin because you can go and look at the ORs (originality reports) and also Turnitin has become far more sophisticated now, ... the fact that you can request original documents and stuff like that, when it's high similarity I find it fantastic.' (Mel)

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- A reduction in lost assignments as they were uploaded to a secure storage facility;

'...posting it electronically, excellent! You make sure everybody has access to it and gets it. Marking them electronically, I think it's a sad fact of life. There was a huge issue with a thousand students, losing papers. Who's going to sort them? Where are they going to submit them to? They said they've submitted them, but they are not there. We don't get that anymore.' (Amy)

- Improved moderation quality as cross-marking systems were facilitated without the need to shift large volumes of paper; and
- Improved feedback quality through the adoption of rubrics.

The extra functionality provided by the systems enhances the chance of the system uptake and sustained use.

4.2.6.5 Collaborating Spaces

Collaborating spaces are available in all three applications explored (Blackboard Learn, Google App, and Facebook), with different implementations. Blackboard Learn offers Blackboard collaborate, where you can organise video conferences with screen-sharing capabilities. Sam and Mel have used collaborating spaces in Blackboard Learn.

Facebook is less sophisticated than Blackboard Learn, as it only allows users to exchange ideas via posts, and to upload or download files so that students can share their work. A chat tool is also available, which could be used to communicate. None of the participants used Facebook for collaborating spaces.

Google Apps allows for a number of ways to afford collaborating spaces for students to complete learning activities and assessment tasks. Real-

time collaboration is enabled for working on the same document or sharing ideas.

Figure 4-5: Collaborating spaces – interviewees’ experience pictures the distribution of participants using collaborating spaces in the Blackboard Learn, Google Apps, and Facebook applications.

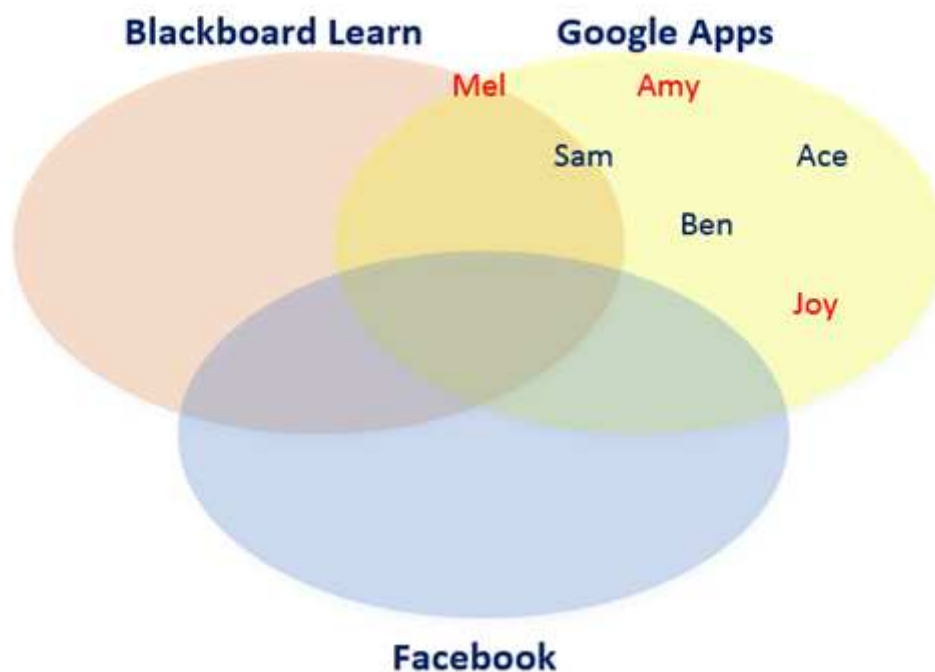


Figure 4-5: Collaborating spaces – interviewees’ experiences

Mel and Sam used collaborating spaces on Blackboard Learn. Mel had a very negative experience, and has said she was not willing to use the collaborating spaces affordance with the Blackboard Learn application again:

‘I used it last year in an academic workshop that I deliver every year for the Office of Learning and Teaching and it was an absolute nightmare. ... No, I won’t use Blackboard Collaborate again, no.’ (Mel)

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The problem was caused by hardware incompatibilities: some were using PC laptops, and some MacBook laptops. Sam sees the collaborating spaces affordance with the Blackboard Learn application as a tool more appropriate for set-piece lectures, rather than for ad hoc student collaboration. His perception brings up that the lack of flexibility is a problem. Joy reported that she did not know about collaborating spaces on Blackboard Learn, because she teaches online students in small groups. For group communication, Joy and her students use the Facebook application and Google Drive/Docs, and the use of Blackboard Learn for collaboration is not necessary.

Amy, Ace and Sam reported that students have been using Facebook for collaboration; but as students are not part of this study this has not been validated. None of the instructors have actually used Facebook as a collaborating space:

'I know that where Tim, he has a discussion board, right at near the end of an assignment, they would get on and talk about it. ... they use Facebook.' (Amy)

Mel has used Google Apps as a collaborating space, but only for research, not as a teaching tool. Ben reported that students choose whiteboards rather than Google Drive/Docs when they are given the chance:

'[when students are given a choice of using the whiteboards or Google docs, how many did prefer Google?]' Most used the whiteboard. Only a few that have got laptops or have used it or remember how to use it that will use it.' (Ben)

Sam, who is a Google enthusiast, uses Google Drive/Google docs extensively, and his students follow suit. Sam also reported than one of the learning collaborations he designed, developed and implemented in

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the classroom required students to use several different Google Apps, including:

- Creating and participating in a meeting using Google Hangouts;
- Connecting to students participating through a video call;
- Sharing screens and discussing the work

It would be interesting to know if in the future Skype will be replaced by this method of collaboration. Sam said bandwidth was a barrier to uptake, which was similar to adoption of alternative applications such as Skype or Blackboard Learn. However, Google Apps settings could be adjusted to allow for efficient communication and collaboration, which facilitated uptake, once adjustments were made for local use. Sam discussed similarities between the operation of collaborative Google Apps and Skype; which is however outside the scope of this research.

The Google Drive and Google Docs method of collaboration was used quite successfully by Sam, Amy, Ace, and Joy. Ben is considering using Google Apps, because one of the subjects he is involved in delivering has a setup which uses the ETE. Unlike the Blackboard Learn collaborating spaces functionality, participants did not report any Google Apps errors or compatibility issues.

One of the biggest barriers to uptake of collaborating spaces in Blackboard Learn was the cumbersome operations (Mel, Sam). Google Apps allowed for intuitive operation, which was reported by all participants as an uptake and sustained use-enabling factor. The reported errors or the difficulty to use Blackboard Learn collaborative spaces acted as a barrier to uptake of the collaborating spaces affordance. The reported error rate negatively impacted on application and associated

work efficiency, which was a secondary barrier and obstacle preventing successful uptake, reported by Sam and Mel. Enabling factors reported were:

- Compatibility with other applications available via the University infrastructure (hardware and software);
- Extra functionality offered by the Google Apps system;
- Flexibility in methods of operating the application;
- Integration of the application with other software systems; and
- Student uptake and positive response to the ETE when modelled positively by the instructors.

The present study found that the most important enablers for the successful uptake and sustained use of the collaborating spaces affordance are, mainly, the affordance's compatibility and its integration capability.

4.3 Factors Identified and Relevance to System Acceptability Theory

The factors identified by analysing the collected data, and further interpreted, are summarised in Figure 4-6.

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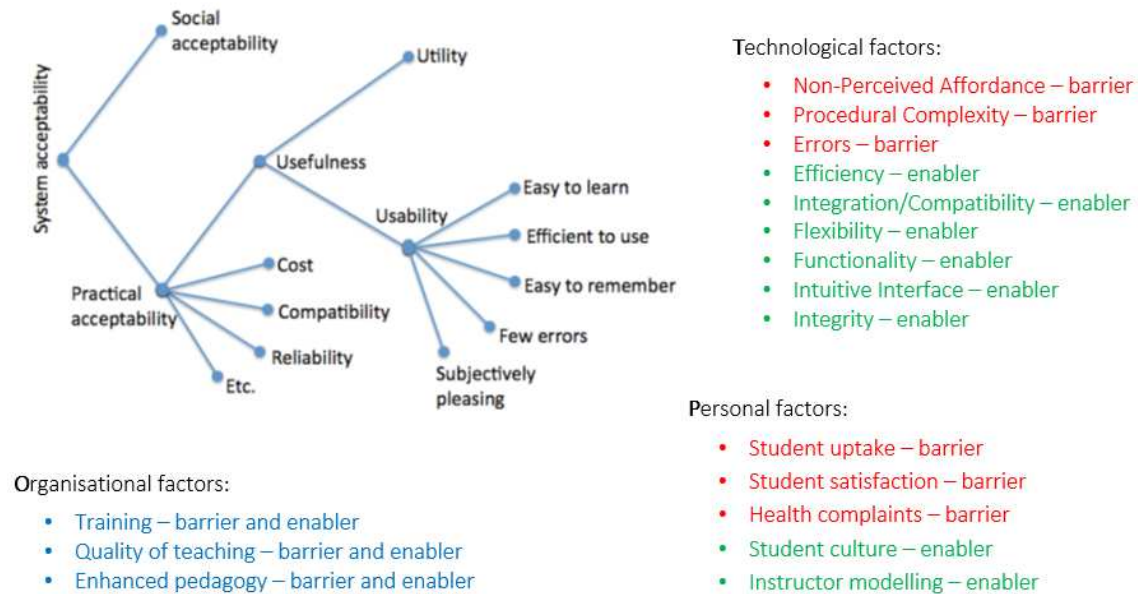


Figure 4-6: System acceptability theory and factors identified

The factors in red are barrier factors; the green-coloured ones are acting as enablers; and the blue can act as both barrier and enabler factors. The alignment of the ‘found factor’ to the system acceptability theory nodes is described in Table 4-3.

Factor	T/O/P	Barrier/ Enabler	System Acceptability Theory Node
Non-Perceived Affordance	T	Barrier	Utility
Procedural Complexity	T	Barrier	Easy to learn/ Easy to remember
Errors	T	Barrier	Few Errors
Efficiency	T	Enabler	Efficient to use
Integration/Compatibility	T	Enabler	Compatibility
Flexibility	T	Enabler	Utility

Functionality	T	Enabler	Utility/Usefulness
Intuitive Interface	T	Enabler	Utility/Usefulness
Integrity	T	Enabler	Reliability
Training	O	Barrier & Enabler	Easy to learn/Utility
Quality of teaching	O	Barrier & Enabler	Utility/Usefulness
Enhanced pedagogy	O	Barrier & Enabler	Utility/Usefulness
Student uptake	P	Barrier	Social acceptability
Student satisfaction	P	Barrier	Social acceptability/Subjectively pleasing
Health complaints	P	Barrier	Practical acceptability
Student culture	P	Enabler	Social acceptability
Instructor modelling	P	Enabler	Social acceptability

Table 4-3: Factors and system acceptability theory alignment

4.4 Discussion of Key Factors Identified

The data collected revealed issues that have been identified and classified as technological, organisational, or people issues. The impact of each issue influencing uptake and sustained use of ETEs has also been assessed based on the participants’ responses, and displayed using the word cloud technology, in Figure 4-7.

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- Procedural Complexity; and
- Errors – in setting up the affordance or the actual use of the affordance.

Non-Perceived Affordance

When an affordance is not perceived it cannot be used. The non-perceived affordances in the Blackboard Learn, Google Apps, and Facebook applications were:

- Exporting/importing rubrics options when using posting assignment upload details in Blackboard Learn application (as part of setting up for the affordance) (Amy);
- The option of using collaborating spaces in both Blackboard Learn and Facebook applications (Joy);
- The option of sending emails through Blackboard Learn (Mel); and
- The option of using Google Apps to achieve discussion threads (Ace).

The perceived state of an affordance has been reported as an opportunity for using technologies by a number of studies (Leonardi 2011; Osiurak, Jarry & Le Gall 2010; Surry & Land 2000). By contrast, we can conclude that if an affordance is not perceived, it acts a barrier factor to using a technology and by extrapolation an ETE.

Procedural Complexity

Affordances in both Blackboard Learn and Google Apps were reported to be procedurally complex for promoting capacity for peer instruction. Once peer instruction has been reported, Google Apps fares better than Blackboard Learn. The complexities reported are:

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- Group creation in Google mail (sending emails affordance in Google Apps) (Ace);
- Getting back archived items after archiving items in Google Mail (sending emails affordance in Google Apps) (Ace and Amy);
- Use of collaborating spaces in Google Apps through the use of Google Drive and Google Docs (Ace, Amy and Joy);
- Sending emails using Blackboard Learn, in particular the application's inability to send to both groups and individuals (Amy and Joy). In addition, when this is permitted, the user can only add one more recipient, and there is no autocomplete feature to confirm the validity or even existence of the email address typed.

Procedural complexity as a negative factor in the use of technologies has been reinforced by extant literature: two generic studies, using TAM and DOI, respectively, support the complexity of the system indirectly impacting the intention to use technology (Albirini 2006; Teo 2009); a study of use of Personal Digital Assistants (PDA's) amongst personnel and health care students, which states that the complexity of the system can act as a barrier to its use (Lindquist et al. 2008); and a study of use of Web3D technologies, which concludes that simple navigation ability rather than complex functions would allow for better use of such technologies (Chittaro & Ranon 2007).

Errors

Error were reported, either during setting up or during instructor and student usage. Further problems could be prevented via more effective training. Errors while using various affordances were often caused by application incompatibilities, or by limitations that are not common knowledge. If students experienced assessment feedback and marking

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errors caused by cumbersome operations, staff would not sustain the usage due to poor student-satisfaction levels.

If an error is catastrophic (e.g. a student cannot complete the test or all marks are accidentally deleted), the impact on usability is far greater than if an error is just annoying (e.g. the last action can't be undone). Examples of errors reported are:

- Error when setting up groups manually for sending emails in Blackboard Learn (Ace);
- Error in sending the email to the wrong recipient(s) due to the confusing threads in sending emails via Google Apps (Amy);
- Errors when using hotspots and pictures embedded in MCQs when setting up assessments in Blackboard Learn (Amy);
- Errors reported when setting up and working with rubrics when posting assignment upload details in Blackboard Learn (Mel and Amy);
- Errors when setting up the due date/time for offshore courses (current time rather than local time) when using posting assignment upload details in Blackboard Learn (Mel and Sam);
- Minor errors reported when group members can miss posts on Facebook (discussion threads affordance) (Joy);
- Easy errors reported using Google Hangouts when using collaborating spaces in Google Apps (Sam);
- Students disappearing out of the system (out of semester scenario or withdrawing from subject) when using posting assignment upload details in Blackboard Learn (Ben and Ace); and
- Students '*bombing out*' in the middle of the test when using quizzes in setting up assessments in Blackboard Learn (Sam, Ace and Amy).

The researched literature does not seem to report errors being a negative factor in the uptake of technology; but according to the system acceptability theory, the rate of errors and the way the user recovers from encountered errors is a usability attribute (Nielsen 1993, 2012). A study of students' attitudes towards online learning found that one of the factors - positive perception of technology - is influenced by the ability to recover from error (Drennan, Kennedy & Pisarski 2005).

4.4.2 Technology Factors - Enablers

Technological enabling factors identified in this research are summarised below:

- Efficiency;
- Integration/Compatibility;
- Flexibility;
- Functionality;
- Intuitive Interface; and
- Integrity.

Efficiency

The impact and attitude towards uptake and sustained use was high when the efficiency of the ETE was seen as high. For example, Gmail (sending emails affordance in Google Apps) was reported as an enabler because it allowed for email access anywhere, anytime. Instructors could be more efficient in communicating with students, as well as with other staff members, and could 'push' information to initiate communication channels with students.

Examples of efficiency were reported as follows:

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- Discussion threads in Blackboard Learn are efficient when the number of students in the cohort are larger (more than fifty), as the instructor becomes a moderator and students get to help their peers (Ben);
- Discussion threads on Facebook, as being streamlined to a simple Internet Relay Chat (IRC) used for disseminating information and effective communication (Ace, Ben and Amy);
- Enhanced feedback to students when using posting assignment upload details in Blackboard Learn (Amy and Ben);
- Blackboard Learn as an efficient repository of resources for a subject (Mel);
- The efficiency of using Gmail (sending emails in Google Apps) (Mel) and using inter-related Google Apps (Ben); and
- All three applications, Blackboard Learn, Facebook, and Google Apps, together have been seen as efficient, as they allow instructors to achieve their academic goals (Joy).

The research literature reports on various relevant studies, such as on determining the success factors for e-learning acceptance, a generic study of perceived factors influencing the use of technology, and one researching the use of Virtual Learning Environments (VLE). Each study used a different approach, varying from TAM to Activity Theory; but they all agreed that efficient is a factor impacting positively on the use of technologies (Blin & Munro 2008; Selim 2007; Teo 2009).

Integration/Compatibility

Google Apps has been seen as more integrated and compatible with other applications than the other two applications. Google Apps allowed for the instructor's mental model to be implemented with the use of its

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applications, as Sam and Ben mentioned in their interviews. Sometimes such a fit works, and therefore it can act as an enabling factor to the uptake of the emerging learning technologies. Examples of integration or compatibility with other applications are:

- Talking about Blackboard Learn being a central point, embedded in the University's infrastructure (Ace, Amy, Mel, Ben and Sam);
- When sending emails via Blackboard Learn the users are offered integration to the school directory system (Ace);
- The successful and seamless integration between Blackboard Learn and Turnitin when using posting assignment upload details (Amy, Ace, Ben, Joy, Mel and Sam);
- The successful integration between Blackboard Learn and use of rubrics when using posting assignment upload details (Amy);
- Good integration of various Google Apps, to achieve collaborating spaces and for interoperability (Sam and Ben, respectively);
- Google Apps can be compatible with almost everything through the use of API's (Application Programming Interface) (Ace).

As support for these research findings, from the literature review we can report two studies, one of students' experiences with technology and another looking at adoption of educational computer games from teachers' perspectives (Conole, Gráinne et al. 2008; Kebritchi 2010). The results of these studies showed that compatibility and integration are factors positively impacting on the use of educational technologies.

Flexibility

Google Apps is quite a flexible application, which could fit everyone's mental model, but planning is needed to achieve this. Once there is a match between the two mental models, instructors and application used,

the operation does not seem cumbersome. Examples of flexibility reported through the interviews are:

- Multiple ways into the application when using posting assignment upload details on Blackboard Learn (Ben);
- Autocomplete feature available in Gmail (sending emails via Google Apps), which helps by decreasing users' memory load (Ace, Amy, Sam and Mel);
- Flexible ways of providing feedback when using posting assignment upload details in Blackboard Learn (voice and written as a general feedback, as an attached file, or short comments scattered though the uploaded assignment) (Joy);
- The flexibility and richness of discussion threads on Facebook (Ben); and
- Flexibility provided by using Google Apps to achieve collaborating spaces (Sam).

Two studies, one involving students and instructors studying a web-based MBA course and another looking only at students' perceptions on learning, of two MBA courses (one purely online, and the other a combination of online and face-to-face), have investigated factors influencing the technology use. Both these studies have found that perceived flexibility of technology is an influencing factor, and that it impacts the use of technology positively (Arbaugh 2002; Arbaugh & Duray 2002).

Another study focusing on Web3D technologies used for educational purposes concurs that the flexibility of technology is a positively influencing factor on the use of technology (Chittaro & Ranon 2007).

Functionality

The extra functionality offered by Google Apps would enable better uptake of such an application, as reported by the present study's participants. Extra functionality reported:

- The ability to see assignments submitted by groups that students belong to when using of posting assignment upload details on Blackboard Learn (Amy and Ace);
- The ability to use voice recording for providing feedback to students when using posting assignment upload details on Blackboard Learn (Joy);
- The intricate ways that using posting assignment upload details in Blackboard Learn allows the instructors to get access to the original document, when a high originality index is reported (Mel);
- Screen-sharing capability as part of collaborating spaces in Google Apps (Mel);
- The ability to access Turnitin and Gradebook functionality when posting assignment upload details in Blackboard Learn (Ace, Amy, Ben, Joy, Mel and Sam);
- Highlighting the extra functionality offered by Gmail (sending emails via Google Apps) compared to the previous Novell email system (Mel); and
- Reported extra functionality available through Google Apps when using collaborating spaces and sending emails affordances (Sam).

The literature review did not yield many results in terms of these aspects, but we can report one study that examined the adoption of tablets in tertiary education and reported that extra functionality provided by either the tablet or installed application resulted in a better adoption of

tablets used for education (Mang & Wardley 2012). The low support provided by the literature to this factor highlights that this could a direction for further study.

Intuitive Interface

An unintuitive interface would impact on the efficiency of an application, and therefore on the uptake of such an affordance, application or technology. Examples of unintuitive interface occurrence are:

- When comparing the interface between Blackboard Learn and Google Apps, concluding that Google Apps offers a more intuitive interface than the one offered by Blackboard Learn (Ace, Ben and Amy);
- Highlighting that the interface provided by Gmail is not as intuitive as the Optus email application's interface (Amy).

Firstly, it needs to be said that, through research of the literature, we found that the term 'intuitive interface', which was identified as a factor through the analysis of the interviews, is an ambiguous term. One study attempts to define the term intuitive interface by the actions of the user on an interface being correct and complete, together with the user's cognitive load being reduced (Naumann et al. 2007). Apart from that article, only one other article was found on this topic, stating that, even if 'intuitive interface' was to be defined precisely, it would define the outcome without offering ways to achieve this desired outcome. This points to the need for further research, because, as an interface is described as being intuitive or not, it does not give the designers guidelines to achieve this.

System Integrity

Integrity of an application is reported as a positive factor in the uptake of an affordance or application. One example is provided by the respondents of this study:

- When talking about the system integrity offered by posting assignment upload details on Blackboard Learn through the use of Turnitin (Amy, Ace, Ben, Mel and Sam).

The literature does not report integrity of IT system as a positive factor for the use of technology, apart from a single study, which found that the users' perception is positively influenced by the system's integrity (Li, Hess & Valacich 2008). Directions for further studies are implied by the lack of literature reports into this factor, system integrity.

4.4.3 Organisation Factors – Barriers and Enablers

Organisational factors, both enabling and impeding the successful uptake and sustained use of ETEs, have been identified in this research, as:

- Training;
- Quality of teaching; and
- Enhanced pedagogy.

Training

Formal training has been reported by Amy and Sam as a positive experience. Amy's requirements were, however, very specific and not suited to training developed for large groups.

Peer informal training has been reported as effective for uptake and sustained use of ETEs by all participants. It appears that, if we can share our knowledge, we would yield better results and experiences. We

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assume that students come with knowledge about the infrastructure systems that we make available to them. Organisational training and information dissemination can influence the instructors.

However, instructors would like an opportunity to inform students outside traditional courses, to model and therefore increase student satisfaction, which influences instructor uptake of ETEs.

Reported training, formal or peer, or the lack of it, is listed below:

- No formal orientation for the use of Blackboard Learn (Ace);
- Peer training when using affordances in Blackboard Learn (Amy and Ace);
- Reported peer- and student-led training which help instructor use new features in Facebook (Amy);
- Asking and getting access to training in different features of both Blackboard Learn and Google Apps (Amy); and
- Student-led training for innovative ways of using collaborating spaces in Google Apps (Sam).

In support for training being a positive factor, four studies can be reported. The first study is a longitudinal study of training for Microsoft PowerPoint™, where four weeks of training has been proven to be a contributing factor to the positive use of technology (Hu, Clark & Ma 2003). Two other studies looked at the importance of teacher education and professional development, respectively, which yielded a better use of technology for teachers (Ertmer & Ottenbreit-Leftwich 2010; Kimberly & Pellegrino 2007). The last but not the least important study looks at instructors' training, focusing on developing tool-related competencies

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rather task-related competencies, which is desirable to achieve an efficient use of educational technology (Blin & Munro 2008).

Quality of Teaching

No instructor would use any affordance if it does not add to the quality of teaching and student satisfaction. If the instructors see an affordance as an addition to their teaching quality, they are likely to adopt the application. Examples of affordances or applications adding to the quality of teaching reported in these interviews are:

- Addition to quality of teaching by using MCQs as a method of ensuring that students do their recommended pre-lecture reading and preparation activities for workshops (Sam and Amy);
- Sending emails through Blackboard Learn creating the feeling of inclusion for students (Amy and Joy); and
- Making systematic use of Google Apps to add to quality teaching (Sam and Ben).

In support of this research's findings that quality of teaching is a positive driving factor for the successful use of technology, we report a study that demonstrates the use of e-simulation adding to quality of teaching through the quality experience provided to students (Dale, Stephen & Jacob 2013). In addition to that, other studies have demonstrated that there is a need to create pedagogical models for the use of technology in support of greater learning (Ertmer & Ottenbreit-Leftwich 2010; McLoughlin & Lee 2007; Sun et al. 2008).

Enhanced Pedagogy

Any affordance used by the participants of this research has enhanced pedagogy through the use of interaction, communication and changed

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curriculum resources. If instructors see an affordance as a pedagogy enhancer, they will uptake such affordance or the application which contains the affordance. Examples of such enhancements are:

- Enhancement to pedagogy through the use of sending emails with Google Apps, by creating interaction and better communication with the students (Amy and Ace);
- Using quizzes, by using the Setting up Assessments affordance on Blackboard Learn, to create a checkpoint for students' learning in a flipped type of classroom approach (Ben and Sam); and
- Enhanced pedagogy through the use of rubrics in posting assignment upload details affordance in Blackboard Learn (Mel, Amy, Ben and Joy);
- Inclusion value of using discussion threads on both Facebook and Blackboard Learn when dealing with a study tour and online students (Joy and Ben);
- Looking forward to using ETEs, but needing to justify the change pedagogically (Mel); and
- Admitting that what they do is pedagogically driven (Sam, Mel and Ben).

Literature review validation points are one study of the use of e-simulations, another of Web3D technologies use, and one of the use of mobile learning; all using technology as a pedagogical enhancement (Chittaro & Ranon 2007; Dale, Stephen & Jacob 2013; Kearney et al. 2012). These studies target a particular technology, but are complemented by generic studies that support the idea that technology is a meaningful pedagogical tool (Ertmer & Ottenbreit-Leftwich 2010).

4.4.4 People Factors – Barriers

Human barriers to the successful uptake of emerging educational technologies have been identified as:

- Student uptake;
- Student satisfaction; and
- Health complaints.

Student Uptake

Student uptake is a barrier to instructor uptake of the affordances studied. If students' uptake is very low, the affordance or application will not be used. Reports of student uptake (or lack of it) as a positive (or negative) influence to the uptake and use of a technology are:

- Lack of student uptake to discussion threads on Blackboard Learn (Amy, Mel, Sam and Ace);
- Drop in student uptake of discussion threads affordance on Blackboard Learn, when student numbers are going down in a course (Ben);
- The successful student uptake of discussion threads on Blackboard Learn, when they are involved in group work (Joy);
- Lack of general student uptake to Blackboard Learn (Mel); and
- A number of instructors known giving up the use of discussion threads on Blackboard Learn and moving to discussion threads on Facebook (Ben).

A study of Facebook use in higher education found that students are more likely to use Facebook and similar technology in an education context (Roblyer et al. 2010), concurring with this study's findings that student

uptake is a positive driver for educational technologies. This is possibly a further study direction suggested by the limited literature on the topic.

Student Satisfaction

Errors in using the application, in particular at critical times such as assignment upload, assessment delivery and marking, results in student complaints, which in turn is a barrier to the use of an application. Student satisfaction reports by the interviewees are:

- Lower student satisfaction through student complaints when they encountered errors taking MCQ quizzes via Setting up Assessments affordance on Blackboard Learn (Amy, Sam, Ben and Ace); and
- Student complaints when they encountered errors while using collaborating spaces on Blackboard Learn (Mel).

The literature is quite scarce on this topic, but we can refer to an article that reports that student satisfaction is affected by positive perception of technology and therefore can be seen as a positive influencing factor in the use of educational technologies (Drennan, Kennedy & Pisarski 2005) The lack of literature on this topic highlights one other possible direction for further research.

Health Complaints

Changes in practices such as online marking of assignments can cause health issues when offsite spaces and offsite hardware do not comply with Occupational Health and Safety (OH&S) standards. Examples of reported health issues arising from changed practices are:

- Sore back caused by marking online assignments submitted by students through posting assignment upload details in Blackboard Learn (Amy); and

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- Sore eyes caused by online marking the assessment that students submitted through posting assignment upload details in Blackboard Learn (Mel and Amy).

No studies have reported health complaints due to changed practices caused by the addition of educational technology in the landscape of teaching in higher education. This presents a new direction of research that the present study reveals. It must be noted that health issues have not been reported because preventative OH&S compliance procedures have already been set in place before health complaints could arise.

4.4.5 People Factors – Enablers

Human enabling factors to the successful uptake of emerging educational have been identified as:

- Student culture; and
- Instructor modelling.

Student Culture

Students reportedly use Facebook for communication and collaborative work (as Ace, Mel and Amy mentioned in their interview). If we tap into this factor, we can increase the likelihood of system uptake. The China study tour using Facebook for communication, and evidence from its successful implementation, support the idea of finding out what students use and applying this knowledge to the construction of available infrastructure and aligned pedagogy for educational purposes. An example provided by this study's respondents was:

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- Facebook as being part of the student culture when used for discussion threads and possibly aiding the successful integration of the technology in their education (Sam, Amy, Ben and Ace).

Literature research found a study showing that students who have used new technologies, socially or otherwise, and that they are embedded in their culture and more easily accepted for education purposes (Conole, Gráinne et al. 2008). In addition, more specific studies advocate the use of social networking technologies such as Facebook to help establish better connectivity between students, instructors and faculties (Larry & James 2013; Roblyer et al. 2010).

Instructor Modelling

When instructors model a positive behaviour, it has a positive outcome. Sam positively modelled the use of Google Apps and the students' uptake was high. Examples of positive and negative instructor modelling are:

- Modelling effective communication channels for groups when using sending emails via Blackboard Learn (Amy and Ace);
- The use of Google Apps for various tasks in the subject and the students mirroring the instructor's behaviour (Sam);
- Setting up communication channels through discussion threads on Facebook, and sending emails through Google Apps and Blackboard Learn; and students joining in enthusiastically (Joy); and
- If no modelling is present (students are given a choice), students choosing the easy option for collaboration (whiteboard rather Google Apps) (Ben).

There is substantial support in the extant literature that ICT integration is impacted by teacher's beliefs and attitudes in both secondary and

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tertiary education sectors (Donnelly, McGarr & O'Reilly 2011; Prestridge 2012; Sang et al. 2010; Selim 2007). Most of the time, instructors' beliefs and attitudes appear to act more as a barrier to the successful ICT integration in education. However, the instructor modelling, either positive or negative, influences the use of educational technologies.

4.5 Chapter Summary

The uptake and sustained use of five complex affordances, in Blackboard Learn and Mobile Learn, Google Apps, and Facebook, have been investigated. The five affordances explored were: discussion threads; sending emails; setting up assessments; posting assignment upload details; and collaborating spaces. Instructors were interviewed to obtain a detailed explanation of the technical, organisational and people barriers and facilitating factors influencing uptake of the ETE affordances.

Blackboard Learn was the most complex and least liked application. Participants reported that Facebook was only used for discussion threads, as they were found to be streamlined and used successfully mainly as a secondary means of communications. Google Apps application was reported as being of medium complexity, and was quite popular with the participants; but was still in its incipient phase at the university.

A summary of findings, for each affordance in each application relative to system acceptability theory, is found in Table 4-4. The table displays all affordances and applications, highlighting the applications where affordances are not available or which are available but not used. In addition, each affordance is assessed in relation to the system acceptability nodes.

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Firstly, sending emails is not available in Facebook. Content-based affordances, such as setting up assessments, and posting assignment upload details, are only available in Blackboard Learn due to the university policies.

Secondly, discussion threads in Google Apps and collaborating spaces in Facebook are available for use; however, the study participants have not used them. Discussion threads in Google Apps has been newly added to the University domain, and the discussion threads affordance in the Facebook application has been reportedly used by students, but not by instructors.

Facebook offers two affordances, but participants have successfully used only one. Blackboard Learn is the polar opposite of Facebook, with all five affordances available and used. Content-based affordances were successfully used by instructors in the case studies, while other types failed to achieve their potential.

A standout application is Google Apps, with three available, but only two used affordances. However, each of the two affordances used, sending emails and collaborating spaces, have passed all system acceptability theory nodes tests. In addition to that successful outcome, it has been discovered that Google Apps offers a different way of collaboration, through the use of Google Calendar and Google Hangouts.

Discussion threads and sending email are communication-based affordances. Setting up assessments and posting assignment upload details are content based. Collaborating spaces are collaboration based. The content-based affordances are specific to one of the applications (Blackboard Learn), due to the university policies, and quite successfully

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used. The other three can be used in all three applications; however, they appear rather to be used in only one application:

- Discussion threads used mostly in Facebook as a secondary means of communication;
- Sending email via Google Apps, specifically Gmail;
- Collaborating spaces used mostly via Google Apps, specifically Google Drive/ Google Docs; but a new method has been revealed by use of Google Calendar and Google Hangouts.

Blackboard Learn is the most complex investigated technology, and possibly the most criticised application investigated. All five affordances selected for this study are present in Blackboard Learn application, which has been around the longest. Blackboard Learn was the first application to be part of the University's infrastructure, and its use is regulated by University policies. Blackboard Learn is a very rigid application, which makes it hard for instructor users to adapt it to their mental model of teaching. Formal training has been reported, but it did not yield answers to participants' questions. Peer and informal training reportedly provided answers and produced a better resolution to participants' issues.

System Acceptability Nodes		Affordances														
		Discussion Threads			Sending Emails			Setting up Assessments			Posting Assignment Upload Details			Collaborating Spaces		
		BB	GA	FB	BB	GA	FB	BB	GA	FB	BB	GA	FB	BB	GA	FB
Social acceptability		✘	∅	✓	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅
Practical acceptability	Compatibility	✘	∅	✘	✓	✓	n/a	✘	n/a	n/a	✓	n/a	n/a	✘	✓	∅
	Reliability	✘	∅	✘	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅
Utility		✓	∅	✓	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✓	✓	∅
Usefulness		✓	∅	✓	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅
Usability	Learnability	✓	∅	✓	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅
	Memorability	✓	∅	✓	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅
	Efficiency of use	✓	∅	✘	✘	✓	n/a	✓	n/a	n/a	✘	n/a	n/a	✘	✓	∅
	Error handling	✓	∅	✓	✓	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅
	Subjectively pleasing	✓	∅	✓	✘	✓	n/a	✓	n/a	n/a	✓	n/a	n/a	✘	✓	∅

Legend	
✓	Passed
✘	Failed
∅	Not used (but available)
n/a	Not available

Applications	
BB	Blackboard Learn
GA	Google Apps
FB	Facebook

Table 4-4: Technologies and affordances fit to system acceptability theory

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Blackboard Mobile Learn, the version of Blackboard Learn available on mobile devices, has been reportedly trialled by four out of the six participants. The other two participants did not know Blackboard Mobile Learn existed. The trial has been unsuccessful, as the application seems to have been designed with students in mind, and it lists all courses that the instructors have taught and been provided access to. The large number of entries listed overwhelm instructors, and when coupled with limited functionality compared to the web version of the application, it seems reasonable to conclude that the ETE has been trialled but its use was not sustained, at least by instructors.

Only three out of the six participants have used the Facebook application. Its use has been employed only when it suited a pedagogical purpose. It is the simplest application, with only one affordance used – discussion threads. Facebook has been reported to be used as a collaborative space by students; however, instructors have not used it for the purpose of collaborating with students. Peer training has been reported to have a positive influence on the uptake of the application.

Google Apps is a somewhat mid-range application, with two affordances presently used (sending email and collaborating spaces), and the discussion threads affordance being only recently made available to the university community. Google Apps offers a very flexible environment, which can be adapted to different instructors' mental models. However, instructors have to plan and set up thoroughly before using Google Apps. Successful formal training has been reported by one of the participants as having a positive influence on the uptake and sustained use of the application.

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This chapter discussed the factors identified and classified them, as well as produced a model as a response to the research question. The factors identified have been researched through reference to the extant literature, to triangulate the findings of this study. The triangulation process validated most of the factors, but provided directions for further studies, in regard to factors such as errors, functionality, intuitive interface, system integrity, student uptake, student satisfaction, and health complaints.

Chapter 5 Conclusions

5.1 Introduction

This chapter presents the conclusions to this study, where an answer to the research question has been proposed, developed from the analysis of the collected data, and refined by the discussion of the findings in Chapter 4. As planned in Chapter 3, this study provides answers to the research question, supported by the system acceptability theory.

The objective of this chapter is to provide a summarised answer to the research question from the data that was collected and analysed. This study has performed a systematic analysis on the collected data, identifying common occurring themes. Data interpretation has been triangulated by research of extant literature to yield the answers to the research question and sub-questions. This chapter highlights this study's contributions as well as its limitations, providing clear paths for further studies.

5.2 Review of Research Outcomes

This research seeks to identify the contextual and behavioural factors influencing instructors' approaches in their decision to uptake and sustain the use of emerging educational technologies. In order to identify these contextual and behavioural factors, a case-study approach has been selected, and data has been collected through semi-structured interviews. The design of the interview instrument has been informed by HCI concepts and affordance theory. The study involved six participants, who were interviewed about three specific educational technological systems

and five particular affordances available within those applications. The technological systems are instantiations of emerging technologies used for educational purposes in the form of software applications: in particular, Blackboard Learn, Google Apps, and Facebook. The Blackboard Learn application investigated included the mobile version available for Android and Apple platforms. The following affordances have been investigated:

- Discussion threads (communication affordance);
- Sending email (communication affordance);
- Setting up assessments (content affordance);
- Posting assignment upload details (content affordance); and
- Collaborating spaces (collaboration affordance).

The content affordances are only available in Blackboard Learn due to University policies and infrastructure.

The analysis has been driven by system acceptability theory. Thematic data interpretation identified factors that influenced positively and negatively the uptake and sustained use of emerging technologies for education. Those factors have been categorised as technological, organisational, or human, and each has been deemed to be either an enabler or a barrier to the use of educational technology. This is consistent with the sub-questions proposed in order to obtain a holistic answer.

This research has implemented a validation process through the use of literature review triangulation for each of the identified factors. Some of the factors have had weak validation through the literature, and therefore open up avenues for possible further research.

Technological factors identified are more prevalent than organisational and human factors. All factors have been grouped into barrier factors, which hinder the successful uptake and sustained use of ETEs. In contrast, enabling factors identified support for successful uptake and sustaining of the use of ETEs.

Technological factors identified that act as barriers to the successful uptake and sustained use of ETEs are:

- Non-Perceived Affordance – a non-perceived affordance cannot be used;
- Procedural Complexity – Affordances in both Blackboard Learn and Google Apps were reported to be procedurally complex, prompting the need for peer instruction; and
- Errors – in setting up the affordance or the actual use of the affordance (the literature research did not validate this factor).

Technological factors identified as enablers of the uptake and sustained used of the interrogated applications are:

- Efficiency – the efficiency of the system is directly proportional to the likelihood of uptake and sustained use of a system;
- Integration/Compatibility – Google Apps has been seen as a more integrated and compatible application compared to the Blackboard Learn and Facebook applications, and therefore more likely to be used;
- Flexibility – Google Apps provides flexibility, which could fit an instructor's mental model, and which impacts on the likelihood of the application to be used for a sustained period of time;

- Functionality – extra functionality provided by the system is an enabler for the successful uptake and sustained use of technology (this factor has not been validated by extant literature);
- Intuitive Interface – an intuitive interface inspiring natural interaction is a vague concept (the literature did not validate the factor); and
- Integrity – the integrity of the system means that the system is carrying out its planned functions without being corrupted or weakened by deviations or interferences in its environments, both internal or external (*BusinessDictionary.com*) (the factor has not been validated through the literature review).

Organisational factors, both acting as enablers and barriers to the successful uptake and sustained use of ETEs, are:

- Training – either formal organisational training, peer- or student-led training;
- Quality of teaching – when technology adds to teaching quality; and
- Enhanced pedagogy – technology enhances learning and teaching, as well as providing improved methods for delivering content.

Human barriers identified as impacting the successful uptake of emerging educational technologies have been identified as:

- Student uptake – the uptake of technology by students is driving the overall technology uptake and sustained use (this factor has not been validated by literature research);
- Student satisfaction – when there are students' complaints, mainly due to technological errors, and mostly at critical times, such as tests or exams, the student satisfaction will drop and so will the

likelihood of the system being used for a sustained period of time (this factor has not been validated by the literature review); and

- Health complaints – reported as eye and back problems caused by changed practices (this factor has not been validated by the literature review).

Human factors enabling the successful uptake of emerging educational have been identified as:

- Student culture – Facebook and other social networking systems are embedded in students' culture, which makes them more likely to be adopted by students; and
- Instructor modelling – positive modelling by instructor will result in higher uptake and sustained use of technology, while negative modelling will inhibit it.

The factors identified are as listed individually, relative to their type and ability to impact positively or negatively on the use of technology. In section 4.4 (Discussion of Key Factors Identified), each factor was validated against extant literature. This study recognizes that those factors are interrelated. However, the reciprocal relations between technological, organizational, or human factors, which acted as enablers or barriers to people's use of ETE's could not be fully explored in this study due to its scope.

However, the use of instructor-focussed case studies allowed a depth of ETE use interrogation that may not have been possible if a range of institutions and educational sectors had been included. The instructors, even though they were housed by the same institution used a range of technologies to support a diverse set of delivery styles and curriculum

design pedagogies. A more thorough piece of research that encompasses case studies drawn from all educational sectors and a range of associated institutions is necessary. There is a need to further research the interrelated nature of the technological, organisational and human an impact on ETE uptake and sustained usage.

5.3 Research Question – Extent to which it has been Addressed

Of the applications investigated, Blackboard Learn was found to be the most complex and the least liked. Participants reported using the discussion threads available in Facebook only rather than those on Blackboard Learn, as the former were found to be more streamlined. Discussion threads on Facebook were used quite successfully as a secondary means of communications with students. Google Apps was reported as being of medium complexity and was quite popular with the participants of this study; but was in its incipient phase, indicating a successful emerging educational technology.

The content-based affordances (setting up assessments and posting assignment upload details) are specific to Blackboard Learn due to the university policies, and are quite successfully used. The other three affordances (discussion threads, sending email, and collaborating spaces) can be used in all three applications. However, they each seem to be mostly used in one application only:

- Discussion threads are used mostly in Facebook as an ancillary mean of communication; they are not used in Google Apps or Blackboard Learn;

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- Sending email is done mainly via Google Apps, specifically Gmail; initiating sending email via Blackboard is quite common, but this is later followed by Gmail communication;
- Collaborating spaces is used mostly via Google Apps, specifically Google Drive/ Google Docs, but a new method has been revealed by use of Google Calendar and Google Hangouts.

Blackboard Learn is the most complex, with all five affordances selected for the research being available in the application. It is possibly the most critiqued application. It has been used the longest and was the first application to be part of the University's infrastructure. It is a very rigid application, which makes it hard for instructors to implement their mental model of teaching when using it. Peer and informal training for Blackboard Learn have been reported, and its use has been more successful than formal training.

Blackboard Mobile Learn, the Blackboard Learn mobile application, has been trialled by four out of the six participants, while the other two participants did not know it existed. The Blackboard Mobile Learn application has been trialled but its use has not been successfully sustained, as it is designed with students only in mind. It lists all courses that the instructors have been involved with, which causes the instructors to be overwhelmed by the numbers of entries. There is also limited functionality available compared to the web version of the application. It can be concluded that the Blackboard Mobile Learn application has been trialled, but its use was not sustained, at least by instructors.

Facebook has been used only by three respondents, and only when it suited the pedagogical purpose (study tour, and students' requested channel of communication with instructor). It is the simplest application,

with only one affordance used, discussion threads, and it has been reported to be used as a collaborative space by students. Peer training has been a positive influence on the uptake of the system.

Google Apps is somewhat mid-range in complexity and functionality, with two affordances presently used (sending email and collaborating spaces), and one being only recently made available to the university community (discussion threads by using Google+). It offers a flexible environment, which can suit instructors' mental models of teaching, but they have to thoroughly plan for and set up the system before use. Successful formal training has been reported by one of the participants.

5.4 Contribution to Theory

The research identifies a number of technological, organisational and human factors impacting the uptake and sustained use of educational technologies. They are either barrier factors, inhibiting the likelihood of uptake and sustained use of technology, or enabling factors, facilitating a more likely uptake and sustained use of technology in education.

The study has identified the following barrier factors, which inhibit the likelihood of uptake and sustained use of technology in education:

- Non-Perceived Affordance – technological factor;
- Procedural Complexity – technological factor;
- Errors – technological factor;
- Student uptake – human factor;
- Student satisfaction – human factor; and
- Health complaints – human factor.

The following enabling factors, which facilitate a more successful uptake and sustained use of educational technology, have been identified by this study:

- Efficiency – technological factor;
- Integration/Compatibility – technological factor;
- Flexibility – technological factor;
- Functionality – technological factor;
- Intuitive Interface – technological factor;
- Integrity – technological factor;
- Student culture – human factor; and
- Instructor modelling – human factor.

Organisational factors acknowledged by this research are acting as both barrier and enabler factors:

- Training – formal organisational training, or informal peer- or student-led training;
- Quality of teaching – technology adds to teaching quality, or it can act as a barrier creating more problems than it solves; and
- Enhanced pedagogy – technology can enhance students learning and teaching methods.

Once the factors were identified by this research, the process of validation began by means of a literature review. The literature reviewed for the purpose of factor validation used a number of alternative theories, which have also been considered by the researcher: TAM, DOI, and activity theory. Most of the validating studies limited their inquiry to one or few factors. None of these theories have been able to validate all factors; so

we can conclude that the system acceptability theory underpinning this study fits best when investigating the uptake and sustained use of ETEs.

The theoretical contribution of this research is the generation of a model to promote the enabler factors and reduce the negative impact of barrier factors: for example, specific training to minimise the setting up errors when using the setting up assessments affordance in Blackboard Learn application.

5.5 Contribution to Practice

As a practical contribution, the insights developed in this study can potentially inform future technology providers in developing ETEs that have increased likelihood of positive uptake and sustained use. As a result of knowing which enabling and barrier factors impact on the use of technology, instructors may improve their decision to uptake and sustain the use of an ETE, through an appreciation of the perspectives and behaviours that impact on technology choices.

The technological factors enabling the successful uptake and sustained use of technology are: efficiency, integration/compatibility, flexibility, extra functionality, intuitive interface, and system integrity. However, barrier technological factors inhibiting the successful uptake and sustained use of educational technologies are: non-perceived functionality, procedural complexity, and occurrence and severity of errors.

Organisational factors acknowledged by this research are acting as both barrier and enabler factors: training (or the lack of it), quality of teaching (improved or hindered by technology), and technology-enhanced pedagogy.

People-driven factors identified by this research that act as enablers to the successful uptake and sustained use of ETEs are: student culture and its use of a particular technology, and instructor modelling. The barrier factors hindering the successful uptake and sustained use of ETEs are: lack of student uptake of technology, student satisfaction with the experience offered by education delivered with technology, and health complaints spawned from change related to the introduction of technologies in teaching practices.

5.6 Research Limitations

The limitations of this research have been first iterated in Chapter 3, when planning the methodology of this study. The first major limitation is that it is restricted to only one stakeholder type – instructors. Other possible stakeholders include students, educational institutions, content providers, technology providers, accreditation bodies, and employers. This study has chosen to look only at instructors as it has been limited in time, and it was deemed that the instructors as stakeholders are central to delivering education.

The number of participants in this research, six instructors, is compensated by the richness of data collected through semi-structured interviews, and is in line with case-study research recommendations. However, all six instructors are from the same institution, which limits the contextual experience explored by this research.

The third limitation is that the study is not open ended, but focuses on three particular educational applications and five particular affordances available in these applications. As this research is exploratory and limited in time, such limits are necessary to allow accurate answers to the

research question. Various contexts, a number of technologies and different stakeholder groups will expand on the capacity to build a sustained uptake model for ETEs and should be used when considering further research, perhaps in the form of a PhD.

Lastly, the exploratory qualitative nature of this study is in line with the research question proposed, which seeks to explore the factors, rather than provide a validation process. The thesis should be judged by criteria that are within this tradition, not using more positivistic perspectives or research traditions.

5.7 Possible Future Research Direction

Possible further research could be a large study through mixed methods to validate findings and potentially propose a model to enhance the uptake and sustained use of ETEs. Such a study should involve more than instructors only, and definitely include stakeholders from more than one institution. Ideally, the study should be open ended, involving the ETEs that the participants' experience rather than a limited set of ETEs and a sub-set of their affordances. It would be interesting to identify which innovative features have been used by participants in the research. For example, the present study found that upgraded features of Google Apps have been used for discussion threads rather than the discussion threads available in Facebook or Blackboard Learn.

The triangulation process through the use of literature review validated most of the identified factors, but also provided directions for further investigation in regard to factors such as errors, functionality, intuitive interface, system integrity, student uptake and student satisfaction, and health complaints. More research needs to be done to see if those factors

can really influence positively or negatively the uptake and sustained use of emerging technologies for education.

The following points emerged from this investigation, as important matters for further research:

- Organization culture as a barrier in the uptake and sustained use of ETEs;
- Impacts of institutional environment on the uptake and sustained use of ETEs;
- Linkage between the perspectives of instructors and student cohorts in regard to institutional environment; and
- Educational benefits of the uptake and sustained use of ETEs.
- The interrelated nature of the technological, organisational and human factors identified.

5.8 Chapter Summary

This research started a quest to find the contextual and behavioural factors influencing the instructors' decisions to uptake and sustain the use of educational technologies. Factors have been identified, and categorised as technological, organisational and human. They have also been distinguished as either enabler or barrier factors. A literature triangulation has been performed for each of the identified factors.

The present study has identified the following barrier factors, which inhibit the likelihood of uptake and sustained use of technology in education:

- non-perceived functionality (technological factor);
- procedural complexity of the system (technological factor);

- error handling (technological factor);
- student uptake of technology (human factor);
- student satisfaction of technology driven educational experience (human factor); and
- health complaints created by changed practices (human factor).

The following enabling factors which facilitate a more successful uptake and sustained use of educational technology have been identified by this study:

- system efficiency (technological factor);
- system integration and compatibility (technological factor);
- flexibility of the system (technological factor);
- extended functionality (technological factor);
- intuitive interface of the system (technological factor);
- system integrity (technological factor),
- technology used in student culture (human factor); and
- instructor modelling (human factor).

Organisational factors determined by this research are acting as both barrier and enabler factors:

- training (formal organisational training not as influential as informal peer- or student-led training);
- quality of teaching (technology adds to teaching quality, or does not); and
- enhanced pedagogy (students' learning experience can be enhanced by using technology, or cannot).

Most factors have been validated through the triangulation process. Some factors have not been validated, and they provide directions for further research. These factors are: errors, functionality, intuitive interface, system integrity, student uptake and student satisfaction, and health complaints.

The model generated by this study recommends the promotion of enabler factors identified, while minimising the impact of the barrier factors, for the successful uptake and sustained use of emerging technologies for education.

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Appendices

Appendix 1. Ethics Approval Letter – BCHEAN 19265



**Business College Human
Ethics Advisory Network
(BCHEAN)**

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Notice of Approval

Date: 9 April 2015

Project number: 19265

Project title: *Stakeholder Approaches to Uptake and Sustain the Use of Emerging Technologies for Education*

Risk classification: Low Risk

Chief Investigator: A/Prof Joan Richardson
Other Investigator: Dr Ian Storey
Student Investigator: Mrs Anabianca Ananiev

Project Approved: From: 31 March 2015 To: 31 March 2016

Terms of approval:

Responsibilities of the principal investigator

It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. *Amendments*
Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.
2. *Adverse events*
You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
3. *Participant Information and Consent Form (PICF)*
The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.
4. *Annual reports*
Continued approval of this project is dependent on the submission of an annual report.
5. *Final report*
A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.
6. *Monitoring*
Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.
7. *Retention and storage of data*
The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,

Dr Christopher Cheong
Chairperson
RMIT BCHEAN

Appendix 2. Interview Outline

Most interviewees will be asked only about one technology/system but some may be iteratively asked about a number of technologies/systems. The technologies/systems are taken from the list in Table 1-1: Technology descriptions.

The interview will address each affordance relevant to the system experienced by the interviewee (some affordances will not be relevant for some systems – see Table 4-1: Availability of affordances in the investigated , or will not be experienced by the interviewee in depth). Some of the questions will refer to the system overall, and other questions will refer to particular affordances of that technology. The technology will be referred to by using the term ‘system’.

Affordance questions:

Each affordance will first be introduced to the interviewee and briefly described, although affordances will be termed ‘capabilities’ since ‘affordance’ is a technical term not in common use. For example, the affordance of ‘Upload Information Content’ will be introduced by saying, “The following questions relate to the capability of uploading information content”. There will then be a brief introduction of the affordance in everyday language from the list above, with a brief description of each affordance listed in Table 3-4: Affordance descriptions

If the interviewee agrees that they have understood and experienced the affordance, then we proceed with the following questions:

1. Please describe in your own words how you use this capability.
2. How easy was it to find the capability when first using the system?
3. If relevant, how easy is it to find the capability again from one semester to another and from one year to another?
4. Did you find the capability difficult to use? If so, can you please briefly describe what in particular makes the capability difficult to use? If not, are you able to describe any elements which perhaps could be done better?
5. Have you encountered any error(s) when using the capability? If so, can you please briefly describe what particular error(s) you encountered?
6. Do you have trust that the capability is straight-forward to use without unwanted side effects?
7. Is this a capability that you find useful?
8. Are you satisfied with the capability?

Technology/System questions:

9. Do you think that the overall system is efficient or inefficient? Please give reason for your answer.
10. Do you trust that your personal data and business transactions are secure? Please give reason for your answer.
11. Is the overall system compatible with other systems you are using? Please give reason for your answer.
12. How long have you been using the system?

The interview and focus group discussion questions will be:

- A. In what role have you used system/s for educational purposes?
- B. What system/s do you use for educational purpose?
- C. Was there an initial stage when you resisted or were negative towards using the system/s?

If the answer is “yes”, the following questions will be asked:

- D. Have you resisted or were you negative towards using the system due to emotional reasons, such as: the application is too hard to use or you have found the complexity of the application overwhelming?
- E. Have you resisted or were you negative towards using the system due to being cautious (you wanted to make sure people around you were using it and you had the moral support if you had troubles using it)?
- F. If you changed your mind about using the system was it because of your personal use of mobile devices?
- G. If you changed your mind about using the system, was it due to changes inside the organization (more training, upgrades to the software/ hardware, better support)?

Iteratively, a description of each ‘capability’ that the ‘system’ has, is provided to the interviewee. Once the interviewee agrees that they understand the capability, the following questions will then be asked:

- H. Have you experienced the ‘capability’ in any of the system/s?

If the answer is “no”, ask the following question:

- I. What other system have you used to achieve the ‘capability’?

If the answer is “yes”, question 1-8 will be asked, followed by next question:

- J. If you had a choice, would you choose a different implementation of the capability?

If the answer is “yes”:

- K. Have you seen a better implementation of the capability in a different system?
- L. If you have not seen a better implementation, what would you changed about the current implementation of the capability in the current system?

Conclude with technology/system questions 9-12.

Appendix 3. Number of Questions Asked Relative to all Possible Questions

	Ace	Amy	Ben	Joy	Mel	Sam
Blackboard Learn	39	40	39	39	35	39
Blackboard Mobile Learn	2	2	2	2	2	2
Google Apps	19	22	19	15	8	23
Facebook	13	-	13	11	-	-
General Questions	2	2	2	2	2	2
Total Questions Asked	75	68	75	69	47	66
Total # questions: 94	80%	72%	80%	73%	50%	70%

Appendix 4. Areas Covered Relative to all Possible Areas, by Respondents

	Discussion Threads	Sending emails	Setting up Assessments	Posting Assignment Upload Details	Collaborating Spaces
Blackboard Learn	Ace, Amy, Ben, Joy, Sam, (Mel)	Ace, Amy, Ben, Joy, Sam, Mel	Ace, Amy, Ben, Sam	Ace, Amy, Ben, Joy, Mel, Sam	Mel, Sam
Google Apps	-	Ace, Amy, Ben, Joy, Mel, Sam	-	-	Ace, Amy, Ben, Joy, Sam, Mel
Facebook	Ace, Ben, Joy	-	-	-	-

Appendix 5. Summary of Identified Factors

Factor	B or E?	T, O or P?	Who? (Affordance/System)
Non-Perceived Affordance	Barrier	Technology	<ol style="list-style-type: none"> 1. Amy when talking about exporting rubrics to Excel when using Posting Assignment Upload Details in Blackboard Learn 2. Joy when talking about using Collaborating Spaces in Blackboard Learn 3. Mel when talking about Sending Emails through Blackboard Learn 4. Joy using Facebook for Collaborating Spaces 5. Ace when talking about Discussion Threads on Google Apps
Procedural Complexity	Barrier	Technology	<ol style="list-style-type: none"> 1. Ace when talking about creating groups in Google Apps (Sending Emails) 2. Ace when talking about getting items back after being archived when using Gmail

			<p>3. Ace when talking about Collaborating Spaces in Google Apps</p> <p>4. Amy when talking about archiving in Google Apps (Sending Emails)</p> <p>5. Joy when talking about Collaborating Spaces in Google Apps</p> <p>6-7. Amy and Joy when talking about Sending Emails though Blackboard Learn</p> <p>8. Amy when talking about organising file Google Drive when using Collaborating Spaces in Google Apps</p>
Errors	Barrier	Technology	<p>1. Ace when talking about setting up groups for sending emails in Blackboard Learn</p> <p>2. Amy when talking about email threads in Gmail and sending the email to the wrong people.</p> <p>3. Amy when talking about use of hotspots in questions when Setting up Assessments in Blackboard Learn</p>

			<p>4. Amy when talking about use of pictures in questions when Setting up Assessments in Blackboard Learn</p> <p>5. Amy when talking about working with rubrics when Posting Assignment Upload Details in Blackboard Learn</p> <p>6. Ben when talking about students disappearing out of system between semester when using Posting Assignment Upload Details in Blackboard Learn</p> <p>7. Mel when talking about setting up rubrics Posting Assignment Upload Details in Blackboard Learn</p> <p>8. Mel when talking about setting up the submission date/time when using Posting Assignment Upload Details in Blackboard Learn</p> <p>9. Sam when talking about students bombing out in the middle of the test when using quizzes in Setting up Assessments in Blackboard Learn</p> <p>10. Joy when talking about group members missing posts when using Discussion Threads in Facebook</p>
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			11. Sam when using Google Hangouts when using Collaborating Spaces in Google Apps
Efficiency	Enabler	Technology	<p>1. Ben when using Discussion Threads in Blackboard Learn with a larger group (instructor becomes a moderator and students help their peers)</p> <p>2. Ben when talking about giving feedback when using Posting Assignment Upload Details in Blackboard Learn</p> <p>3. Joy when talking about all three systems: Blackboard Learn, Facebook and Google apps as they allow instructors to achieve their academic goals</p> <p>4. Mel when talking about Blackboard Learn as a repository of resources for a subject</p> <p>5. Ace when talking about Discussion Threads on Facebook as a simple IR chat</p> <p>6. Ben when talking about Discussion Threads on Facebook for disseminating information</p>

			<p>7. Amy when talking about Discussion Threads on Facebook as the communication is effective</p> <p>8. Ben when talking about Google Apps operation</p> <p>9. Mel when talking about Sending Emails in Google Apps</p>
Integration/Compatibility	Enabler	Technology	<p>1. Ace when talking about Sending Emails on Blackboard Learn having integration to the school directory system</p> <p>2-6. Ace, Amy, Mel, Ben and Sam when talking about Blackboard Learn being a central point, integrated with everything</p> <p>7. Amy when talking about the integration with rubrics when using Posting Assignment Upload Details on Blackboard Learn</p> <p>8-10. Ben, Sam and Ace when talking about Google Apps integration</p> <p>11. Sam when talking about different Google Apps to achieve Collaborating Spaces</p>

			<p>12. Ben when talking about Google Apps compatibility for interoperability</p> <p>13. Ace when talking about Google Apps compatibility allowed through the use of API's</p> <p>14. Ben when talking about Google Apps compatibility when using Collaborating Spaces</p>
Flexibility	Enabler	Technology	<p>1. Ben when talking about Posting Assignment Upload Details on Blackboard Learn allowing multiple ways into the system</p> <p>2. Joy when talking about Sending Emails via Google Apps identifying email address when typing email recipients</p> <p>3. Joy when talking about the varied way you can provide feedback when using Posting Assignment Upload Details in Blackboard Learn (voice and written)</p> <p>4. Joy when talking about being able to provide the feedback in an attached document when using Posting Assignment Upload Details in Blackboard Learn</p>

			<p>5. Ben when talking about the flexibility and richness of Discussion threads on Facebook</p> <p>6. Sam when talking about flexibility of using Google Apps for Collaborating Spaces</p>
Functionality	Enabler	Technology	<p>1-2. Amy and Ace when talking about the ability to see the assignments through groups when using Posting Assignment Upload Details on Blackboard Learn</p> <p>3. Joy when talking about being able to record the feedback to the student when using Posting Assignment Upload Details on Blackboard Learn</p> <p>4. Mel when talking about being able to get access to the original document which has a high originality index when using Posting Assignment Upload Details in Blackboard Learn</p> <p>5. Mel when talking extra functionality (screen sharing, etc.) when using Collaborating Spaces in Google Apps</p>

			<p>6-11. Ace, Amy, Ben, Joy, Mel and Sam about using the Turnitin, Gradebook and other functionality when Posting Assignment Upload Details in Blackboard Learn</p> <p>12. Mel when talking about the extra functionality offered by Gmail as opposed to the previous Novell</p> <p>13. Sam when talking about the extra functionality offered by Google Apps for Collaborating Spaces and Sending emails</p>
Intuitive Interface	Enabler	Technology	<p>1-3. Ace, Amy and Ben when talking about Blackboard Learn’s interface not being intuitive but Google Apps have more intuitive interface</p> <p>4. Amy when talking the Gmail interface not as intuitive as her Optus email application’s interface</p>
System Integrity	Enabler	Technology	<p>1-5. Amy, Ace, Ben, Mel and Sam when talking about the integrity offered by Posting Assignment Upload Details on Blackboard Learn</p>
Training	Enabler	Organisation	<p>1. Ace when talking about no formal orientation for Blackboard Learn</p>

			<p>2-3. Amy and Ace when talking about peer training to using Blackboard Learn</p> <p>4. Ace when talking about peer and student led training to using Facebook</p> <p>5-6. Amy when talking about being able to get access to training for both Google Apps and Blackboard Learn</p> <p>7. Sam when talking about student led training to using Collaborating Spaces in Google Apps</p>
Quality of teaching	Enabler	Organisation	<p>1-2. Amy and Sam when talking about the capability of when using Setting up Assessments on Blackboard Learn</p> <p>3-4. Amy and Joy when talking about Sending Emails through Blackboard Learn to create inclusion with students</p> <p>5-6. Sam and Ben when talking about using systematic of Google Apps use to add to quality teaching document</p>
Enhanced pedagogy	Enabler	Organisation	<p>1-2. Amy and Ace when talking about the ability to enhance pedagogy through the use of Sending Emails with Google Apps by creating interaction and better communication</p>

			<p>3. Ben when talking about using quizzes by Setting up Assessments on Blackboard Learn to create a checkpoint for students’ learning in a flipped sort of classroom approach</p> <p>4-8. Mel, Amy, Ben and Joy when talking about the enhanced pedagogy of using rubrics when using Posting Assignment Upload Details in Blackboard Learn</p> <p>9-10. Joy and Ben for the inclusion value of using Discussion Threads on both Facebook and Blackboard Learn when dealing with a study tour and online students</p> <p>11. Mel is looking forward to using ETEs but she needs to justify the change pedagogically</p> <p>12-14. Sam, Mel and Ben admitted that what they do is pedagogically driven</p>
Student Uptake	Barrier	People	<p>1-4. Amy, Mel, Sam and Ace when talking about the lack of student uptake to Discussion Threads on Blackboard Learn</p>

			<p>5. Ben when talking the lower and lower student uptake to Discussion Threads on Blackboard Learn when student numbers are dropping in a course</p> <p>6. Joy when talking about the successful student uptake to Discussion Threads on Blackboard Learn when they are involved in group work</p> <p>7. Mel when talking about the lack of general student uptake to Blackboard Learn</p> <p>8. Ben reporting that a number of tutors gave up using Discussion Threads on Blackboard Learn and moved to Discussion Threads on Facebook</p>
Student satisfaction	Barrier	People	<p>1-4. Amy, Sam, Ben and Ace when talking about complaints from students when encountered errors using Setting up Assessments on Blackboard Learn</p> <p>5. Mel when talking about student complaints when encountering errors while using Collaborating spaces on Blackboard Learn</p>

<p>Health complaints</p>	<p>Barrier</p>	<p>People</p>	<p>1. Amy reported sore back caused by marking online assignments through Posting Assignment Upload Details in Blackboard Learn</p> <p>2-3. Mel and Amy reported eyes hurting due to online marking online assessment through Posting Assignment Upload Details in Blackboard Learn</p>
<p>Student culture</p>	<p>Enabler</p>	<p>People</p>	<p>1-2. Ben and Ace when talking about Facebook being part of the student culture (Discussion Threads)</p> <p>3-4. Sam and Amy reported Facebook being part of the student culture (Discussion Threads)</p>
<p>Instructor modelling</p>	<p>Enabler</p>	<p>People</p>	<p>1-2. Amy and Ace when talking about the setting up communication channels for groups when using Sending Emails via Blackboard Learn</p> <p>3. Sam when talking about using Google Apps for various tasks in the subject and the students following suit</p> <p>4-5. Joy when talking about setting up communication channels though Discussion Threads on Facebook and Sending Emails through Google Apps and Blackboard Learn</p>

			6. Ben when reporting that if no modelling is present (students are given a choice) they choose the easy option for collaboration (whiteboard rather Google Apps)
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