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Use Your Own Device (UYOD) Guidelines as a mechanism to enable sustainable mobile learning in a Higher Education Institution

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Abstract

Despite significant research activity around mobile technologies and growing awareness of the potential of the mobile technologies for education, higher education institutions have not seen mobile learning happen on a large scale and in a sustainable manner. There is no guidance on how to create an environment that enables the use of personally owned devices in learning contexts to enable innovation in teaching practices in higher education institutions. There are many frameworks to guide the implementation of mobile learning initiatives in higher education institutions and evaluate the success of such initiatives. However, none of these frameworks or models provides a roadmap that considers all the processes systems, infrastructure and the people involved to incorporate a Use Your Own Device(UYOD) approach, which then helps to create an ecosystem where the use of mobile technologies to support learning and teaching is enabled. The frameworks also do not take into account the rapidly evolving nature of mobile device capability and the impacts of this on affordances that may be harnessed in learning and teaching contexts.

This research aimed to determine how capacity for mobile learning can be created or enabled within an organisation such as a higher education institution in a manner that mitigates risks and creates the capacity to capitalize on the affordances of the technologies as organisations takes advantage of students bringing and using their own devices. The thesis presents guidelines for enabling a Use Your Own Device (UYOD) approach to creating a mobile learning enabled environment within an organisation such as a higher education institution. The guidelines proposed are the result of three cycles of Design-Based Research (DBR) based on Roger's theory of Diffusion Of Innovation (DOI), while also taking into consideration issues around organisational culture as they influence the progression of innovation in using mobile devices and technologies.

The Design-Based Research (DBR) approach (also known as design science research) took iterative steps to build the guidelines through three cycles which investigated the questions:

- What are the obstacles around "Use Your Own Device" (UYOD) in learning and teaching

- How can policy and practice in an institutional context for UYOD respond to these obstacles?
- What leadership requirements would be adequate to implement helpful policy and practice to enable UYOD for mobile learning?

The proposed guidelines present a novel approach, leveraging the integration of individually owned devices to enabling mobile technologies for learning and teaching in how it considers the organisational culture alongside the process of creating the enabling systems and processes for facilitating innovation with mobile technologies.

The contribution from this research is of value to technology leadership, policy influencers and learning technologists in higher education institutions, who are interested in enabling sustainable mobile learning initiatives. The guidelines proposed give strategic direction, which can be customised at a local level to suit the conditions of a particular organisation.

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Glossary of frequently use terms and Acronyms

BYOD

Bring Your Own Device whereby student is allowed to bring their own mobile devices for use within an institution's infrastructure.

DBR

Design-Based Research

DRHEA

Dublin Regional Higher Education Alliance

DOI model

Diffusion of Innovation model proposed by Everett Rogers

DSR

Design Science Research

eLearning

Electronic Learning: the use of ICT technologies to facilitate learning.

Feature phones

Mobile phones which offer a limited range of capability such as voice calling, texting and basic multimedia.

HE

Higher Education

HEI

Higher Education Institution

ICT

Information Communication Technology

IOT

Internet of Things

ITs

Institutes of Technology (generally used in plural in this thesis)

IT

Information Technology

LTSC

Learning Technology Services Centre (LTSC) Unit in OOI who work with academics and IS to develop, support and facilitate teaching practices that enhance the student learning experience.

MMS

Multimedia Messaging

mLearning

Mobile learning

OOI

Organisation of Interest- in this thesis, the institution in which the research is conducted.

PC

Personal Computer

SAAS

Software as a Service

Smartphones

Smartphones are mobile devices with computer-like functionality in form of complete operating system and a platform for application developers to build and distribute apps

SMS

Short Message Service.

TAM

Technology Acceptance Model

TEL

Technology Enhanced Learning

UYOD

Use Your Own Device whereby student is enabled to use their own mobile devices to participate in and support learning irrespective of where they are located.

VLE

Virtual Learning Environment

1. Introduction, Organisational Backdrop and Thesis structure

Introduction

1.1 Researcher's Background and Perspective

The researcher of this thesis is an information communications technology professional focused on enabling and supporting the use of technology to enhance learning and teaching. During the duration of this research, they worked as a learning technologist in the Organisation of Interest (OOI) which is based in Ireland. In order to protect the participants in the study, the Institution is referred to as the Organisation of Interest and its name is redacted in all documentation.

In the role of learning technologist, it is the researcher's responsibility to observe trends in the use of technology, patterns of adoption by staff and students, and to advise leadership and management for planning purposes. The researcher is also charged with supporting academic staff to implement technology enhancement into their practice and acting as an advocate for ensuring information technology systems and other supporting functions are aligned for supporting learning and teaching. While not vested in any particular technology or application, it is the learning technologist's role to ensure that the experience of using Information Communication Technology (ICT) in learning and teaching practice goes smoothly.

The researcher worked within a team to provide support and best practice advice for dedicated learning technologies such as the virtual learning environment (VLE), learning portfolio platform, lecture capture system, texting system, and any other external platforms appropriated for use such as the virtual world SecondLife and even social media platforms such as Twitter. Solutions that take advantage of ICT such as those deployed in this research were designed and developed by the researcher in their role as learning technologist in response to opportunities identified by academic staff who are then responsible for implementation in their practice.

The research described in this thesis is particularly relevant to the Irish HE setting within which OOI is situated and can influence IT practice through

regional and national networks. In so far as the Irish HE institutions are similar to others outside Ireland, the results from this study can be generalised to such.

The OOI was part of the Dublin Regional Higher Education Alliance (DRHEA) which combined the strengths of its members, who represented more than half of the Irish higher education institutions and include Institutes of Technology (ITs) as well as Universities until its dissolution in 2013. The work of the DRHEA was focused on Enhancement of learning, graduate education, widening access and internationalisation and continues in an informal capacity. More recently, the OOI is part of a national initiative called the National Forum which aims to enhance learning and teaching for all students in higher education by engaging with leaders, managers, academic staff and students to mobilise expertise and input.

The current research is conducted from the viewpoint of an eLearning developer (also sometimes referred to as a Learning Technologist). In some organisations, this role is focused on instructional design and development of eLearning artefacts. In others, such as the Organisation of Interest (OOI), learning technologists have a more varied role. As well as being involved in instructional design and development of artefacts, they also provide development development support, advice, and expertise to Information Services (IS) departments, institutional management and leadership functions, and contribute to shaping institutional policy. In the OOI, the learning technologists are part of a unit called the Learning Technology Services Centre (LTSC), whose aim is to develop, support and facilitate teaching practices that enhance students' learning experience. This includes providing expertise, support, and advice for using technology in education and working alongside IS.

In the OOI, the Learning Technologists are also involved in academic activity such as lecturing on postgraduate courses, carrying out research and facilitating workshops. The learning technologists in this space are referred to in literature as "third space professionals." Third space professionals are a category of professional staff in higher education who occupy that space of intersection between professional and academic spheres of activity (Whitchurch, 2008). While in this space, eLearning development officers are usually a bridge between the pedagogy and technology and can come from various backgrounds.

The background of the eLearning development officer may be in any primary area including education and Information technology amongst others. Whatever the background, while performing in this role in the OOI, the eLearning development officer is required to bridge the gap between the Information Communications Technologies (ICT) and learning and teaching practice. In general, eLearning professionals advise and guide academic staff on the use of tools and technologies while working with the Information Services (IS) department to support an environment that facilitates learning and teaching. They also advise management and leadership on strategy concerning the use of technology in learning and teaching. It is in this capacity, the observations leading to this study were made. Since the incorporation of the Learning Technology Services Team in the OOI, the role of eLearning has grown within the institution. The term "eLearning" in the OOI is used to refer to any instances where information and communication technologies are used to enhance, support or augment the learning experience or processes around the learning experiences. As such any technologies that gain prominence in the day-to-day lives of students are explored for suitability in educational contexts.

This PhD thesis is grounded in the areas of practice of information technology, technology management, and learning and teaching as pertaining to creating capacity for using personally owned mobile devices for mobile learning in an organisation such as a Higher Education Institution.

In Chapter One of this thesis, the research setting is described and the peculiarities of the "Organisation of Interest" (OOI) are outlined to illustrate the organisational background within which the research is contextualised and outline what makes the OOI a typical higher education institution. The case is made for why recognising and addressing the issues and challenges around using individually owned mobile technologies in higher education is important.

The sections in this chapter describe the research setting by highlighting the nature of the target institution, peculiarities of the OOI, the organisational structures and organisational culture and dynamics. A declaration of the researcher's point of view is given to provide the motivation for the perspectives from which the research is carried out and a timeline for the research described in this thesis is presented. The chapter ends by giving an outline of the chapters to follow.

1.2 Organisational context as Higher Education Institution Environment

The setting for this research is the Higher Education (HE) environment in Ireland. A higher education institution is described as

> *"the term used in Europe to designate organizations providing higher, post-secondary, tertiary, and/or third-level education."(Chance, 2017)*

Irish higher education institutions similar to the rest of Europe are post-secondary education providers of courses from certificate to higher degree levels. Higher education systems in most European countries are divided into the university and polytechnic or institutes of technologies. Universities have usually been providers of degrees and higher degrees for longer and comprise of public and private institutions. Polytechnics or institutes of technology (ITs) on the other hand, are mostly former industrial and vocational training colleges and have a legacy of being strong in technology and engineering professional areas. The differences between the universities and the polytechnics or institutes of technology are that universities have more funding sources, higher budgets from the government, higher number of staff with doctorate degrees and usually have a stronger focus on research. Universities can also award their own degrees but ITs and polytechnics awarded degrees accredited by a national body.

As of Summer, 2017 when this thesis is being reported, the higher education space in Ireland is made up of eight universities, fourteen Institutes of Technology (ITs), six part funded specialist colleges (for teacher education, music, and medicine). The Universities and ITs are similar in terms of their legislative and governance foundations as well as their funding and human resource management arrangements. In Ireland, the Higher Education Authority (HEA) has had statutory responsibility for governance, regulation, and funding in both ITSs and Universities since 2007 (HEA Website, 2017).

The OOI is comparable in form and function to a university such as Trinity College Dublin (TCD), University College Dublin (UCD) or the University of Nottingham in the UK. It meets the descriptions in the previous paragraph of granting degrees up till higher level, has a strong research focus and awards its own degrees. Typically, the main function of the Institutes of Technology in Ireland is to:

> *"… provide vocational and technical education and training*
> *for the economic, technological, scientific, commercial,*
> *industrial, social, and cultural development of the state with*
> *particular reference to the region served by the College…"*
> *(Regional Technical Colleges Act, 1992).*

While not a hard rule, the fundamental difference between the Institutes of Technology (ITs) and Universities was that the main focus of the ITs was on career education in industry rather than within research or education but this line has blurred over the last years, and in recognising this, in the UK, polytechnics were granted University Status such as Nottingham Trent University, formerly Trent Polytechnic (later Nottingham Polytechnic), Anglia Ruskin University, formerly Anglia Polytechnic; and Birmingham City University, formerly Birmingham Polytechnic (Scott, 2012). While the OOI does not have formal university status, it is involved in research and higher-level education, as well as fulfilling the traditional remit of the Institute of Technology by providing vocational courses to degree level such as Culinary Arts, Aircraft maintenance amongst others. To this end, there have been applications made to acquire full university name status, and this is being considered under a proposal for a Technical University.

In the last few years, the Higher Education space in Ireland has undergone changes and reviews as a result of the economic conditions and increased student numbers, as well as changing needs of the industries and professions into which the graduates enter. In 2009, an expert group led by Dr. Colin Hunt was convened to draft a national strategy for higher education to 2030. In 2011, the resulting "*Hunt Report*" was published, and subsequently, Higher Education Institutions have aligned their strategic objectives to address the recommendations from the Hunt Report (Hunt, 2011).

The OOI is undergoing changes regarding positioning in the sector, campus location, and internal structures. In 2010 when this research commenced, the OOI had approximately *22,000* students and an estimated core staff of approximately *1,723.* The OOI was established as an amalgamation of vocational and technical colleges. It is spread across Dublin city in 6 main campuses which were former colleges. There are discrepancies in the services available across campuses despite all efforts to create an equitable environment.

Some of these discrepancies are due to various factors such as structural differences in campus buildings, varying levels of support onsite, and the organisational culture of the individual home faculties.

In the OOI, the year 2014 saw the start of a move to a new purpose-built campus. The new campus is envisaged to have the potential to level the College experience and unify the institute's colleges and services. It is also an opportunity to design learning spaces that are reflective of modern technologies, teaching and learning methods and other needs aligned with the mission of the institution. In the academic context, there have been several initiatives and programmes to create a more "student centred environment" and support "active learning" approaches which take advantage of information and communication technologies (ICT) including mobile technologies.

Given that a researcher has to determine the focus of their case study (Bogdan and Biklen, 2006, p. 67), the overview of higher education institution space given in this section and the description of the OOI situates the OOI as a case of such higher education institutions.

1.3 Information Communication Technology

For many institutions, Information Communication Technology (ICT) features as a top priority to the extent to which it is useful to accomplishing their broader aims. The National Forum for the Enhancement of Teaching and Learning in Higher Education is a convergence of all those involved in shaping third level teaching and learning in Ireland. In 2015, the Forum published a roadmap for the enhancement of learning in a digital world for 2015-2017. The roadmap recognises that technology does not automatically enhance learning environments, but then acknowledges that digital capacity has important and ever-increasing potential (National Forum, 2015).

The ICT sector offers a broad range of technology options for higher education use today and has become more integral to daily life as the technologies have progressed to become more affordable and available. This improved affordability and availability has resulted in increased ownership of Personal Computers (PCs) and Internet access, which has been reflected in the higher education ICT space. Institutions have made significant investments in enterprise-wide systems that simplify administration and try to widen participation in education. The trends of technologies are tracked by publications

such as Horizon and Educause as well as the EDUCAUSE Center for Analysis and Research (ECAR), which all highlight technologies of interest and make predictions on which may have the most value in the year following their prediction.

1.4 Mobile Technologies and Mobile Devices

Mobile technologies have become a key part of most societies and communities today with rapidly growing numbers in device ownership of smartphones, which are sometimes described as 'pervasive' or 'ubiquitous.' Smartphones are mobile devices with computer-like functionality in form of complete operating system and a platform for application developers to build and distribute apps. Feature phones on the other hand, are mobile phones which offer a more limited range of capabilities such as voice calling, texting, and basic multimedia.

As of November 2014, there were approximately 7 billion mobile subscriptions worldwide (ITU, 2014). Broken down further, there were 4.5 billion mobile users, who have more than one subscription (Ericsson, 2014). It was predicted that mobile subscribers will reach 9.3 billion by the end of 2019 (Portio Research, 2013). These numbers differ when broken down further to compare emerging and developing countries such as Nigeria, Kenya or India to the developed ones such as Ireland, United Kingdom or the United States. Where the economically-developed world is already considered to be at full penetration, there is still room for significant growth in the emerging world space. The numbers change yet again when considering smartphones or tablets to show much lower but rapidly growing ownership patterns for smartphone and tablets in the emerging world.

In organisations, including higher education institutions, the ownership patterns described in the previous paragraph are reflected in the local populations with students and staff owning various types of mobile devices (Chen and Denoyelles, 2013; Engel and Green, 2011). Students are using their devices to access institutional systems such as the virtual learning environments, emails, and others, whether they are optimised for mobile or not. Information Services (IS) departments in these institutions have been presented with new challenges in how to deal with increasing integration of personally owned devices in varied numbers of ways, such as access to some internal systems and data, security implications, support expectations. On the other hand, many educators have

been thinking about how to harness the opportunities afforded by the devices and their ownership to enhance the learning experience or banning/ignoring the devices or yet still, actively exploring the affordances of mobile technologies. These affordances include:

> *"1) high device-portability that enables easy access to mobile devices and user mobility (Brown, 2009);*
>
> *2) relatively strong computing power that gives learners the ability to achieve and complete tasks on small devices with a capability equivalent to larger and less portable devices (Lai & Wu, 2006);*
>
> *3) always-on and stable Internet connectivity with high bandwidth which allows for instant access to large amounts of information and real-time communication regardless of location."*
> *(Johnson, Smith, Willis, Levine, & Haywood (2011) cited in Hsu et al., (2014, p. 2)*

Over the last few years, handheld cellular mobile devices have evolved from the Motorola phone through the first smartphone in 1993/94 by IBM called Simon, which included a calendar, address book, clock calculator, notepad with a QWERTY keyboard and began the trend of Short Message Service (SMS). These earlier generation smartphones depended on a 2G network which was subsequently updated to 3G and facilitated the ability to access the internet from the devices. 5G networks are now due to launch in 2020 potentially bringing more data capacity and lower latency, improving on 4G and providing an opportunity for virtual and augmented reality experiences. In the earlier days of mobile devices, some users carried a PDA device alongside their cell phone (or "mobile phone"). Alongside improved connectivity, the capabilities of smartphones have grown to include a camera, media player, integrated PDA, web-browsing, motion sensors, location awareness, and more. In 2007, Apple released the iPhone which introduced the ability to download and run applications (also called "apps") on the phone. The use of *apps* made it possible to extend the capabilities of the phone and create new affordances which opened the door for more widespread adoption and interest in education as well as other

sectors. Moreover, the newer generations of these mobile phones can enable context-aware ubiquitous learning which describes learning that offers seamless services, adaptive services, and context-aware services (Yang et al., 2007). More recently, mobile devices have expanded to include augmenting devices such as glasses, watches collectively known as 'wearables', and other location aware solutions to form an ecosystem of personal technologies that extend the functionalities of the smart phone.

Initial use of individually owned devices was in the corporate sector starting with Intel who realised their employees used their own devices to connect to the corporate network resulting in productivity increase and cost savings which has led other organisations to find ways to allow their employees do same (Harkins, 2013). In the higher education setting however, the drivers for wanting to use individually owned devices are more aligned to organisational goals of increasing and diversifying access to learning and student numbers in response to changing economic demands and rising cost of education. The core business of higher education institutions regardless of their size or student numbers is the provision of education in preparation for work or research and as part of this, formally assessing their students. This need for formal assessment is a key differentiator from the corporate use of UYOD. Higher education institution programmes are designed to ensure that the learning plans including content and activities deliver on specific goals and are assessable. Introduction of new technologies must therefore take into consideration the management systems in place.

1.5 Management system and mobile device deployment in Higher Education Institutions

The type of management system in higher education in Ireland is Anglo-Saxon meaning typical to the English speaking countries on the European continent such as Ireland, United Kingdom. This form of management is decentralised rather than as in Continental Europe (Erdem, 2016, p. 255). The Anglo-Saxon management style gives the faculties and departments more autonomy over how their staff fulfil their duties to achieve the organisational goals. Faculties can determine whether their staff focus on innovative or traditional approaches to delivering the curriculum in the required timeframe for the semester.

Introducing any new technology in educational settings has always presented challenges that need to be overcome. Learning and teaching with mobile devices and technologies has been no exception. Despite a fair amount of research activity in the area, the use of mobile devices in learning has not achieved as much ubiquity in formal contexts as it has in other domains of student life. This is despite some successful pilots in a range of applications. Some pilots have stalled, but unfortunately, these garner limited attention. In some cases, it has been suggested that they might not have been generalizable or scalable due to being project based or fixed term and small scale (Traxler and Wishart, 2011).

Over the last decade, there have been studies into various affordances of mobile devices in an educational context to explore the possible range of uses. The year 2009, saw what is described as the first campus-wide mobile learning initiative, in the Abilene Christian University (ACU), in which all first-year students received an iPhone or iPod Touch for personal use (Perkins and Saltsman, 2010). In 2011, Charles Stuart University established a mobile learning exploratory project to investigate the potential for mobile technology to be used in all their learning and teaching contexts (Klapdor and Uys, 2013). In other universities, there are pockets of mobile learning activity as interested lecturers experiment with incorporating the use of student owned devices in their practice. When a systematic review was carried out into 21 mobile learning initiatives from 2005 to 2011, it was found that most of the initiatives indicated benefits from using mobile devices. These benefits were identified to be: an increase in achievement, productivity, engagement and motivation (Pollara and Broussard, 2011).

Despite the apparent success of these initiatives, there has not been an observable wide scale uptake in the use of mobile devices in learning and teaching. Looking ahead to the future of mobile learning, David Parsons warns that making assumptions about what mobile learning is or how it could be, could lead to failure to appreciate its full set of potentials. He concludes that the concept of mobility will have an increasingly important role to play in lifelong learning as supporting technologies become more fluid, adaptive, collaborative and exploratory (Parsons, 2014).

In active exploration of the affordances of mobile devices, educators highlight a number of barriers to the continued use or sustainability of their initiatives, including physical limitations such as infrastructure, device screen size, and

usability, as well as safety and academic integrity (Engel and Green, 2011). The effort to address these barriers led to the search for a model or framework for guiding the implementation of mobile learning in higher education institutions. Many researchers (Alrasheedi and Capretz, 2013; Wingkvist and Ericsson, 2010; Koole, 2009; Park, 2011)   so far have focused on the implementation of mobile learning frameworks that guide the implementation of specific mobile learning initiatives or applications rather than the creation of the environment within which student owned mobile devices can be incorporated as part of the learning experience. An early example of one such study looked specifically at the design requirements for mobile learning environments to identify what factors and design elements are crucial to the mobile learning environment (Parsons et al., 2007) It focuses specifically on the design of mobile learning applications and systems rather than the environment within which such systems are deployed in.

Since the inception of the current Ph.D. study, the gap for a framework or model that looks at the broader challenge of enabling sustainable mobile learning across institutions has also been recognised by other researchers. The Mobile Learning Evaluation Framework (MLEF) is one of such. It is a project supported by the Australian government's Collaborative Research Networks (CRN) program and the Commonwealth through the Australia-Malaysia Institute of the Department of Foreign Affairs and Trade. The project aims to create an evaluation framework that will aid the selection and justification of mlearning initiatives (Murphy and Farley, 2012). This is also the research focus of a recent thesis which focuses on the development of a maturity model based on a Capability Maturity Model (CMM) to assess how far mobile learning can grow and mature in a defined area such as mobile learning (Alrasheedi, 2015).

A common thread across studies examined is that mobile devices and applications have the potential and expectation to have a significant impact on teaching. However, a clear strategy for how to best harness the technology for institution-wide adoption is unclear, especially in the face of budget constraints and restricted discretionary funding (Alden, 2013). Additionally, these studies do not take into account that mobile technologies are fast evolving and so projected impacts need to take this into account.

1.6 Defining Mobile Learning

When considering the integration or adoption of mobile learning technologies in an organisation such as a higher education institution, there needs to be a consideration of the mobility of the users- both students and staff, the role of the mobile devices in the interactions that enable, support, and recognise learning as a process. The definition proposed by Sharples emphasizes the process of learning through cross-context interaction which is enabled by the devices being used:

> *"...Mobile learning can be defined as, "the processes (both personal and public) of coming to know through exploration and conversation across multiple contexts amongst people and interactive technologies" (Sharples et al., 2007, p. 224)*

In this definition, "learning" reflects a change in knowledge state facilitated by engaging in conversation using the medium of the personal devices as interactive technologies. These conversations which happen across multiple contexts facilitate a process of mutual adjustment and negotiation of schemas within self and with others (Pask 1975, quoted in Sharples, 2007). The emphasis in this definition does not only consider the device as being used for accessing content and information but for also for more active and participatory learning and engagement. However, on the surface, this definition can be applied to any technology that facilitates communication rather than just individually owned mobile devices. The definition proposed by MoLeNET emphasizes how the mobile devices differ from laptops or PC in defining mobile learning as:

> *"The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning." (MoLeNET, 2015)*

This will allow for the exploration of mobile learning in terms of the mobile device being readily and always available as well as the mobility of the device owner, and the environments where the learning activities occur. There are many alternative definitions for mobile learning which tend to reference *"anywhere, anytime"* learning. Such definitions can be limiting when considering the integration or adoption of mobile technologies in an organisation, as they do not

account for the full range of affordances in today's mobile devices (Parsons, 2014). They also do not capture the aspect of personal ownership of the devices which is a core part of the mobile learning experience (Sundgren, 2017). The defintion therefore proposed for this thesis is that:

Mobile learning is the use of individually owned interactive devices along with enabling technology infrastructure to access resources for learning and participate in learning activities independently and within formal and informal learning contexts irrespective of location.

This definition expands the scope of individually owned devices to include all personal interactive technologies and introduces the notion of "Use Your Own Device" (UYOD) rather than "Bring Your Own Device" (BYOD) which makes it seem like the learning must occur at a fixed location or time and does not consider how students often create private learning spaces even in public places and act as a bridge between public and private life (Ilic, 2015, p. 29) . It is also flexible to allow for the evolving nature of personal mobile devices as their functionality gets expanded onto accessories and wearables such as glasses or watches.

As the internet has evolved to become more participatory by the creating of Web 2.0 platforms, social media, social networks, mobile devices and underlying networks have also improved. Today, there is a broader range of devices including telephones and tablets at different price points. Recently we have seen the addition of smart watches with a range of applications to augment the smartphone. The underlying networks on which these devices run have also improved to offer more stable and reliable connectivity, higher network speeds and data capabilities. In recognition of the fact that mobile devices have become a more visible part of the landscape across institutions and on networks, higher institutions started to consider developing mobile learning integration strategies. It was in light of this widespread use, the Horizon Report (Johnson et al., 2011) gave mainstream adoption of mobile devices in education a year or less. At the time, this prediction was attributed to the convergence of three trends which are:

- The growing number of Internet-capable mobile devices.
- Increasingly flexible web content.
- Continued development of the networks that support connectivity.

The 2011 Horizon Report gives a US-centric perspective, and the mobile learning emphasis in it is more on the development of products such as content for mobile platforms and applications for mobile devices. However, it is also relevant as a reference in Europe as pressure mounts for educational curricula to be more globalized (Nieto, 2014) and boundaries begin to fade with more people availing themselves of distance learning opportunities.

The JISC mobile and wireless review (Belshaw, 2011) for the JISC eLearning program, gives a more Euro-centric report after reviewing European-wide initiatives such as MOBIlearn, Learning2Go, MoLeNET, as well as interviewing various education practitioners in the mobile learning community. The JISC report highlights the notion that mobile learning cannot be considered in isolation from wider societal and cultural changes in the sector and institution, for example, the move towards cloud computing or flexible service delivery in the ICT industry.

In 2013 and 2014, the Horizon report underwent a reformat to focus its publications on the implications of the trends driving educational technology strategy and the perceived challenges. It also includes a more global perspective with over seventeen countries represented. From this global stance, it is observed that universities are taking advantage of mobile technology to meet students where they are to offer tailored educational content and tools (Johnson et al., 2015). It is also recognised that alongside yielding opportunities and offering advantages for growth, there are also threats to the way an educational institution runs its business regarding technological infrastructure, financial impacts, instructor and student training, human resource management, and course deployment (Kraglund-Gauthier, 2015). In an earlier report by JISC, it was highlighted that it was important to integrate or adopt mobile technologies in a way that enhances the pedagogy of teaching experiences as well as considering the economic, cultural and social concerns (Belshaw, 2011). In consideration of these pedagogic, economic, cultural and social concerns, what is also important, but not often mentioned, are the systems and infrastructure within which these factors play. These infrastructural and organisational challenges are not easily observed or their interrelationships are underestimated.

Most institutions have their information technology systems set up in the hub or jigsaw models (Paulsen, 2002a). These models represent how the various

systems across the institution are connected with others. This topology of how the systems are connected and communicate with each other, and how the users and groups of users are connected and impact each other needs to be reflected in the adoption of mobile learning. In the current research, the interplay between the users, system infrastructure, and organisational structures is not considered.

This section has set the scene for viewing mobile technologies for learning within the broader ICT for education framework as being both parts of a continuum of technology enhanced learning but more importantly, enabling the realisation of going beyond the enhancement of learning to enable transformational experiences (Puentedura, 2006). It has also presented the definitions being applied in this thesis. The next section builds on this by assessing the current research landscape of mobile technologies in higher education, showcases examples of mobile technology implementation and identifies the present challenges and opportunities.

1.7 Proposition of Research to be conducted

An understanding of the pedagogical backdrop, policies, and general trends in use of Information Communication Technology (ICT) in the HE setting creates a background from which the use of mobile technology emerges.

Institution leaders and academic staff strive to take advantage of the technologies to impact on their strategic goals while enhancing learning and teaching. Most of the exploration of how to make use of the mobile technology happens in silos which do not often interact, the various stakeholders operate within their own work group, and so the benefits of each are not readily available across the board to the entire institution. Existing frameworks examined have not provided guidance on how an institution can enable a "Use Your Own Device" (UYOD) approach to support learning and teaching activities.

The proposition of this research is that to create a mobile learning aware environment within a higher education institution that takes advantage of student owned devices, there needs to be some strategic guidance. The guidance this will comprise of a series of actionable items. These actionable items when addressed by an institution ensure that the mobile learning environment deals with the issues pertaining to UYOD are to enable sustainable and innovative

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mobile learning experiences in a world in which there is a fast pace of change in the types of personal mobile technologies.

This PhD thesis explores the issues a higher education institution such as the OOI encounters to enable the use of personally owned mobile devices in sustainable mobile learning initiatives. It does so by the deployment of casestudies which are used to test the infrastructure, processes and examine the culture. The infrastructure here refers to both technological as well as organizational systems and processes. From the research conducted, this thesis will present insights which are applicable to other institutions similar to the OOI.

This thesis describes how through a series of Design-Based Research (DBR) cycles which address these aspects of the OOI:

- The sensitivity of the organisation to UYOD
- The capacity of the OOI to accommodate use in learning contexts.
- Lastly, the findings are explored with stakeholders across the organisation.

From these actions, guidelines are derived to identify how a higher education institution such as the OOI as has been described in section 1.2, can design and develop an infrastructure and culture to enable and sustain UYOD to enhance and support learning while bearing in mind the continuously evolving nature of personal mobile technologies.

1.8 Research Approach and Timeline

This research takes a Design-Based Research (DBR) approach to explore the OOI as a case study of a higher education institution by starting by exploring current difficulties around UYOD in learning contexts, identifying the systems and processes impacted when UYOD is implemented in learning and teaching contexts. In the last phase, the results derived from the earlier interactions are verified against the wider organisation through a series of interactions with students, academic staff, and the institutional leadership.

The research timeline spanned from November 2010 until 2015 to encompass all research activity from initial literature review to writing up as laid out in Table 1.1:

Table 1.1 Research Timeline and activities

Time Window	Activity
From November 2010	Preparation and planning for research
August to October 2011	Cycle 1: The pilot study
September to December 2012	Cycle 2: Investigating Institutional Capacity
December 2013 to July 2013.	Cycle 3: Revisiting findings against broader Institutional Context.
2013 to 2014	Reviewing and Data Analysis, final research annual review.
2015	Writing up of thesis

These activities are detailed in this thesis, and the following section is an overview of how the narrative of the research is unfolded in each chapter.

1.9 Thesis Chapter Organization

This first chapter present has presented the background for the research by explaining the researcher's background and why the OOI was the setting. The OOI was characterised as a typical higher education institution and bounded as a case study of such. Information Communication Technology (ICT) and Mobile Technologies in the society and higher education space are outlined and situated in the higher education context. The culture of innovation and the management structures in place in higher education institutions are highlighted and the OOI has been described to give insight into how the need for this research was determined as demonstrated in the researcher's perspective. A definition of mobile learning was specified and the proposition of the research was given. The timeline for the work carried out was outlined and this chapter has given a synopsis to show how the narrative of the research conducted is laid out in the rest of the thesis.

Chapter Two examines issues the facilitation of mobile learning within a higher education institution. The aim of the discussion in Chapter Two is to explore current research to identify where there is a gap in the literature on mobile technologies in higher education and thereby identify relevant questions to guide the research. This is done by examining recent research into the use of mobile learning technologies in higher education institutions. Mobile learning is discussed in terms of its relationship with eLearning and use of mobile

technologies (portable individually owned devices) within the infrastructure of an institution, while highlighting the relevance of mobile learning within a higher education context. Other related issues are discussed such as the information technology infrastructure and existing processes, and the mobile learning is classified by the affordances of the mobile devices as of today while acknowledging that there is a need to ensure as much as can be predicted, an organisation's plans are future proofed. ICT configuration models used in the higher education institution are described and the mobile learning frameworks in research are outlined to identify the areas not addressed. The gap in research is highlighted and the research questions to be answered to address this gap are specified.

Chapter Three focuses on the strategic approach to the research and presents an exploration of the philosophical viewpoint and assumptions on which the current research was done. It also gives an overview and justification for the methodologies and methods used in the current research to address the research questions. The mixed methodologies (Design-Based Research, Case-study) and research methods used are justified. The cycles of the Design-Based Research (DBR) are outlined. The chapter concludes by highlighting the ethical and quality assurance pertinent to the research.

Chapters Four through Six describes the data collection and analysis through three cycles of Design-Based Research (DBR) to produce conceptual guidelines grounded in the output from the research. The period of data collection and analysis was through 2011 to 2013, while in 2014 the research was reviewed and presented for annual review. The narrative of the study is outlined as it goes through the cycles for each iteration, the on-going analysis of the resulting data as it was collected, and how codes and themes were identified, and categorised, and the response to the analysis is presented as guidelines for guiding the creation of a mobile learning enabled environment.

Lastly, Chapter Seven summarises the findings from the research cycles and focuses on the discussion of the guidelines proposed. The aims of the research and related research questions are revisited by outlining the key contributions of the current research and how they address the aims of the research. Recommendations and possible directions for future works are highlighted as well as limitations of the research conducted in this thesis.

1.10 Conclusion

The researcher's background as a learning technologist in the OOI has been outlined to emphasise the importance of their role to the evolution, development and proper deployment of learning technologies within the OOI. Their relationship with the OOI where the research was conducted was highlighted to explain why the OOI is the case being studied. The OOI was characterised as a higher education institution and a definition for mobile learning was proposed for the research to be undertaken. The next chapter presents the literature review which provides the background and context from which the need from this research arose.

2. Literature Review- Contextualising the research

Introduction

In this chapter, the research questions are derived by critically examining issues regarding the implementation of mobile technologies for learning within a higher education institution. The proposition for this thesis is that organisations such as higher education institutions need to have practical guidance to incorporate a Use Your Own Device (UYOD) approach as a mechanism to enable sustainable mobile learning initiatives and practices in a higher education institution. The need for further research is determined by examining and evaluating literature in the domains of higher education, technology, information technology management and mobile learning, technology and innovation integration and processes in large organisations.

Existing evidence from published reports, reviews, and other documented accounts are drawn on to identify trends and gaps. Searches were performed in journal databases available through the University library as well as external portals for social referencing and Google Scholar. As mobile learning is still an evolving concept, anecdotal evidence such as blogs, discussion forums, and other online spaces were also reviewed. This allowed insights into the experiences of practitioners engaged in the active practice of using UYOD in mobile learning.

2.1 ICT in Higher Education environments

Following from the summary of ICT and mobile technologies in society and their influence in the higher education space, in this section, the trajectory of ICT in the higher education space is discussed. The changes that have occurred as a result of the use of ICT are identified and the use of mobile technologies is positioned within this broader ICT context, leading to a discussion of the research landscape of mobile technologies in higher education learning and teaching. Drawing on examples that represent the more general landscape of the execution of mobile technology implementation for enabling learning, the challenges around the use of mobile technologies are highlighted. This thesis is focused around how user owned mobile devices may be adopted in a UYOD or integrated within existing infrastructure of ICT in higher education institutions. The chapter ends by examining the processes of ICT innovation and adoption in

higher education with particular focus on frameworks applicable to mobile device use. It also identifies the areas where there appears to be less focus so far in the research and outlines the questions which guide the research.

2.1.1. Introduction of ICT in Higher Education

One of the earliest uses of eLearning in higher education was the Programmed Logic for Automatic Teaching Operations (PLATO). PLATO was a computer assisted instruction system designed by the University of Illinois to offer coursework to students and the local community. It was designed and developed by Donald Bitzer in 1960. Not too long after, in 1966, Patrick Suppes and Richard Atkinson conducted experiments in California in using computers to teach mathematics to school children. This resulted in a technical report in which computer-assisted instruction (CAI) was referred to as "a newly developing area" (Atkinson, 1967). The early implementations of "eLearning" required the use of expensive terminals owned by the government or school. This cost barrier was improved as more affordable personal computers came on the scene in the 1970s. By the 1980-90s, Computer Based Training (CBT) using CD-ROM and Floppy drives were used to implement training in Information Technology (IT) skills. CBT was characterised by the use of CAI models within interactive multimedia courseware dominated by passive learner models, and constructivist influences began to appear in educational software design and use (Kidd, 2010).

As the internet gained prominence in the mid to late 90s, and as internet access has continually improved regarding cost and bandwidth, the educational ICT space has seen increased offerings which are used not for simply delivering learning but enhancing the learning experience and the activities that enable learning. This increased internet activity has given rise to the ICT genre of "*learning technologies*" and the professionals referred to as "*learning technologists"* or *"educational technologists"* (Shurville et al., 2009). The prominent areas of learning technologies applications have included:

- The Virtual Learning Environment (VLE) which is a platform used to provide access to structured content, assessment and learning activities such as discussion boards. By the late 1990s to mid-2000s, most HEIs across UK and Ireland had adopted and implemented at least one VLE (McAvinia, 2016). Educause reported in 2014 that 99% of over two

hundred US colleges surveyed use a VLE. Some of the VLEs in use globally are Blackboard (formerly WebCT), Moodle and Sakai.

- Virtual reality environments such as second life which are a 3D simulation of the real world and an enabler for active learning and practicing skills within a safe and

low-risk environment (Rapanotti et al., 2011). While experiments in the use of earlier examples like SecondLife did not lead to the mainstream use of the technology, recent technological advances such as the virtual reality headsets have led to speculation that virtual environments may be the next logical extension of cyberspace and lead to mainstream use (Sinclair and Gunhouse, 2016).

- Serious games, game-based learning, and gamification are also applications of the use of multimedia technology and the capabilities of modern computers and devices where game mechanics and approaches are used to enhance and enable learning by

embodying pedagogical strategies such as experiential learning, problem-based learning and situated learning (Rooney et al., 2009).

- More recently in the 2000s, there have been opportunities for greater use of multimedia and the entrance of live-streaming giving rise to concepts such as Massive Open Online Courses (MOOCs). While MOOCs have not been the solution to the challenges in higher education, they have provided some data which has shaped the research direction (Veletsianos et al., 2015) and allowed researchers to study the design, development, and delivery of online materials to continue to enhance and develop new proficiencies around technology-mediated teaching to the benefit of education in general. (Ho et al., 2015).

- Another area that has arisen from the use of ICT is computer supported collaborative learning (CSCL) whereby learning is a result of interactions and collaboration among students through computers (Stahl et al., 2006).

- There is also the concept of networked learning which is defined by the Center for Studies in Advanced Learning Technology (CSALT) at Lancaster University as:

"Learning in which information and communications technology (ICT) is used to promote connections: between one

learner and other learners, between learners and tutors;

between a learning community and its learning resources."

(Goodyear, 2001, p. 9).

CSALT note that the use of online materials is not enough to define networked learning and that the interactions between people can be synchronous as well as asynchronous through text, voice, graphics, video, shared workspaces or combinations of these forms.

In general, the presence of ICT in the higher education environment has grown and become a more central part in how institutions conduct their activities and communicate. After the slow start in the 1990s, there has been a gradually increasing presence of ICT in the higher education landscape. ICT has moved from being a novelty to an essential, expected element of the University (JISC, 2015) even if this has not yet resulted in the revolutionary change in pedagogies that was expected (Sarkar, 2012). Since the start of the 2000s, it has been highlighted that the changes that were being observed have been mainly remediated existing administration of educational practices into digital format and improved access to learning especially with improved internet connectivity. Teaching staff mainly use the technologies that offered affordances for facilitating what they already did rather than change teaching and learning practices:

> *"...in campus-based contexts, teaching staff appropriate those*
> *technologies which they can incorporate into their teaching*
> *activity most easily, that offer affordances for what they*
> *already do, rather than those which radically change teaching*
> *and learning practices." (Kirkup and Kirkwood, 2005).*

When researchers reviewed and assessed how Technology Enhanced Learning (TEL) is interpreted in recent literature, they concluded that ICT use in education that transforms the learning experience accounts for less than one-third of interventions. It was also found that the potential of technology to transform teaching and learning practices does not appear to have achieved substantial uptake (Kirkwood and Price, 2014, p. 24). When the correlational and experimental evidence in a majority of educational interventions are taken together, they do not offer a convincing case for the general impact of digital

technologies on learning outcomes (Higgins et al., 2012). Sir Michael Barber posits that where technology is used in education, research findings on its impact on learner outcomes are disappointing despite the potential of the technologies (Fullan and Langworthy, 2014). However, he goes on to suggest that the technological revolution in progress, encourages the continuation of the ambition to use technology in the classroom (Fullan and Langworthy, 2014).

Mobile devices and technologies are a significant part of this so-called revolution and so figuring out how to create the enabling environment and infrastructure for the use of such technologies that enables and sustains innovative practices becomes even more important.

In considering the use of ICT in education, the Substitution, Augmentation, Modification Redefinition (SAMR) model (Puentedura, 2006) gives a useful classification (Table 2.1) of the impacts into two areas, given as transformation and enhancement, of which there are two categories each:

Table 2.1 SAMR Model (Puentedura, 2006)

Transformation	Enhancement
Redefinition: The technology allows for the creation of new tasks previously inconceivable.	**Augmentation:** The technology acts as a direct tool substitute with some functional improvement.
Modification: The technology allows for significant task redesign.	**Substitution:** The technology acts as a direct tool substitute with no functional change in the activity.

Most applications of ICT in the educational context are in the enhancement phases. Popular technologies, such as Virtual Learning Environments and Electronic Assessment systems, have provided the means to enhance existing practices by either augmentation or substitution.

Today, the presence of ICT permeates through all functions across pedagogic and administrative areas in similar enhancements of practices. From the initial course application, offer acceptance and registration, to fee-payment for university courses, most administrative functions are now done predominantly via ICT systems which enhance how they are carried out. In the learning and

teaching contexts, the use of ICT has created an environment where most written assignment submissions are created on the computer rather than handwritten and students can make submissions online independent of time and place. Similarly, in many institutions, lecture notes and supporting study resources are distributed via the Virtual Learning Environments (VLE) (O'Rourke et al., 2015).

This ICT adoption and usage described so far in higher education has been driven by technology advancement. For example, an iPhone 5 smart phone today has more computing power than the 1985 Cray-2 supercomputer which was the fastest machine when it was released. With easier access to computational power as well as increased ownership of mobile devices, there is an opportunity for higher education institutions to pursue the agenda of transforming education in response to global and social pressures by taking advantage of these modern technologies as they emerge. In the next section, the changes that have occurred in higher education as a result of ICT use are explored.

2.1.2. Changes in Higher Education resulting from ICT

These changes are driven by a number of factors such as increase in demand for higher education as a result of rising participating rates (Mcguinness et al., 2012) as well as growth in emerging economies thereby creating new markets, increased global competition (British Council, 2012); and increasing cost of tuition and availability of technologies that can scale online learning quicker than brick and mortar (Anderson et al., 2012). Going back to the early 2000s, an investigation of "*what happened to eLearning and why*," identified that the "*revolution*" in education practice in higher education, though slow in gaining momentum, had been launched. It determined that the story of ICT to enhance learning, referred to as *"eLearning*", was still unfolding with no one knowing what was ahead and that the underlying technologies on which eLearning depends are too ubiquitous to ignore (Zemsky and Massy, 2004). The changes so far realised have been a significant shift in some ways in the higher education model, particularly in how education is delivered. For example, use of ICT has hugely increased access to higher education. However, as was illustrated by using the SAMR model, in the actual learning and teaching context, the changes may not be as radical as was envisaged (Kirkup and Kirkwood, 2005). Neither have the changes been transformational but rather, have been supportive of existing modalities in educational practice as reiterated in the statement that:

"...We tend to use technology to support traditional modes of teaching – improving the quality of lecture presentations using interactive whiteboards, making lecture notes readable in PowerPoint and available online, extending the library by providing access to digital resources and libraries, recreating face-to-face tutorial discussions asynchronously online – all of them good, incremental improvements in quality and flexibility, but nowhere near being transformational."
(Laurillard, 2007, p. xv)

This view of incorporating the technologies into their activities in ways that support or replace existing methods in teaching rather than embarking on radical new practices expressed is also expressed by (Laurillard, 2007; Kirkup and Kirkwood, 2005). as well as quiz and online submission tools for conducting assessments.

One of the reasons for the slow pace of transformational changes resulting from the use of ICT in educators' practices may be that many of the technologies, despite their promises to unblock or reroute obstructions to learning, have not lived up to expectations in the higher education space. They, therefore, do not get wider adoption. Perceived obstructions that are supposed to be addressed by the technology are not so easily dislodged (Crook, 2002). These "*perceived obstructions*" present in various ways from one group of stakeholders to another. For example, higher education management and leadership are interested in balancing the central organisational vision of providing education and research facilities to a community, with other factors such as increased competition for students, rankings, attracting funding and maintaining accountability. Furthermore, academic staff are often torn between ensuring the curriculum is delivered and assessed and participating in research - as well as fulfilling other administrative duties. It has also been argued that because education has various components such as assessment and accreditation, and qualifications with social capital, there is a fundamental conservatism around higher education (Pearce et al., 2012). This conservatism is due to auditing pressures that HEIs suffer such as the tight management, transparency, and tracking of assessment practices which lead to educators designing courses with evaluation and audits in mind rather than taking risks and innovating for learning (Power, 1994, p. 36).

The obstructions, perceived or not, and the conservatism around change have led to the use of technology mostly staying in the "enhancement" phase of the SAMR model (Puentedura, 2006). More recently, it has been stated that the potential for better use of technologies that are widely available can only be realised through innovative teaching practice, and developing an understanding of technology's proof, potential and promise with an emphasis on integrating multipurpose digital tools that are more inclusive (Luckin et al., 2012).

The enhancement phase described in the SAMR model is a useful entry point for the technology; it is non-threatening and the value is easily seen which leads to wider adoption or *normalisation* (May et al., 2007). The state of widespread adoption and use where the technology becomes normalised to the extent that students have come to expect a certain level of ICT use as the norm is a state that has been achieved by conscious effort. When asked about how they were changing their learning and teaching strategies to enable flexible learning and improved access to educational resources, 81% of institutions cited the exploitation of ICT as one change mechanism they intended to harness (Gibbs, 2001, in Kirkup and Kirkwood, 2005). Taking a retrospective view and looking back on the period between 2001 and 2012, it is shown that development of ICT to support learning in higher education institutions in the UK has been consistently focused on enhancing learning and teaching. They do this by implementing enterprise-wide systems to manage and control learning processes and standardise learning experiences. This has left the technologies that support collaborative learning and knowledge sharing at the level of local provision by departmental projects (Walker et al., 2013). There has been less focus on conceptualising the role of ICTs in higher education teaching models for various reasons. These reasons are: the number of new and emerging digital technologies that animate and instigate innovative forms of pedagogy; the complexity of teaching models using ICTs for pedagogical applications and innovative pedagogies; as well as different patterns of adoption in HE institutions (Caird and Lane, 2015).

Higher education institutions and supporting organisations such as the Joint Information Systems Committee (JISC) eLearning programme (2003-2012). In Ireland, the Higher Education Authority Network (HEAnet), have invested significant resources into supporting and researching projects that use ICT to

enhance education practice. For example, Spot the Difference (Garrett and Robinson, 2012) which is a non-text plagiarism tool, was developed to support the detection of plagiarism in arts education. Another project in the University of Nottingham was the Sharing Higher Education Data (SHED) (Coolin, 2012) which enabled student-employer matching by using an ePortfolio to manage student professional learning and enable opportunities for knowledge practice or transfer. One of HEAnet's most popular and visible services is in providing infrastructure such as "Edugate", the federated access login used in Irish higher education institutions. HEAnet provides bandwidth to connect all Irish higher education institutions and also provides connections to networks in Europe via its links to the GÉANT backbone and Janet (the UK education and research network). The GEANT network provides high speed connectivity to share data across European education communities while Janet is a JISC managed project which provides a network infrastructure to meet the needs of the research and education communities. It connects UK universities, FE Colleges, Research Councils, Specialist Colleges and Adult and Community Learning providers. Support from organisations such as HEAnet and JISC has enabled increased activity in the use of ICT for enhancing education.

 The next section further explores the reasons why the resulting changes so far have not been more radical, as well as the factors and motives that influence the adoption of ICT in the higher education institutions.

2.1.3. Factors that Influence ICT adoption in higher education

In the previous sections, works highlighting the development of ICT in higher education were reviewed and the consensus from these concluded that ICT has mostly contributed to the enhancement rather than the transformation of higher education practice by enabling digital manipulation that triggers learning activity, reflection, and self-monitoring of understanding (Livingstone, 2012). Similarly, it is proposed that challenges remain in developing course delivery models which focus on active student learning and maximise the opportunities that ICT technologies now offer for interactive student-centred learning design (Walker et al., 2013). This dominance of enhancement in the technology change has been due to various factors.

Given that the aim of this thesis is to create a specification for an environment within a higher education institution that enables the use of mobile technologies

in learning and teaching contexts, it is important to understand the factors that influence the adoption of ICT.

2.1.3.1. Chance of Success

When educators use a technology or strategy, they want to be able to determine how well it supports the learning objectives (Howard, 2013), while continuing to participate in other aspects of their roles including research and administration associated with teaching. There is a perception of the risk associated with using technology not living up to expectations which may discourage more uptake in use and subsequent exploitation for what it can do best (Balacheff et al., 2009, p. 297). There is also the need for the organisational leadership and management to ensure that strategic goals and associated activities capture the vision of the organisation and enable responses to increased competition for students (Farhan, 2014). Other reasons for not having more transformative changes associated with higher education include the complexity of teaching models for using ICT in some disciplines and varying patterns of adoption across disciplines.

2.1.3.2. Institutional Objectives

Institutions often have various motives underlying their adoption of ICT. These include factors internal to the institution as well as external factors from the community and operating environment. (Zhu, 2013). Since 2001, the Universities and Colleges Information Systems Association (UCISA) carried out a survey as part of a longitudinal study into the use of TEL in higher education in the UK. The report for 2014 identified the top five motives for adopting ICT technologies in UK higher education institutions in order of ranking, as

1. Enhancing the quality of learning and teaching; 2. Meeting students' expectations; 3. Improving access to learning for students off-campus; 4. Improving administrative processes; and 5. To help create a common user experience. (Walker et al., 2014).

The 2014 UCISA results on student expectations confirmed previous data from the surveys in earlier years which demonstrated that students generally have higher expectations for transactional experiences and increased flexibility (Barnett, 2014, p. 35) than they have for transformational ones (Walker et al., 2013). Transactional expectations are those associated with getting content and

information such as having access to Wi-Fi for their own devices, use of VLE, and access to portals. For transformational expectations, which are to do with their actual learning experiences, they looked to academic staff for leadership. The 2017 student digital experience tracker by JISC revealed that students want more proficient, consistent and coordinated use of technologies rather than a variety in technologies (Newman and Beetham, 2017). These findings highlight that an institutional approach that purposefully takes advantage of the new technology affordances is justified.

2.1.3.3. Availability of Support

Similarly, it was early identified that while there has been a focus on enhancing teaching and learning over the years, most of the investment has been directed to the implementation of enterprise-wide systems to manage and control learning processes deliver efficiencies of scale and standardisation through centrally managed solutions, rather than support for student-controlled tools (Walker et al., 2013). These centrally managed solutions have also been aimed at improving access for students offline and improving administrative processes. This approach is probably in part to respond to the changing student demographic where advances in the technology, needs of the economy and higher tuition fees, highlight the importance of remaining competitive (Cesares et al., 2015).

2.1.3.4. Technology Advancement and Future Trends

The rate of digital technology growth in the last ten years has also been a motivating factor in how institutions have tried to give students access to institutional portals. As connectivity has become more available and network speeds improved, the use of the internet has evolved. Web 2.0 tools such as blogs, wikis, and social networking such as Facebook and Twitter alongside media content platforms such as YouTube have become more and more part of everyday life. Web 2.0 is a description of the internet as being writable as well as readable. This has led to pockets of innovation with some academics trying to adopt teaching strategies that take advantage of learner-generated content and facilitating online collaboration amongst learners in ways that encourage self-regulation and rely on individual access to a larger network of peers. (Dabbagh, 2011; Berg, 2011; Pelet, 2014). This way of interacting has led to the tools being integrated into the landscape of tools used in higher education. Most VLEs have

some sort of WIKI, blog or discussion forum as part of their tool portfolio. The VLEs also have tools for substituting paper assessments with online versions through quizzes or assignment submission mechanisms.

As a result of all of the activity described, higher education institutions have over the last decade evolved from having mostly computer rooms with institutionally owned computers, to also supporting the incorporation of student-owned laptops on the institutional network. This enablement of students bringing their own laptops is the initial instance of *"Bring Your Own Device"* (BYOD) where the devices were student-owned laptops. The infrastructure to enable the use of student-owned laptops has been in place in higher education institutions for many years now and this is the model that has been extended in many institutions for the administration of the devices through the use of Mobile Device Management (MDM) Systems such as VMWare Airwatch. The usage of student-owned devices moderated through this approach includes accessing the internal network and systems, installing or accessing some institutionally owned applications (dependent on licensing), ensuring the presence of anti-virus software and getting email and other information. As part of the management strategy for this, many institutions advise the purchase of "approved" computers via discount schemes. For example, in Ireland, the DIT Student Laptop Scheme in the Dublin Institute of Technology was negotiated to give students the opportunity to purchase high-quality laptops, which are ready for campus use, at affordable prices (DIT, 2015). In the United Kingdom on the other hand, the University of Nottingham operates a laptop loan service from which students can borrow laptops to use as theirs, including installing applications which are wiped on return (UoN, 2015). Both of these schemes have extended to include Mobile tablets. The use of individually owned mobile devices for learning and teaching (UYOD) is often considered as a subset or continuation of the earlier use of ICT for education. It is however important to recognise that mobile devices enable different use cases in interactions, and are often used to enrich or extend existing modes of learning (Glahn et al., 2015). Such enrichment using mobile technologies in learning and teaching goes beyond using technologies to support or replace existing practices such as accessing content and information. This issue is further compounded when future trends in how mobile technologies and devices are explored in the context of personally owned devices.

Determining future trends in technology is a gamble but in the current and immediate future, smart phones are the centre digital lives for many people. It has been speculated that in the mobile device may be replaced in the future by everyday devices such as eyeglasses which are controlled by eye movement. In such a scenario, virtual reality and real life will be so closely mixed that it will be difficult to differentiate (Scoble and Israel, 2016). The Internet of Things (IOT) and the developments to integrate mobile devices, virtual reality(VR) and better camera for higher quality media are opening opportunities for mobile based augmented reality in learning, as illustrated in a language learning application (Meda et al., 2014). Furthermore, the interactions of users as they interact in social and learning contexts are a rich source of data for learning analytics (Ahmed, 2016, p. 88) which will can be used together with artificial intelligence to create personalised experiences (Gulsun and Hakan, 2017, p. 84) or mentors for every learner (Woolf et al., 2013) and, enhance the massive open online classroom experience. However, as the use of mobile devices, virtual reality, artificial intelligence merge, the question on how to address ethical issues as pertaining to the courses they facilitate will need to be addressed (Burton et al., 2017). Since these developments take advantage of mobile devices or new forms of personal mobile devices, they also bring challenges in interoperability, privacy, and pedagogical and organizational systems and processes. Understanding these accompanying challenges and as a consequence, putting in place suitable strategies and services that are adaptive and agile to respond to the fast-moving pace of technological development will ensure that the organisational systems remain fit for purpose. These actions including suitable strategies, services, and infrastructure updates will require an investment of resources by the organisation.

Having followed the trajectory of ICT in higher education and outlined how activity involving the use of ICT has existed and been adopted in this space up until the time of this thesis and highlighted the future trends using individually owned devices, the next section presents a closer examination of current research relating to the enablement of the use of mobile technologies in higher education.

2.2 The research landscape of mobile technologies in higher education

There is a growing literature of research on mobile learning and mobile technologies in higher education. In the literature, the term "*mLearning*" is often used in place of "*mobile learning*." Most of the literature on mobile technologies or use of mobile devices focuses on mLearning implementations in specific learning and teaching contexts or the design of mobile learning initiatives which take advantage of individually owned mobile devices. There is a limited number of those that specifically look at the broader implementation of mobile learning at an institutional or organisational level in a manner that addresses UYOD issues.

In section 2.1.3 the factors that influence ICT adoption in practice are stated to be the existence of institution wide provisions for support such as alignment to strategic objectives, enterprise level management solutions, and support mechanisms. The gap of work on institution wide implementations is often attributed to the field of mLearning being relatively new compared to others like eLearning, with research and practice in the field still being a growing area with practitioners are seeking to develop theory, focused on design (Pollara and Broussard, 2011; Sharples, 2013). To facilitate the exploration of mobile learning in ways which can lead to sustained innovative change, the environment including the infrastructure and culture must be considered.

To scrutinise the areas of mobile learning along with mobile technologies in higher education and thereby get a broad sense of the progression and current status of research, multiple sources including online and print repositories were queried. This section of the literature review focuses on examining the publications from the search that attempted to theorise mobile learning and associated infrastructure and technologies by examining evidence from practice across a range of disciplines and institutions. These were described as "*systematic*" reviews of various aspects of mobile learning. A systematic review identifies, appraises and synthesizes the empirical evidence using pre-specified criteria to address a given question to produce reliable findings that can be used to inform decision making (Higgins and Green, 2011). In addition to the systematic reviews, examples of mobile learning implementations were also

examined to get insights into the types of use cases and identify the challenges that prevent sustainability.

The first of these systematic reviews provided a critical analysis of mobile learning projects published before the end of 2007. Specified criteria were applied to analyse 102 existing mobile learning projects with the purpose of highlighting common grounds and similarities, as well as differences and inconsistencies within the domain of mobile learning from a design perspective (Frohberg et al., 2009). The projects they reviewed had to meet the criteria given as: tools, the objective of learning, communication, context, control, and subject, were applied to 102 projects. The projects were graded on a scale of 1 to 5 for each factor, except for that of context, which was graded as being independent, formal, physical or socializing. The review concludes by suggesting that mobile learning, rather than being used for content delivery, can best provide support for learning in contexts where learners are asked to apply knowledge, rather than just consuming it. It is also suggested that these learners should ideally be advanced learners rather than novice ones and that there should be special tools for monitoring and moderating, that don't compromise transparency for tutors or risk disorientation for the learners. However, this work did not review any publications that focused on concepts, frameworks, potential use cases, technical infrastructure and technical issues.

When text mining techniques were applied in a review to investigate the longitudinal trends in mobile learning articles pertaining to higher education published between 2003 to 2009, it was found that mobile learning research was being done by early adopters with the most popular domains being effectiveness, evaluation, and personalized Systems (Hung and Zhang, 2011). This is confirmed again in another systematic review of trends from mobile learning studies from 2003 to 2013, which found that the purpose of most mobile learning research was focused on the effectiveness of mobile technologies for learning and mobile learning systems design (Wu et al., 2012) independently of the environment within which they are implemented. It was suggested that the next stage of research could be more focused on strategies and frameworks (Hung and Zhang, 2011).

By 2013, mobile learning is reported to have grown from small-scale studies to large national and international projects, but it still lacks an evidence base of

comparative studies and research into large-scale deployment (Sharples, 2013). Another challenge to the scaling up or sustainability of mobile learning initiatives was that those failed projects are hardly ever mentioned. This is despite the fact that they could be instructive and expand the understanding of the mechanics of projects and pilots or in other words, learn from mistakes and influence future research (Traxler and Wishart, 2011; Crompton et al., 2016). Not being open with failures in research is not limited to mobile learning research or technology research. This has in part has been attributed to a general publishing bias (Franco et al., 2014). Elsevier has recognised this bias and piloted a journal titled *"New Negatives in Plant Science"* (Granqvist, 2015). This may lead to similar titles in other research disciplines. However, commenters on the Elsevier site express concerns that while the problem is visible and acknowledged by many, a fundamental challenge is that most research is funded by external sources. Reporting negative results in thesis work or a funded project could have implications for future funding. The issue of continued funding is also highlighted and somewhat addressed by the move towards students using their own devices albeit with concerns about the lack of standards, stability, uniformity, equity and control within the classroom and institution (Traxler and Wishart, 2011, p. 41).

The reviews evaluated here highlight that a lot of the research in mobile learning has been focused on initiatives in learning contexts and has not explored overarching architectural investigations or creation of frameworks to guide the mobile initiatives to sustainability or scaling up. Technologies, infrastructure, and architecture of mobile applications and technologies are considered the backbone of their functionalities and capabilities, and influence how they work and are used to support or enable learning (Khaddage et al., 2015).

The theme of building systems for supporting mobile learning is also continued by Bhat and Saleh when they review the most cited papers between 2003 to 2014 (Bhat and Saleh, 2015) and find that these focus on the evaluations of mobile learning systems and their design with experimental research beingthe primary research method. In discusson, Bhat and Saleh (2015, pp.4) note that for the effective design of mobile learning systems, there needs to be a broader approach that considers elements such as management of courses, preparation of self-study materials, and design of modules that are accessible to various

devices. This type of broader approach requires a consideration of what elements are to be considered and the user expectations around how devices and systems are used.

To get a more in-depth view of creating a learning environment that supports mobile learning, and uses student owned devices, Alrasheedi's systematic review investigates the user expectations and identified factors that would cause reduced uptake of mLearning by the learners in higher education (Alrasheedi et al., 2015). To do this, they reviewed the primary data from 30 studies across 17 countries, which comprised responses from the mLearning users on how they evaluated the various aspects of the mLearning process that was tested in their institution. The researchers identified that the five most important factors for mobile learning from the learner's perspective are: platform accessibility, internet access, personalization of the platform, the possibility of blended learning, and the prospect of learning made interesting. Other factors they found in decreasing order of importance are listed as: application working, assimilation with curriculum, technical competence of students, user-friendly application design, learner community development, increased productivity, learner autonomy, and technical competence of educators.

From the educator's perspective, authors in the UK were asked to express the pedagogy underlying their use of mobile learning and while doing so, highlight any organisational or logistic issues they encountered, attitudes of their students and any sustainability or scalability issues they encountered. The reviewers acknowledged that as at 2011, after at least nine years' worth of research and case study material, there are still significant challenges in mobile learning around how to scale-up, sustain and extrapolate to other contexts beyond the pilots (Traxler and Wishart, 2011). In preparation for the 2016 Digifest, John Traxler argued that "mobile learning has stalled" because time has been spent in looking inwards and backwards and extending the status quo rather than exploring new possibilities (Traxler, 2016a). He put out a challenge to researchers and practitioners to figure out what happened to mobile learning and why.

When observed from a broader perspective, the pattern of reports about what works and what doesn't determines that the success factors are: the availability of technology, institutional support, connectivity, integration with the

curriculum as well as the student experience, and ownership of technology (Sharples, 2013). To take a closer look at these success factors in context and see the dynamics involved in the integration of mobile technologies for learning that prevent the scaling up of smaller projects to an institutional level, the next section below presents a range of implementations which focus on mobile learning using student owned devices in ways that are familiar to students.

2.2.1 Classifications of Mobile Learning Implementations

Mobile learning so far has encompassed a broad range of learning activities that take advantage of the affordances of mobile devices. To be used at scale, each of these mobile learning activity types requires that different adjustments be made in order to be integrated with existing infrastructural systems and processes in a higher education institution. Figure 2.1 below is a classification showcasing implementations of mobile learning in higher education.

To derive this classification, papers that describe mobile learning implementations were identified from databases, journals, conference proceedings and research networks such as ResearchGate, Mendeley, and Academia.edu. The keywords used in the search were *"mlearning," "mobile learning," "higher education" and "BYOD".* The papers were reviewed and categorised by the affordance they explored in their implementation. An affordance is described as the action potential that can be taken given a technology and this potential exists when leveraged within a specific area (Majchrzak et al., 2013, p. 39) - which in the current research is education.

The examples referenced in Figure 2.1 were selected to represent how the aligned affordance has been exploited in a higher education learning context. Since the purpose of this classification is to understand the range of uses of mobile technologies in learning contexts, the affordance is the meta-characteristic on which the classification is made.

Figure 2.1 is a simplified visual representation of the mobile affordances that were leveraged in the implementations which have been described so far.

This classification gives a high-level view of the range of uses by breaking them down by the affordances that they take advantage of. It expands on an earlier classification of affordances (Parsons et al., 2016, p. 44) by simplifying the description of the mobile affordances and extending the list. This classification

is based on an "as-is" state of mobile learning to showcase the current possibilities as a starting point for mobile learning.

Figure 2.1: Classification of Mobile Learning Affordances

Mobile Affordance	Feature of the device	Context of Use
Portability	Physical form	Ease of movement, ubiquitous access
Gather data and information	Data recording and retrieval- camera, text input, audio recorder	To gather, manage and store information
Communicate through multiple modes	Text input, camera and microphone for recording of video and audio,	For communication or collaboration in one to one or group settings.
Interact with the interface of the device to achieve some goal	Screen Gestures, text input, camera,	Multiple uses as native and hybrid apps take advantage of multiple affordances
Share location information via geo-coordinates with other systems or contacts	GPS	Location based activities, Augmented Reality, QR codes, Geotagging
Get contextual information about immediate environment	Inbuilt sensors	motion detection
Connect in real time to contacts to share data or information	Long and short range connectivity through data networks, bluetooth, near field communication(NFC)	Sharing information in multiple formats, real time communication
Store information and data for easy access	Portable storage	Local library of books, documents, media, address book, dictionaries
Access online resources anytime from anywhere	Mobile Browsers, internet connection	Access to email, internet sites and applications
Extend device function by connecting with wearables such as glasses or a watch	Long and short range connectivity through data networks, bluetooth, near field communication(NFC)	sending alerts to smart watches, augmented experiences using glasses

This Fig 2.1 classification enables IS management and institutional leaders to better understand what types of activities are currently possible, the types of activities that can be engaged in as part of a learning experience and the particular features that need to be supported in order to identify the processes and systems to be put in place to scale smaller implementations of mobile learning and understand the challenges associated with the use of mobile technologies.

The following are examples that illustrate applications of how some of these affordances are combined to enable different learning experiences.

2.2.1.1. Access to online resources anytime from anywhere

Implementing a mobile enabled platform with content alongside messaging allows the exploration of learner's acceptance of the use of Mobile Phones to

deliver tutorials in a distance learning context (Adedoja et al., 2013). Content was disseminated for distance learning through a mobile platform. Modules contained chat sessions, forums and quizzes and access to learning material. SMS was used to alert students when new material was available and encourage participation in the forum. The infrastructural requirements identified to sustain this type of implementation include a mobile accessible platform, student ownership of smartphone, reliable network connectivity, bulk SMS account for institution, tools for creating mobile content, support for those with low IT skills (e.g. to use tools such as the Quiz), accessibility adjustments, student's permission to receive messages, guidelines for creating mobile friendly content and guidelines or expertise in user interface design for mobile platforms.

2.2.1.2. Communication through multiple modes

One to one messaging comprises of SMS messaging as well as the use of instant messaging or chat apps as are more commonly used now such as WhatsApp, WeChat, Telegram and many others. While SMS messaging is a basic function common to both smart phones and feature phone, instant messenger apps are applications that are available to smart phones based on their operating system. In 2006 smartphones were not so common and instant messaging through applications such as WhatsApp, and Viber was not widely available. To provide ubiquitous scaffolding and support for undergraduate students, SMS messaging was explored for supporting students (Hayes and Weibelzahl, 2009). SMS messages were sent from the lecturer to the students outside of regular class times to help their students through their course work. The messages sent were of three basic types: small amounts of learning material; motivational messages; and administrative messages. Extending this use to a wider audience across the institution required a way to send bulk messages from the lecturer, maintenance of student contact details, guaranteed student phone ownership, reliable network connectivity, and student's permission to receive SMS messages.

In a more recent study, instant messenger was used instead of the local phone SMS. As part of a comparison study, three communication media to support group work were compared within a Korean university (Kim et al., 2014). One group of students used the KaKaoTalk application to share content, information and have group discussions without constraints of time and space. This was run alongside two other groups who used the discussion board in the institution's

VLE and PC-based instant messenger (MSN) respectively. The considerations for this type of use case include student smartphone ownership, instant messenger app, and network connectivity. To be part of the group, the student needed to give their telephone number.

2.2.1.3. Content sharing in one to many; or many to many formats

As discussed in 1.6, Web 2.0 tools also sometimes referred to as social media have led to strategies that encourage the creation and sharing of content by learners. "Moblogging" is an amalgamation of "mobile" and blogging" and involves sending photos and videos by email/multimedia messaging (MMS) to a website. It is similar to using Web 2.0 social platforms such as Instagram, Twitter, Facebook and is dependent on the use of the multimedia capabilities of the phone such as text entry, camera, video and audio recording. A University of Nottingham study explored Mobile Group blogging for supporting the cultural transition in a group of third level students from China (Shao and Crook, 2015). The study comprised four sub-studies, two of which investigated the demands and needs of a mobile group blog, one investigating the mobile blogging activities of a Nottingham based group of students and another investigating a China-based group who evaluated the blogs of those in Nottingham. Another application of content sharing is video streaming whereby students video live activities and broadcast to many via applications such as Facebook Live, Snapchat, or YouTube. To scale and sustain this type of implementation, the requirements to be addressed include student smartphone ownership, access to a mobile centred platform for sharing the content being generated or an app for ease of use, reliable network connectivity. Creation of content by students also requires consideration of media rights as they pertain to privacy and intellectual property.

2.2.1.4. Storing Information and Data

While the social media apps can be used as the accessible web platform or a localised phone application, other content is best suited for the local phone applications. An example is the use of books. Having a mobile library app allows downloading of relevant books. Due to the large amount of information required by doctors, a project (iDoc) was funded to offer trainee doctors a smartphone library of medical textbooks (Bullock et al., 2015). It was found that during transition periods when seniors were not always available, just-in-time access to

reliable information supported confident and efficient decision making. As in the previous use cases described, student ownership of smartphones is a key requirement for scaling and sustaining this type of use, the app to be used for the library should also be available for download, as well as a license that allows local saving of the books to bypass continuous reliance on network connectivity. At a minimum, intermittent good network connectivity to download books is also required.

2.2.1.5. Local positioning system and enhancing reality-based experiences

The Global Positioning System (GPS) is used for proving location information. Along with the phone camera, and Media Player and Quick Response (QR) codes educators have found ways to implement the use of the GPS capability for supporting learning. A study in Spain assessed the integration of Augmented Reality (AR) technology on mobile devices by applying its use in mobile learning case studies in architecture and building construction. (Redondo et al., 2014). Different strategies were tested using optical image recognition using QR codes and GPS positioning. Specific markers were used to download multimedia content created by students, and using 3D georeferencing models allowed information to be, visualised, adjusted and assessed in multiple layers on site using a phone application. Short-range communication (Bluetooth, Near-Field Communication (NFC), and Radio Frequency Identification (RFID) also enhance this type of use as Bluetooth beacons offer Enhancement over QR codes as they do not require scanning. The beacon detects the device and delivers content associated with the specific location or item and can be used to facilitate wayfinding, campus tours, scavenger hunts. The project is dependent on student smartphone ownership, availability, and stability of AR platforms. Currently, two main platforms -LAYAR and Aurasma make it easier for educators wishing to build content to do so. Students also need network connectivity to download and use the app.

2.2.1.6. Using phone specific applications

Native phone apps are built specifically for the device platform on which they are to be used, and are distributed through the aligned store, for example, apps for android and Apple devices are distributed through the Google play store and Apple app store respectively. These Native apps take advantage of the full range of the device's affordances such as the taking pictures, easy manipulation via

the touch screen, tracking movement by using sensors. Mobile app designers are creative in how they develop hybrid apps that can be quickly deployed cross platform solutions and give the user experience of the native app. However, such hybrid apps are still limited in the features they can harness as native apps are implicitly policed by the device makers. The earlier native games on mobile phones such as Tetris on the Hagenuk MT-2000 were not so appealing for use in education. More recent developments enable a wider range of interactions by the smartphone taking advantage of the capabilities such as the sensors, touch screen and camera. Examples of these are mobile games which provide engaging ways to learn and facilitate understanding by enabling a wide range of interactions, such as the use of kinaesthetic learning for enhancing literacy (Sabri et al., 2015). Extended Mobile Gaming Education (*eMgage)* describes a game-based learning concept which using a gamification approach via mobile devices aims to promote student motivation (Bartel and Hagel, 2014). Game mechanics such as points, badges, and leaderboards were applied and used to drive performance and get feedback and status updates. The application is used on student own devices and information is sent to a server to update leaderboards and provide ranking against other learners. The implementation's success, scaling, and sustenance are dependent on meeting requirements such as student smartphone ownership, server provision to host the game, provide data and channel communication and interactions and network connectivity. A supervising client is also required for controlling the server and providing feedback on mobile clients. Lastly, ongoing maintenance of the mobile clients or application to be used by the students is also required.

The Advanced Distributed Learning (ADL) group lead the MoTIF project which aims to explore the intersection of multiple design and research methods. They aim to better understand and potentially influence how education and training practitioners can best utilize and leverage mobile-based technology to design both informal and formal learning solutions. There is a list of 25 affordances for mobile learning identified by the group (Udell, 2014) which includes those listed in figure 2.1.

A pattern in the implementations examined is that mobile learning is not merely eLearning content on a smaller screen or the ability to access content on the move, even though it is the most common use case. It is, as described in section

2.1.2, used to enhance existing learning activities. However, as in the examples in the categorisation, while the affordances of the devices can provide access to content while mobile, more importantly, educators have also used the affordances to create novel and more meaningful transformational interactions in learning contexts. Some of such learning contexts are the use of the GPS as described in section 2.3.3.6, short range communication or in enabling in-context communications using instant messenger. Additionally, the technology created opportunities for interaction and collaboration, and also enabled students to engage in content creation and communication using social media and Web 2.0 tools (Gikas and Grant, 2013).

While the web experience has to be modified for the mobile device as traditional web context is not user friendly on the mobile device, these affordances open the possibility for applications in learning and teaching that can transform the learning experience and provide alternative and more contextual approaches to assessment of learning such as assessments as have been trialled in engineering training (Menezes et al., 2017), or in medicine for teaching about treatment of psychological disorders (Chicchi Giglioli et al., 2015).

The challenges that prevent sustainability of the use cases described for the mobile device affordances (Figure 2.1) are outlined as infrastructural requirements for scaling up.

2.2.2 Considering the Challenges to sustainability of Mobile learning use cases

This section explores the challenges around the infrastructural requirements identified from the classification in section 2.3.3. To do this, it is acknowledged that for most users, their phones are more than just a device for communicating and storing information and can even influence how the users' view their world (Miller, 2015, p. 24). The use of mobile devices has given students independence in a way that they did not previously have and this manifests in the ways they connect with each other, exhibiting stronger connections to their communities, ideas, knowledge and their world in general. Many workplaces have focused on facilitating access and used MDM systems as their BYOD strategy to enable employees to use their own devices for work, however there are challenges with this depending on the industry due to considerations around security of company information, employee data, privacy implications (French et al., 2014, p. 194).

While introducing UYOD in the private sector needs to address how to manage security, privacy and data ownership with regard to the organisation's main purpose, in higher education institutions, there is a need to ensure credible assessment of learning and quality assurance.

The consideration of the challenges around requirements for scaling up learning that take advantage of the affordances in the classification shown therefore needs to reflect that mobile phones are *"cultural resources"* where a cultural resource is described as a conceptual anchor within a sea of ongoing cultual transformation (Cook et al., 2011, p. 184). It also shows that institutions need to consider that the social world in which they are used sets boundaries around the text, context and social relations between users even as the newer technologies and associated cultural practices collide with older ones (Cook et al., 2011, p. 193). It is also important when considering the sustainability of the use of individually owned devices that processes and systems need to consider the future direction of personal mobile technologies to take advantage of future capabilities of personal mobile devices.

2.2.2.1. Student ownership of smartphone and permission to incorporate

The UYOD approach easily allows for the augmentation of learning or provision of support for in context-learning in a manner that takes advantage of the affordances outlined in fig 2.1. The UYOD model may therefore potentially be the strongest viable model for enabling mobile learning at an institutional level and the transforming learning experiences while confronting other obstructions to such transformations such as the assessments and auditing requirements highlighted in Section 2.1.2. While students are usually familiar with the devices they use, integrating these devices into the institutional infrastructure, requires varying monitoring and moderating needs depending on the context of use, thereby requiring permission to be given before incorporation. When deployed within a course of learning with a cohort of learners, the need for special tools for monitoring and reviewing activities and interactions to ensure adherence to rules of community engagement for the cohort and learning is highlighted in most of the implementations. For example, in the use of the mobile-enabled platform, content, and SMS (Adedoja et al., 2013), where there are ongoing chat sessions and an active forum, the course lecturer was responsible for giving support to the online tutors and monitoring the activities of both students and

tutors. The lecturer could also make changes to the course as required. Similarly, in the "moblogging" example (Shao and Crook, 2015) the researcher monitored and guided participants to contribute and even entered a few postings as scaffolds. The iDoc project textbook (Bullock et al., 2015) required students to download an app and issued a license to enable the local saving of books.

The tools used for monitoring and moderation need to be designed in a way that the users - both tutors and learners - do not need to struggle to use them. They need to be transparent and intuitive in a manner which only comes with the thoughtful design of not just learning but the learning environment and technology infrastructure. The mobile group blogging project (Shao and Crook, 2015) highlighted that there are both technology issues and 'human' issues around addressing the use of mobile technology.

The issue of ownership and permission is closely linked with legal and ethical concerns which are discussed in more detail below.

2.2.2.2. Mobile Design and Development, tools, training.

Designing mobile applications, content for mobile interfaces, or mobile learning experiences requires an understanding of pedagogy and instructional design, as well as an understanding of how to design for mobility while ensuring accessibility. Depending on the development to be done, it may also require technical development skills. In most higher education institutions, such design and development skills are not readily available. Rapid development tools that output mobile file formats are used, but they still require an understanding of user experience on mobile devices to produce mobile-friendly content, rather than online content accessible by mobile devices. Institutional licenses and training in using the tools are also often required but not always readily available.

2.2.2.3. Reliable network connectivity

As was highlighted in section 2.1.1, the HEAnet provides bandwidth to connect all Irish and UK higher education institutions and also provides connections to networks in Europe via its links to the GÉANT backbone and Janet (the UK education and research network). This has helped to ensure that most institutions in Europe now provide an institutional network as well as Eduroam on-campus network connectivity. The quality and reliability of the connectivity can vary depending on environmental factors such as the buildings, size of the campus

and available network points. The model of mobile learning integration being investigated in this thesis is the UYOD approach which recognises that some mobile learning activities will occur off-campus. There is a challenge in how to ensure that access to reliable network connectivity while off campus is not a hindrance to participating in learning activities.

2.2.2.4. Support for those with low IT skills

A key advantage of the UYOD approach is that learners are familiar with their devices and so they will need less support and training in using them. However, this does not necessarily imply that they will be familiar with the systems and the use case being applied in the learning context. For example, in a study investigating the use of Web 2.0 tools for reflection, students reported not having the technological know-how or aspiration to use technologies.(O'Connell and Dyment, 2016). Students tend to use a limited range of established technologies in general, and for learning, they are often influenced by their lecturer's teaching approaches (Margaryan et al., 2011). The burden of support often falls on the educators who may themselves need support and training.

2.3.4.5. Messaging or Notification system

 To send messages to students on their mobile devices, there needs to be a system capable of sending bulk messages which can be managed at the individual, course and institution levels. Since the time of the example of using SMS messages for scaffolding (Hayes and Weibelzahl, 2009), there are now a few solutions that do this utilising any messaging application preferred by the student. Additionally, many phone applications include a notification system which alerts users to new content or messages. Even newer developments in messaging known as "off the grid" or mesh network chat-apps allow work without any internet connection over a range of 100 to 200 meters. Regardless of which is used, messaging system functionality should provide ease of use for the sender (administrators and academic staff) and integration into their existing workflow and systems.

2.3.4.6. Legal and Ethical Considerations (Privacy, IP, Copyright, Ethics)

Given the opportunities for accessing personal information when adopting UYOD, as well as the possibility of extending formal institutional boundaries, thoughtful consideration needs to be given to legal and ethical aspects of using mobile technology in education. As far back as 1986, Richard Mason recognised the vulnerability associated with all the information being built and gathered in the "*information age*". He identified four main tenets around which to consider ethical issues in handling information (Mason, 1986). These are summarised by the acronym PAPA which stands for:

> **Privacy:** Specification of what information an individual user must reveal about themselves, under what conditions they had to disclose this, what safeguards are in place for holding information shared, and for how long the information can be held. It also specifies what information people can keep to themselves and cannot be forced to reveal to others.

> **Accuracy:** Specification of who is responsible for the authenticity, fidelity, and accuracy of information that is being held, as well as who is accountable for any errors and how injured parties are compensated.

> **Property ownership:** Specifies who owns the intellectual property of information, how access to information is determined, and who owns the channels through which the information is transmitted.

> **Accessibility:** Specification of the information an individual or organisation has the right to obtain and the conditions under which they may do so.

These tenets are a useful starting point for considering ethical issues around ICT use, but they do not specifically address the peculiarities of mobile learning. Such peculiarities include the personal ownership of the devices, blurring of boundaries between personal information and public information as a result of the ubiquity of mobile technologies along with social media (Pimmer and Grohbiel, 2013), and the speed of dissemination of content which makes recovery from error more difficult. To address mobile learning research concerns, researchers built on the PAPA tenets to propose a framework to guide ethical mobile learning research. It is pointed out that the long-standing issue for the mobile learning research community is that mobile devices are more than physical tools, they are also gateways to cyberspace (Andrews et al.,

2015). Addressing legal and ethical considerations is an area that needs to continue to evolve alongside the technology.

2.2.2.5. Equity and Equality

The UYOD approach to enabling mobile learning is based on the assumption that all students will own suitable devices for use in the learning contexts that are to be explored. To maintain equity and equality, institutions need to define how they intend to ensure that:

- All students own or will have access to devices that they need to participate fully in learning activities.
- Ownership or non-ownership of specific devices does not put any student at a disadvantage.
- Accessibility concerns with regard to the use of the devices are considered in the design of mobile learning initiatives.

Addressing these and any other factors that could create inequity enables an equal or more level playing field when students bring their own devices as personal devices will reflect individual preferences. A common approach used to address equity has been the provision of devices for those who do not have them. For example, the laptop discount schemes, loan schemes referred to as examples in section 2.1.2.4 are earlier examples of institutions doing this when laptop use became more popular. In section 1.4 an example of a mobile device scheme given was the ACU where all first-year students received an iPhone or iPod Touch. Apart from the devices, inequities can be introduced when participation in a learning activity depends on connectivity such as while out on fieldwork when some student may not have a suitable data plan (Nykvist, 2012, p. 333).

Some academics prefer to exclude or ban the use of mobile technologies, however, it is also argued that this can create a digital divide in which learners are denied the opportunity to participate in their society and shape it (Gardner et al., 2013).

2.2.2.6. ICT Governance (Hardware and Software)

ICT governance is defined as the processes in an organisation that ensure the effective and efficient use of ICT resources to achieve its goals (Gartner, 2016). It balances the value, cost, and risk associated with information technology use within the organisation and its people.

The governance of the ICT infrastructure and processes in a higher education institution determines the process for procuring, integrating and securing a hardware or software system, as well as its ongoing support. To scale projects beyond the pilot context often requires sourcing of funds by the researcher or their department to continue, or by any other staff who wants to use the initiative. This often leads to a decentralised model of ICT funding, challenges with ongoing maintenance and scalability. As far back as 2008, an ECAR research study found that such decentralised funding and authority systems have created a situation where ICT decision making falls outside of the influence of the central ICT department (Yanosky and McCredie, 2008).

As well as overseeing the mechanisms for procurement and ongoing support of systems in the infrastructure, enabling mobile learning requires that ICT governance include a risk management strategy. This strategy must address security and reliability challenges to the existing IT infrastructure, that may arise from opening the institution's computing infrastructure to private use while taking advantage of user-driven innovation (Middleton et al., 2014).

The challenges around the requirements to scale the use cases in the classification as outlined here exist mostly because the current infrastructure and system have not caught up with the rate of development of mobile technologies. Mobile devices are outside of the institution's control and therefor require special consideration for the design of learning initiatives (Sundgren, 2017, p. 2) and subsequently governance.

To consider how higher education institutions may adapt, the next section will examine the prevailing culture of ICT innovation, adoption and integration of technology in higher education.

2.3 ICT Innovation and Integration in Higher Education Institutions

It is important to differentiate between the terms: innovation, adoption, and integration for considering them within the use of ICT in higher education. Innovation is the introduction of a new approach or tool to accomplishing a goal and is often a risk to established methods. Cambridge dictionary defines adoption *as "accepting or starting to use something new"* or *"choosing or taking something as your own"* and defines integration as *"the process of combining two or more things into one."* In relation to ICT in higher education institutions, innovative practices may adopt the use of ICT to accomplish stated goals. When an innovative practice becomes more widely applied and utilized, it can become a candidate for integration. According to Carr (1999), adoption refers to the stage at which a technology is selected for use by an individual or organisation, while integration connotes it has reached a level of acceptance and transparency in the user environment. There are a few models of Information Technology (IT) adoption that attempt to explain or predict the growth of innovation in ICT.

The Technology Acceptance Model (TAM) explains how external variables, namely perceived usefulness and perceived ease of use, influence a user's acceptance and therefore decision about how and when they will use technology system (Davis, 1989). While the TAM is focused at the individual level of ICT adoption, the Diffusion Of Innovation (DOI) model, on the other hand, which was first proposed in 1962, addresses a wider system integration of ICT innovation. The DOI model focuses on defining the innovation and communicating the innovation through specified channels over time among members of a social system (Rogers, 2003).

Researchers (Sherry et al., 2002; Li and Sui, 2011) have suggested that the DOI model is the most widely used for spreading innovation in higher education institutions where "*diffusion*" refers to the stage in which the technology spreads to general use and application (Carr, 1999). Both of these models are useful for considering the use of mobile technologies both at an individual level and organisational level. The absorptive capacity theory explains that an organization's absorptive capacity is its ability to recognize the value of new, external information, assimilate it, and apply it in order to benefit from it, depends on individual capacities.These individual capacities are dependent on existing appropriate contextual knowledge and the reliability of gatekeepers

(Cohen and Levinthal, 1990). However, given the multiplicity of use cases for mobile technology, as illustrated in the classification proposed in section 2.3.3, there is a difficulty with adopting a single approach to implementing mobile learning across disciplines and departments in a higher education institution. This is demonstrated in how mobile learning initiatives tend to stall in the adoption phase where they are also hindered by a variety of factors which have been outlined in section 2.3.4. In Section 2.4.1 outlines considers ICT configurations within which frameworks for mobile device use or mobile learning are deployed.

2.3.1 The Higher Education ICT environment

Given that higher education environments comprise a system architecture and underlying processes and people, which all together support a wide range of activities, the Information Technology (IT) systems architecture is designed to share information as needed between the component systems. The IT system architecture is intended to support all the activities of the institution and encompasses learning systems as well as systems supporting other departments such as application, registration, and finance, timetable, and other supporting web services. The two most common models applied in the design of educational environments are the Hub and Jigsaw models (Paulsen, 2002b) illustrated in Figure 2.2:

Figure 2.2:Hub and Jigsaw models of Information Systems (Paulsen, 2002b)
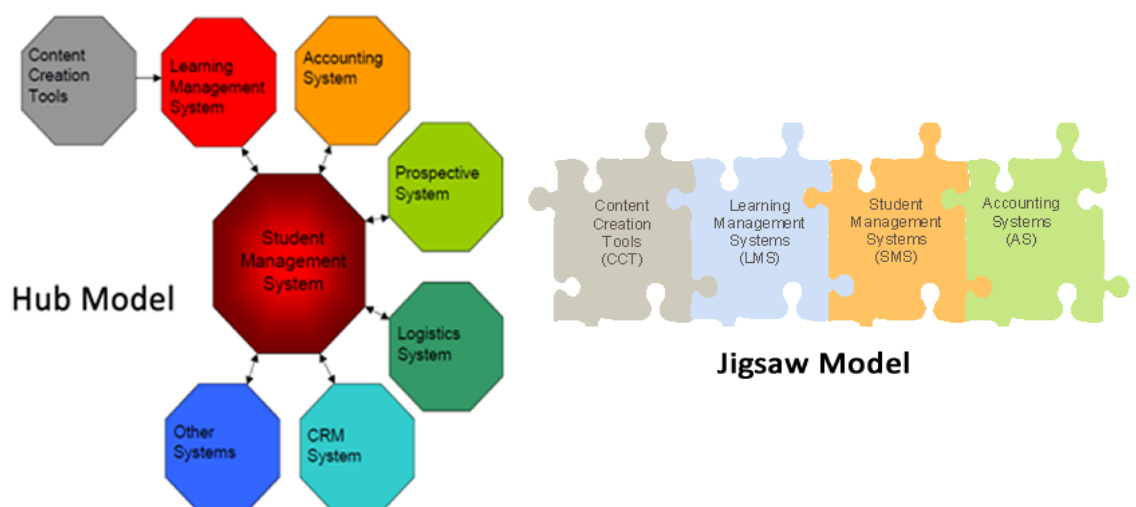
The hub model has all other systems feeding from the student management system at the centre, while the jigsaw model has systems all sharing information

with each other. It is within one of these systems, or a variation of these, that any mobile learning initiative and its enabling systems needs to operate. This is where the challenge also lies as regards handling personal information that would come with the use of personal mobile devices in a UYOD strategy.

A JISC review carried out in 2011 (Belshaw, 2011) regards mobile learning initiatives as being fundamentally about change management and suggests that the incorporation of mobile learning should be treated as such, and in doing that, address issues around institutional strategies, and centralised control. The JISC review also contends that there is no 'perfect mobile device' but only one that suits a particular context and as this is always evolving, institutions need to build or plan for this evolution. When viewed through the DOI lens, the term "mobile technology" means different things to different people across disciplines and departments. In some cases, it is the devices with a focus on enabling learners using their own devices (Perkins and Saltsman, 2010; Figaro-Henry and James, 2015), or in other studies, a particular platform or application in a given learning context that takes advantage of mobile technologies, for example, the use of a mobile enabled platform and messaging (Adedoja et al., 2013).

In dealing with the challenges of mobile learning around issues of change management or the institutional dimension of innovation and ICT enablement, the process of creating a mobile learning enabled environment needs to be considered across all functions of the institution. Integrating one mobile learning system can have a significant effect on existing systems and processes, present challenges to familiarising staff with the systems and educating them on subsequent benefits. Mobile technology integration therefore needs to be considered as a full spectrum of components: technologies, devices, supporting activities and processes. All these components together create a mobile enabled environment, rather than being one single system or simply the ability to use the institutional wireless network while on a mobile device. Mobile technology integration is often approached in higher education from the perspective of particular mobile learning interventions or platforms rather than an ICT management issue that takes into consideration the integration of a UYOD approach.

2.3.2 Technology Integration Process in large organisations: Diffusion of Innovation

Fostering and sustaining innovation in organisations such as the OOI is hindered due to the size and because there is insufficient communication, deep bureaucracies and internal regulations that promote a lack of transfer of information leading to missed opportunities (Figueroa and Conceição, 2000, p. 94). Earlier in section 2.3 the DOI model was determined as being appropriate for wider system integration of ICT innovation as it provided a mechanism for innovation at an organisational level. It is also the most commonly used for studying the adoption of a technology(Medlin, 2001);(Zhang et al., 2015, p. 3). According to Rogers, "*diffusion* is the process by which (1) an *innovation* (2) is *communicated* through certain *channels* (3) *over time* (4) among the members of a *social system*" (Rogers, 2003, p. 11). Working with this definition, in order to identify the types of mobile learning interventions to be supported or enabled, the right people, the innovators, need to be able to explore and take risks around the use of mobile technologies.

Rogers' theory of diffusion of innovation (Rogers, 2003) outlines how a new concept, technology, or product is spread across five main classifications of users in a given community (Table 2.2). It is based on the premise that *"getting a new idea adopted, even when it has obvious advantages, is often very difficult"* (Rogers, 2003, p. 1). The classifications he proposes outline how the users of mobile technologies can be categorised for the purposes of introducing the technology.

The classification includes the innovators, early adopters, early majority, late majority and, finally, the laggards as illustrated in table 2.2.

Table 2.2: Classification of users using Rogers's theory DOI

Innovators 2.5%	Early Adopters 13.5%	Early Majority 34%	Late Majority 34%	Laggards 16%
These are people who want to be the first to try the innovation. They are venturesome and interested in new ideas. These people are very	These are people who represent opinion leaders. They enjoy leadership roles and embrace change opportunities.	These people are rarely leaders, but they do adopt new ideas before the average person. That said, they typically need to see evidence that	These people are sceptical of change and will only adopt an innovation after it has been tried by the majority. Strategies to	These people are bound by tradition and very conservative. They are very sceptical of change and are the hardest group

willing to take risks and are often the first to develop new ideas. Very little, if anything, needs to be done to appeal to this population.	They are already aware of the need to change and so are very comfortable adopting new ideas. Strategies to appeal to this population include how-to manuals and information sheets on implementation. They do not need information to convince them to change.	the innovation works before they are willing to adopt it. Strategies to appeal to this population include success stories and evidence of the innovation's effectiveness.	appeal to this population include information on how many other people have tried the innovation and have adopted it successfully.	to bring on board. Strategies to appeal to this population include statistics, fear appeals, and pressure from people in the other adopter groups.

Rogers's theory asserts that the stages by which a person adopts an innovation, and whereby diffusion is accomplished, include <u>awareness</u> of the need for an innovation, <u>decision to adopt</u> (or reject) the innovation, <u>initial use</u> of the innovation to test it, and <u>continued use</u> of the innovation. He identifies **five main factors that influence adoption of an innovation**, and argues that each of these factors is at play to a different extent in the five adopter categories:

1. Relative Advantage - The degree to which an innovation is seen as better than the idea, program, or product it replaces.

2. Compatibility - How consistent the innovation is with the values, experiences, and needs of the potential adopters.

3. Complexity - How difficult the innovation is to understand and/or use.

4. Trialability - The extent to which the innovation can be tested or experimented with before a commitment to adopt is made.

5. Observability - The extent to which the innovation provides tangible results.

While applying Rogers' theory, Kaminsky suggests that the goal is not to move people from one adopter category to the next, but rather to streamline the innovation to meet the needs of users in all five categories (Kaminsky, 2011). As demonstrated in the categorisation of applications of mobile technologies in learning and teaching (Section 2.3.3), there is a range of applications which can be used across different learning contexts and disciplines', meaning that innovation is more than the use of mobile technology but has to be considered

in terms of the particular relative advantage offered in the use-case. In a higher educational setting such as the OOI, there is therefore a need to ensure that there is a means to provide support for the five categories of users through a process of planned change which takes into account the culture of the organisation. The role of the change agent is identified to be the that of introducing and influencing the use of the innovation.

The next section explains how the organisational culture that defines how various users accomplish their goals in an institution can be an enabler or inhibiter of innovation adoption and diffusion.

2.3.3 Organisational Culture

In considering how an innovation is adopted and diffused through the OOI, the organisational culture that underpins how members of an organisation communicate and share information may facilitate or hinder the uptake of the innovation. This is of particular importance given that mobile technologies have the potential to impact current working practices within an organisation's community. Organisational culture is defined as:

> *"...the pattern of beliefs, values and learned ways of coping*
> *with experience that have developed during the course of an*
> *organization's history, and which tend to be manifested in its*
> *material arrangements and in the behaviours of its*
> *members."(Brown, 1998, p. 9).*

In other words, the organisational culture determines how things are done in an organisation. In higher education institutions, the organisational culture can affect how peers in a hierarchy interact with each other, and how functional units in a higher education institution get things done and relate with each other. In many higher education institutions, there is a Learning Technology team made up of individuals with different areas of expertise who provide support in the use of technology to enhance the learning environment and experience (Laverty et al., 2003, p. 20) thus allowing academics to focus on their discipline. The Learning Technology team examine emerging technologies as a way to advance learning and in some instances control costs, and rely on Information Technology (IT) to address compatibility issues, potential IT risks.(Rushby and Surry, 2016)

The organisational culture also determines the value of innovative solutions in task completion. The organisational culture is however transcended by subcultures which is the culture of occupational groups (Schein, 2010, p. 2), in this case, higher education staff, academic staff, and be limited to specific domains. The culture of the organisation's domain in this case as a higher education institution determines how it relates with other institutions, and identifies within networks such as the HEA, DRHEA described in section 1.2. The organisation's culture has to take into account the culture it shares with others like itself in this case with other higher education institutions, and then its own individual culture which forms its identity as the OOI. Edgard Schein states that organisational learning and planned change cannot be realised without considering culture as a primary source of resistance to change (Schein, 2010, p. 10). To integrate a UYOD approach to mobile learning in an organisation, the guidance provided by models or frameworks to be used needs to consider how to influence the prevailing culture. The next section (2.3.4) is an examination of mobile technology integration frameworks that look at how mobile learning with user owned devices may be operationalized in higher education institutions.

2.3.4 Mobile Learning Technology Frameworks

Higher Education Institutions have built their environment of infrastructural technology over years. This infrastructure is mature and stable, often comprising of legacy systems which have been customised and deeply embedded within the institution's processes and environment and have become a part of the organisation's culture by impacting how things get done. Making any investment into new technologies and their integration and changing processes as would be required by enabling UYOD and mLearning requires an evaluation of fit with the existing infrastructure and systems as well as an assessment of risks.

Over the last decade or more, there have been a number of frameworks and models proposed to address various aspects of mobile technology adoption in higher education institutions. Most of these models and frameworks focus on the facilitation of mobile learning with consideration of the institutional environment or attempt to address the design of systems or initiatives that are mobile enabled rather than exploring organisation wide solutions that incorporate UYOD into the learning environment. The models reviewed below

are in chronological publishing order. The purpose of the review is to show how these models fit into the institutional systems and practices and demonstrate the gap in the existing models.

2.3.4.1 Task Model for mobile learning (2006)

The task model for mobile learning was an attempt to understand the domain of mobile learning by applying a socio-cognitive engineering design method called 'the task model' within the context of a funded project (Taylor et al., 2006). The socio-cognitive engineering approach which is based on the activity system theory (Engeström, 2014) incorporates software engineering, task engineering, knowledge engineering and organisational engineering to consider complex interactions between people and computer-based technology to inform system design as pertaining to learning. The task model expands on the components of Engeström's model namely, control (previously rules), context (previously community), and communication (previously division of labour) to add additional layers of technological space and semiotic space with emphasis on the dialectical relationship between these two spaces. The model is targeted at the audience who design, build and evaluate systems for mobile learning. This audience often comprises of creators of mobile learning systems rather than implementers of mobile technologies or those engaged in developing policies.

2.3.4.2 Koole's FRAME model (2006, 2009)

Koole's FRAME (Framework for Rational Analysis of Mobile Learning Environments) model for mobile learning was originally developed to understand the process of mobile learning and facilitate the understanding of mobile devices as distance learning tools (Koole and Ally, 2006a), (Koole, 2009). Within the model which is represented by three circles (Figure 2.3) mobile learning is seen as:

> *"A process resulting from the convergence of mobile*
> *technologies, human learning capacities, and social*
> *interaction." (Koole and Ally, 2006b)*
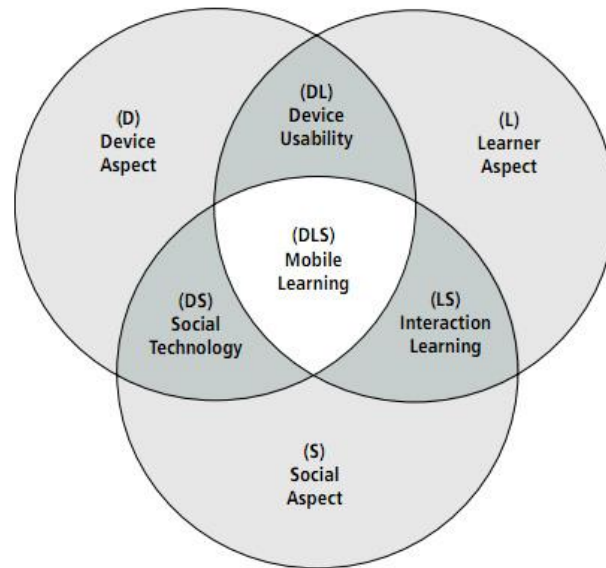
This model comprises of three circles each representing a component of mobile learning interactions namely: the mobile device and its physical characteristics and capabilities, the learner as an individual with prior knowledge, learning history, and social interaction as a process involving conversation and cooperation. The model considers the intersections of these aspects, with their complete intersection point being the ideal space for learning with mobile devices. The FRAME model is a tool that can be used by educators as a checklist when designing mLearning curricula (Hsu and Ching, 2015) and designing the environment for mobile use at an individual level. However, it does not consider the larger institutional environment in terms of the organisational culture and practices within which the learning interaction would be occurring. This deficit is recognized in a study in which the model was implemented for nursing education, where researchers encountered hospital culture and policies which prevented the use of wireless mobile devices (Kenny et al., 2009). The FRAME model looks at mobile learning as being at the convergence of the device usability, learner aspect, and social aspects with overlaps between them, creating secondary intersections of social computing, interaction learning and context learning. It is focused on the consideration of how to design a mobile learning activity as an end in itself by addressing *"contemporary pedagogical issues of information overload, knowledge navigation, and collaboration in learning"*. It is not intended to address the system within which the mobile devices are used or the mobile learning activity happens, but rather appears to assume that the environment and conditions for mobile learning are in place.

2.3.4.3 Four-Stage Mobile Learning Framework (2010)

In 2010 a four-stage framework was proposed to guide the development of mobile learning initiatives along a project management style life cycle (Wingkvist and Ericsson, 2010). Similar to the Koole Model, the focus in this framework is the individual project rather than on the system or environment as an enabler of many projects. The purpose of this framework is to enable the transfer of control from the funders on initiators to long term owners and it is mentioned in the JISC mobile and wireless review (Belshaw, 2011) as being one of the 'most promising' for mobile learning from the perspective of funders rather than the implementers. This is because it tries to address the perceived lack of sustainability and scalability around mobile learning initiatives by using dividing activities into four phases:

1. Idea (establish soundness of idea, establish technical platform)

2. Trial (test the idea, elaborate the learning)

3. Project (large-scale testing, formalise resources and outcomes)

4. Release (hand over control, remove reliance on initiators)

This flow provides a linear product development process for individual projects. It follows the path of a typical project management cycle; this approach makes it difficult to revisit a previous phase. Furthermore, with the rate of change of mobile technologies and variety of devices available, using them in learning contexts with a group of students can get messy, so there has to be a tolerance of ambiguity within a model or framework addressing the use of mobile technologies. While the phases of the four-stage model include testing within the environment and existing infrastructure, these are usually pertaining to the idea being investigated rather than the environment within which the innovative idea is to be implemented.

2.3.4.4 Pedagogical Framework for Mobile Learning (2011)

In a departure from the previous two models which focused on managing specific implementations of using mobile technologies to support or enable learning, the Pedagogical Framework for Mobile Learning addresses a named context- distance learning. It aimed to provide a better understanding of the characteristics of mobile learning within the context of distance education (Park, 2011). This framework was positioned towards instructional designers and

educators, promising them a pedagogical framework for designing distance learning based on its suggested categorizations with particular emphasis on psychological separation of the learner from the instructor. Park's proposed categorizations are based on the transactional distance learning theory proposed by Moore in 1972 (Park, 2011) which she says implies the separation of teachers and learner both in a geographical sense and pedagogic sense.

1. High transactional distance and socialized mobile learning: Here learners have more psychological and communication space with their tutor, they are involved in group learning with their learning material delivered from a predetermined program through mobile devices. Transactions happen mostly between the learners in a group with the tutor having minimal input.

2. High transactional distance and individualised mobile learning: In this category, individuals have more psychological and communication space with the tutor or institutional support. They individually receive tightly structured and well organised content and resources with mobile phones and control their learning process to master their learning material. Transactions here are mainly between the learner and the content.

3. Low transactional distance and socialised mobile learning: This type represents the most advanced form where individual learners have transactions with both tutor and other learners using mobile devices. They have less psychological and communication space with the tutor and loosely structured, undefined learning content. They work in a group as they solve a given problem and try to achieve a common goal while engaging in social interactions and negotiations.

4. Low transactional distance and individualised mobile learning: There is less psychological and communication space between the tutor and learners. The learning content is loosely structured and undefined so individual learners can interact directly with the tutor. The tutor leads and controls the learning in an effort to meet individual needs while maintaining the transactional distance. This transactional distance is one of the keys in this categorization and is controlled by three interrelated factors which are the structure of the learning program, the dialogue that the learners and tutors exchange and lastly, the role of the learners in deciding what, how and how much to learn. While this would suffice for distance learning, where the learning is planned to the last detail in

advance, for everyday learning and teaching in higher education, these categorizations might be quite rigid and do not allow for the overlap that could occur within a learning unit or module. It is also unlikely that mobile learning by itself would constitute the entire learning experience in a program or module of learning, more likely, it would be a unit in a bigger frame.

Park's premise is that previous studies generally lacked a pedagogical framework and while Engestrom's 1987 activity theory (Park, 2011) is acknowledged as a useful framework for designing constructivist learning environments as done in the Task Model. A perceived shortcoming of this is identified by stating that life is generally not compartmentalised in ways that can be so analysed and consistent with theoretical assumptions (Park, 2011). In contrast, (Uden, 2007) contends that activity theory provides a philosophical framework for understanding activities within a social practice and using artefacts and can help designers to understand the social relations that affect learning and learner interactions with other as mediated by tools.

The Park model is focused on designing experiences that utilise mobile technologies to reduce separation experienced by distance learning students. This model enables the navigation of individual and collaborative learning spaces, rather than addressing the challenges of an institutional environment to allow multiple mobile learning initiatives thrive.

2.3.4.5 Mobile Learning Evaluation Framework *(MLEF) (2012)*

Recognising that there are barriers to the adoption of mobile learning initiatives at both personal and institutional level, the aim of the MLEF is to propose a framework to enable higher education institutions, learning designers and educators, to evaluate whether mobile learning initiatives are successful, scalable and replicable (Murphy and Farley, 2012). From engagement with users at organisational, technical, pedagogical (learning and teaching) levels, the framework was to provide an evaluation toolkit which consists of:

- A conceptual evaluation framework and evaluation resources which consist of a set of criteria and assessment instruments for evaluating mlearning in various contexts.
- An mlearning maturity model that will enable HE institutions to assess the maturity of their mlearning capabilities and provide best practice

recommendations for policy development and coordination at an institutional level.

- A database of mlearning examples in the form of case studies and resources

- A mobile user model that gives insight into the context, background, needs and learning styles of students to enable benchmarking of the role and impact of mobile learning in various contexts.

The project, which is funded by the Australian government's collaborative research networks programme, was proposed in 2012 and was intended to aid the selection and justification of m-learning initiatives. The final output from this work has not been published.

2.3.4.6 An MLearning Maturity Model for the Educational Sector (2015)

The MLearning maturity model (Alrasheedi and Capretz, 2013; Alrasheedi, 2015) for mobile learning uses the identification of *"critical success factors"* to determine the success of a mobile learning initiative or platform. To identify the Critical Success Factors (CSFs), a systematic review was carried out from the university students' perspective. This systematic review collated results from 30 studies conducted in 17 countries and applied Roger's diffusion of innovation theory to identify what aspects of the innovation process cause reduced uptake of mobile learning by students. These were given as:

- Relative Advantage—Learning made interesting, increased productivity,
- Compatibility Assimilation with curriculum, blended learning,
- Complexity—User-friendly design, Internet access, application working,
- Trialability—Platform accessibility, learner autonomy, personalization,
- Observability—Technically competent students, technically competent educators, learner community development.
  (Alrasheedi and Capretz, 2015, p. 272)

The mLearning maturity model for mobile learning illustrates the stages and processes to enable the assessment of the maturity of mlearning initiatives and platforms. The framework which is based on a CMM is intended to be used retrospectively by higher education institutions to appraise current mlearning initiatives to determine adoption success by a range of stakeholders by exploring

assessment questions which are used to evaluate the institution. (Alrasheedi, 2015). When applied, this framework allows an institution to determine the extent of its capability for mLearning. It is aimed at establishing what level of maturity a university is in at a given point in time. In considering the creation of capacity for mobile learning in an institution, given that device ownership is a key aspect of the use of mobile, there is no consideration or evaluations of any factors related to this. Additionally, while, this model provides a way to get a snapshot of a university's mobile learning capability at a given time, it does not specify a course of action towards how to define a roadmap for creating a mobile learning enabled environment.

Other mobile learning frameworks address the evaluation of mobile learning interventions at the practitioner level rather than any aspect of the environment or implementation such as the three-level evaluation framework of mobile learning (Vavoula and Sharples, 2009).

In 2010, recognising the need for a consolidated view of mobile learning models, a review was carried out on the premise of mlearning being access to web-based content in learning contexts and the need for the underlying infrastructure to enable this (Udanor and Nwodoh, 2010). The review concluded that because mobile learning was in its infancy, the only major effort was the Task model described in section 2.4.2.1. A more recent review carried out examined 17 models and frameworks categorised into pedagogies and learning environment design, platform or system design, technology acceptance, evaluation, and psychological construct (Hsu and Ching, 2015). This review found that there was a need for considering the mobile learning system architecture in subsequent reviews to provide insights into the technical development of mobile learning applications and systems in institutions. The aspect of creating an environment within which these frameworks can be applied is not addressed by any of the guidance available.

When considering sustained wide-scale institutional deployment of mobile learning, even though mobile learning may mean different things to different people, it is important that an institution begins a dialogue with itself by engaging its staff, learners and the wider community, to define and start driving innovation in using mobile technology (Belshaw, 2011). In doing this, an institution should also consider the effects of its culture on how its community

adopts technologies such as mobile learning. This is particularly relevant when communicating mobile learning innovations over time among members of a social system (Rogers, 2003). The relations between organisational culture and innovation is highlighted in a review to identify the elements of culture which foster innovation and it is revealed that a hierarchical culture and an organization's preference for stability may decrease an organisation's ability to innovate (Büschgens et al., 2013). Organisational models are often used in industry to analyse new strategies and speculate on organisational change. One of the most popular is McKinsey 7-S Framework (Peters and Waterman, 2006) which states that seven key elements (strategy, structure, system, share values, style (culture), staff, and skills) must be effectively coordinated and aligned for long term success. However, such models are evaluative similar to the mobile learning frameworks previously discussed and do not give a clear path of action on how to actually achieve the intended goal of the change management effort. Additionally, it has been argued that the McKinsey 7S framework does not pay attention to the context of an organisation and the influences on implementation which originate from outside the organisation. Most importantly, the McKinsey framework and any other management models tend not to be as effective in higher education environments as these environments are more ambiguous than the corporate settings for which they were intended due to a lack of focus on concepts important in higher education such as intellectual development and scholarly community (Toma, 2010, p. 25) .

By understanding the full range of mobile technology applications for learning and teaching in higher education, and the supports demanded by that range within the context of the organisational culture and expectations, the institution can better create an environment to enable the use of mobile technologies in a variety of contexts.

2.4 Summary of Literature Review with Gaps identified

The literature review explored in chapter two revealed a gap for guidance to enable higher education institutions create an ecosystem of sustainable mobile learning implementations. Enabling a UYOD approach allows institutions take advantage of user owned devices that have a range of fast developing affordances while ensuring that their systems and processes are capable of supporting their use.

Current frameworks do not specifically consider the need to future-proof mobile learning support and infrastructure and do not take into account the rapidly changing technological capabilities of the personal mobile devices. Furthermore, the capabilities of these mobile devices in terms of the projected trends as outline in section 2.1.3.4, and along with the fact most students own a mobile device. The research so far covered has been less focused on the process of adoption of the innovation of mobile devices or in the development of long term strategies to cope with new mobile technologies and applications (Bird and Stubbs, 2015, p. 51, 60). As demonstrated in the classifications of mobile learning given in section 2.3.3, the use of mobile technologies in learning and teaching has a multiplicity of use cases, each of which can be considered innovative. By understanding the full range of mobile technology applications for learning and teaching, and the supports demanded by that range, the institution can better create an environment to enable the use of mobile technologies in a variety of contexts. Section 2.3.4 identifies and explores the challenges around the infrastructural requirements identified when classifying the implementations. This exploration leads to the consideration that, rather than the workarounds that are often implemented for pilots, institutions need a solution that enables a thoughtful and comprehensive consideration of their ecosystem to create an environment that enables and supports innovation in the use of mobile technology. This consideration should include the systems, infrastructure, processes, people and organisational culture of the institution.

To determine the current gaps in the literature and research, the examination of existing mobile learning models and frameworks carried out in section 2.4.2 established the dearth of one that addressed the wider institutional system as an enabler for mobile learning. The models and frameworks tend to be targeted at systems designers and developers or at a local course level rather than at an organisational level and are evaluative rather than directive. Furthermore, a report which published an analysis of 164 articles published between 2003 and 2010 retrieved from multiple databases and peer-reviewed journals found that most of the mobile learning research was either about the effectiveness of mobile learning or the mobile learning system or application design (Wu et al., 2012). Very little of the research so far encountered has addressed the environment for mobile learning or the culture around how higher education institutions operate. A more recent international Delphi study (Hsu et al., 2014) set out to obtain a

consensus from experts about areas in need of research in mobile learning and identified ten research areas. The areas identified in order of priority are: 1) teaching and learning strategies; 2) affordances; 3) theory; 4) settings of learning; 5) evaluation/assessment; 6) learners; 7) mobile technologies and interface design; 8) context awareness and augmented reality; 9) infrastructure and management; and 10) country and digital divide. This means that for an organisation who want to make their environment capable of supporting mobile learning where students can use their own devices and have their staff design and develop sustainable mobile learning initiatives, there is no guidance. If the existing frameworks are to be applied, there needs to be an environment where mobile learning can be implemented and sustained. The aim of this research is to determine how the capacity for mobile learning can be created or enabled within an organisation such as a higher education institution in a manner that mitigates risks and enables opportunities to capitalize on the affordances of the technologies.

When looking into the category for "infrastructure and management" the Delphi experts engaged for the study recognised this as an enabler of mobile learning. However, they also identified that there is little academic research in this category and attributed this to its practical nature as it leaned more toward strategic planning and implementation at the institutional level. It was then stated that, as this category still lacks research, future exploration could help fill the void in the literature and contribute to the understanding of various aspects of infrastructure and management that could enable mobile learning (Hsu et al., 2014, p. 15).

The concept of learning while being mobile is not new. Students have always been mobile in their study habits using their books, and over time, their laptops. However, with the emergence of the personal mobile devices and their evolving affordances, higher education institutions need to confront forms of learning that were not previously possible. There is insufficient understanding of the issues of infrastructure and process around implementing mobile learning with UYOD. To address this, this thesis will provide insights in the form of guidelines which address the challenges and issues in the process of creating an environment within which a UYOD approach is used to enable mobile learning. These

guidelines are derived by addressing the research questions raised in section 2.5 using the OOI as a case study.

Theoretically, the research will add to the existing body of knowledge and the discussion of mobile technologies in higher education, by providing a view from the perspective of the "third space" professional. It will also contribute by highlighting the process of incorporating student owned devices in learning and teaching in this space rather than simply enabling BYOD or UYOD as a channel for accessing organisational systems. By focusing on how to make UYOD integration seamless, this thesis sheds further light on existing research which mostly addresses the range of use in particular contexts of learning and teaching. It highlights the needs of both students and staff while examining the processes of enabling the use of individually owned mobile devices from an institutional perspective and considers the tensions that arise from organisational culture and change management.

While this is mostly a pragmatic piece of work, it also makes contributions to the theory by framing the study within a wider context. It aims to provide guidelines for an organisation similar to that studied here, to support the systematic or strategic enablement of UYOD to enable a mobile learning environment and build mobile learning capacity. Similar organisations would include other higher educational institutions such as universities as described in Section 1.2. and institutes of technology who face the same challenges with scaling, sustaining and supporting mobile learning. These organisations need to build the capacity for enabling, supporting and sustaining initiatives that take advantage of mobile technologies.

The research is a study of how a higher education institution reassesses and adjusts itself to adopt and incorporate a UYOD approach to adopting new technologies such as mobile technologies for enabling and supporting learning. This thesis identifies a present institutional need taking into account the fast-moving nature of the technology, but furthermore, given the opportunities opened by the use of the mobile devices, the thesis also offers institutions a mechanism with which to prepare for where the technology may be leading. The following questions frame the research.

2.5 Research Questions

Question 1: What are the obstacles around "Use Your Own Device" (UYOD) in learning and teaching?

The definitions of mobile learning underlying this research are based on individual ownership of devices that enable interactions that support, enable and enhance learning (Section 1.6). To understand the reception and current obstacles in the use of personally owned devices for supporting learning activities in a higher education institution, the question of how both students and staff are using mobile technologies is explored. A UYOD pilot is used to determine the obstacles when a mobile learning initiative is deployed. The activities in this cycle also serve to reveal whether or not there is an appetite in the institution for mobile learning and what the obstacles preventing the use of individually owned devices are.

Question 2: How can policy and practice in an institutional context for UYOD respond to these obstacles?

Having established the feasibility for this research by establishing that there is an appetite for mobile learning and identified the obstacles, question two aims to determine how policy and practice can respond by establishing the capacity of the institution to react to those obstacles. This question explores the impact on the existing environment when lecturers design and implement learning contexts in which students use their own devices in a UYOD setting while acknowledging the nuances of individually owned devices as personal artefacts that influence how users view their world (Section 2.3.4). In implementing explorations of mobile learning implementation from the range in section 2.3.3, the cycle examines how the existing systems, processes, and culture accommodate students using their own devices in such purposely designed learning contexts and identifies the frictions that may exist and proposes solutions to these.

Question 3: What leadership requirements would be adequate to implement helpful policy and practice to enable UYOD for mobile learning?

In section 2.4.1, the process of implementing mobile learning was described as a change management process that needs to address issues around institutional strategies and control. Building on the insights on the implications of UYOD gleaned in question two, question three seeks to investigate the perspective of

students and staff at a deeper and wider institutional level by engaging with a larger representation of the population. the organisation's leadership and management. By doing this investigation, the guidelines that have emerged are grounded within a broader institutional setting which is comparable to other similar institutions to provide guidance in how to ensure sustainability of mobile learning initiatives even as the types of personal mobile devices and affordances evolve. The findings from the current research will be useful for future work enabling innovation with new personal technologies and enhance understanding of the issues around the integration of personal mobile technologies in higher education for information technology support professionals, information service departments, policy makers, practitioners, and researchers.

2.6 Conclusion

The literature review showed that despite increased mobile learning research output, there is a lack of guidance for higher education institutions to create sustainable mobile learning initiatives. It was proposed that by enabling mobile learning using UYOD in a manner that is responsive to the rapidly developing pace of the technology, higher education institutions could enable transformational learning experiences. However, when existing technology innovation and technology integration models were examined, there were none that took into account the role of organisational culture in technology adoption and provided a means to remain responsive to how the technology was evolving. The research proposition therefore seeks to fill this gap and the research questions to be addressed to give the needed guidance were proposed.

The next chapter focuses on the research methodology adopted to generate the data in response to the questions raised from the literature research.

3. Research Methodology

Introduction

Previously in Chapter two, relevant literature relating to mobile technologies in learning and teaching in higher education was reviewed to give a background, context and rationale for this study. The goal of this research is to produce actionable guidelines which a higher education institution can apply to create a mobile learning environment that takes advantage of student owned devices and is responsive to the rapidly evolving developments in mobile technologies. To do this, the research explored the following questions in chronological order:

> *Question 1: What are the obstacles around UYOD in learning and teaching?*
>
> *Question 2: How can policy and practice in an institutional context for UYOD respond to these obstacles?*
>
> *Question 3: What leadership requirements would be adequate to implement helpful policy and practice to enable UYOD for mobile learning?*

Chapter Three now focuses on the strategic approach underpinning this research and outlines the procedural framework around which the research activities occurring in Chapters Four, Five and Six are based.

The theoretical framework and philosophical grounding for the current research were determined from the "third-space professional" perspective (Whitchurch, 2008), in which the researcher provides an argument for their ontological and epistemological stances as a basis for their methodological choices of case study and Design-Based Research (DBR), which is also known as Design Science Research (DSR). The research is then outlined and the instruments used are defined and justified.

The period of data collection and analysis was through 2011 to late 2013. The on-going analysis of the resulting data as it was collected is outlined through cycle 1 to 3. This includes a thematic analysis which outlines how the data collected was coded, themes were identified and categorised in each cycle and across cycles. The analysis of the data involved sorting through all the data collected to reduce, categorise and find meaning. This meaning is linked to the

questions that drive the research and therefore leads to presentable findings, conclusions and recommendations. As well as the qualitative analysis, quantitative instruments are also used to present and describe some of the data collected. The data collection instruments used included semi-structured interviews, focus groups, surveys and observations. The detail of the execution of each of these is detailed in the narrative.

Key stakeholders were interrogated using interviews, surveys, focus group/group interviews. These stakeholders included academic staff, administrative and managerial staff as well as student groups. Different stakeholders were interrogated at each iteration or cycle of the research with a view to understanding current practices, clarifying expectations, and making projections. Key themes and issues were identified and explored. The data collected included both qualitative and quantitative types. Regardless of what method was used for data collection, all participants were informed about the details of the study and assured of their anonymity and confidentiality. They were also invited to be informed of the results of the study.

The chapter concludes by acknowledging the research challenges in terms of validity, generalizability and quality assurance. Ethical considerations in the study are also outlined in section 3.10. By the end of this chapter, the foundation for the data collection and analysis in Chapters Four, Five and Six is justified.

3.1 Theoretical Framework underpinning the research

The theoretical framework encapsulates the research paradigm adopted and the researcher's positioning from which the research is conducted. The research paradigm on which a research project is based, including the questions being investigated, as well as their positioning within the concept and practices of the discipline they are aligned to, all describe the worldview of the researcher. This worldview includes a definition of what is real- ontology, and how knowledge about reality- epistemology, is acquired and confirmed. Blaikie (2009) explains that ontology refers to the claims and assumptions researchers make about the nature of social reality, their claims about what exists, what it looks like, what units make it up and how these units interact with each other. While epistemological assumptions are the ways of gaining knowledge about whatever the reality is understood to be (Blaikie, 2009, p. 8). A researcher's ontological assumptions are concerned with what they believe constitutes

reality, the nature of being, determining what is real and what is not, so as to determine the phenomena for study, while their epistemology refers to how they know. An ontological position is also quite personal as it is, to put it simply, the researcher's 'point of view'.

In carrying out the research for this study, the researcher considers themselves a "third-space professional" (Whitchurch, 2008). Their work bridges across education, information systems, management, and the support of pedagogical practice, so in this capacity they are often an "enabler". Their role is to take advantage of technology to facilitate the creation of learning spaces, environments and opportunities for innovation while ensuring all of these activities are aligned with the strategic goals of the institution. They do not teach, but rather focus on enabling the environments and infrastructure within which learning and teaching are facilitated by education practitioners. They believe that the technology in and of itself becomes meaningful when the subjects (community) around it interact with it. Mobile technologies have potential but only take on meaning when they are used. This depicts a constructionist view which sees meaning as not being discovered but constructed. With both constructivism and constructionism, every interaction changes the nature of the "knowledge" being acquired.

The key idea of constructivism according to Piaget (1896–1980) was that active engagement with the environment leads to construction of meaning and to learning, whereby "knowledge is constructed in the context of the environment in which it is encountered" (Jordan et al., 2008, pp. 57, 59). At this point, it is worth considering the closeness of constructivism and constructionism, this often causes them to be used interchangeably. Where constructivism is a cognitive function focused more on the way the individual builds a knowledge schema internally, constructionism is more physical, with an emphasis on the production of useful knowledge-based artefacts or material. Constructionism is therefore more suited to a research that will need to be seen, reviewed and critiqued. For both constructivism and constructionism, the dialogue leading to the knowledge is key. In the current research, the knowledge is formed by observing and reflecting on the interventions and stimuli introduced as well as engaging with other parties in the environment. Traditionally, researchers are guided by their view of the world, which is in turn underpinned by their

ontological perspective and epistemological position. These subsequently determine the methodologies they apply in their research.

Remarking on the methodology of cultural studies research which was described as having no distinct methodology due to the need to be pragmatic with the goal being to enable understanding of the topic (Grossberg et al., 1992, p. 2), it was stated that "the choice of research practices depends upon the questions that are asked, and the questions depend on their context." This current research is driven by questions arising out the researcher's own practice as a third-space professional, and it addresses questions of practical application against an interdisciplinary backdrop. For these reasons, approaches and instruments that suit the purpose at the time of application are used. This would be typical of a pragmatic approach.

> *"To a pragmatist, the mandate of science is not to find truth or*
> *reality, the existence of which are perpetually in dispute, but*
> *to facilitate human problem solving"(Powell et al., 2015, p.*
> *884)*

This approach allows the research to focus on the research questions, the actions, practices and results or changes that address it. The pragmatic researcher is at liberty to use any methods as deemed appropriate to the context being investigated to address the needs of data collection and analysis.

Within every discipline, there are underlying paradigms that allow its professionals to engage in discourse and shared practice. The current research sits at an intersection of information science, education practice and management, so it is interdisciplinary. It is also proactive and addresses current problems of the practitioners in this space. Using Crotty's pillars as a foundation, Figure 3.1 is an illustration of the philosophical grounding for this research:

Figure 3.1: Conceptualisation of philosophical grounding

The following sections will outline the methodologies underpinning the choice of methods, procedures and instruments employed in this research. As the research progresses through the cycles, there are ontological and epistemological shifts that can be explained by the nature of the knowledge being pursued.

3.2 The Research as a Case Study

Case study research allows for the thorough examination of a phenomenon through the analysis of an individual case which may be any unit of social life. This also recognises that while the current research is not an arbitrary sampling of the larger population, it is an exploratory case study of the OOI as an integrated entity (a higher education institution) comprising of various departments responsible for different functions (Stake, 1995). The study and related activity in the case studies detailed in the current research are peculiar to the institution being studied. The case study is being used because it provides a suitable method to determine the case in which when the phenomenon under study (in this case the implementation of a mobile enabled environment) is not readily distinguishable from its context (Yin, 2011). This case study is pursued as an inquiry form of research that takes a pragmatic view of knowledge through insider accounts and aims to offer new insights and share understanding rather than generalisable facts (Thomas, 2017) about advancing mobile learning with UYOD. The framing of the context of this case allows other researchers to derive the same conclusion in similar circumstances. There are three steps to framing the research as a case study (Yin, 2009).

1. Defining the case where the "case" is a bounded entity-person, organization, event or other phenomenon. In this instance, it was a higher education organisation (OOI).

2. Selecting a case study design: This was a multiple case study of how one higher educational organisation was implementing a mobile learning environment in their organization by exploring smaller cases within the larger bounded one in cycles of Design-Based Research (DBR).

   In this case study, the areas of interest are thoroughly investigated by using a design-based approach. Bearing this in mind, the conclusions drawn are relevant to this case and similar cases.

3. The third step in framing the study is using theory in design work. This involved using theoretical propositions that exist in current literature to establish or adjust the premise on which the case study is based.

3.3 Design-Based Research (DBR)

While it can be argued that the idea of using iterative cycles of activity aimed at improving any concept is an old approach to design, the identification of this as a formal research methodology as DBR dates to 1992 when the critical characteristics of design experiments were defined as:

-Addressing complex problems in real contexts in collaboration with practitioners.

-Integrating known and hypothetical design principles with technology affordances to render plausible solutions to the complex problems.

And lastly

-Conducting rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles (Brown, 1992; Collins, 1992).

Brown (1992) and Collins (1992) mostly used DBR to extend the findings of research beyond laboratory type settings to real-life contexts.

DBR methods are mainly aimed at designing and exploring the whole range of designed innovations or artefacts, as well as less concrete aspects such as activity structures, institutions, scaffolds, and curricula (DBR Collective, 2003). A Design-Based Research (DBR) effort is a collaboration between practitioners and researchers (Anderson, 2005) which as well as determining what works, cultivates numerous opportunities for exchange of expertise across disciplinary

boundaries. DBR also allows for deriving theories that inform the ecological system within which the research is based thereby advancing both theory and practice simultaneously (McKenney and Reeves, 2014, p. 19).

3.4 Situating DBR in Information Systems (IS) research: Design Science Research (DSR)

In information systems research, the Design-Based Research (DBR) approach is referred to as "design science research." Design science research has its roots in engineering and is fundamentally a problem-solving paradigm (Hevner and Chatterjee, 2010). Similar to DBR, Design Science Research (DSR) is focused on the production of new and true knowledge to a community where this new knowledge can be in the form of artefacts such as constructs, models, frameworks, architectures, design principles, methods and instantiations (Vaishnavi and Kuechler, 2015). The table in figure 3.2 further explains these outputs.

Figure 3.2: Potential Output of a DSR project (Vaishnavi and Kuechler, 2015)

	Output	Description
1	Constructs	The conceptual vocabulary of a domain
2	Models	Sets of propositions or statements expressing relationships between constructs
3	Frameworks	Real or conceptual guides to serve as support or guide
4	Architectures	High-level structures of systems
5	Design principles	Core principles and concepts to guide design
6	Methods	Sets of steps used to perform tasks—how-to knowledge
7	Instantiations	Situated implementations in certain environments that do or do not operationalize constructs, models, methods, and other abstract artifacts; in the latter case such knowledge remains tacit
8	Design theories	A prescriptive set of statements on how to do something to achieve a certain objective. A theory usually includes other abstract artifacts such as constructs, models, frameworks, architectures, design principles, and methods

Both DBR and DSR involve a cyclical approach to generating output. The next section presents the cycles of this research and explains the process of contribution to theory that arises.

3.5 Design Research Cycles

The work done in this study was carried out in three cycles illustrated in figure 3.2. While conducting the study, in Cycles one and two which included mobile learning implementations, the researcher was involved in the design and development of the solutions to be deployed but not in the implementation. Feedback about the implementation was gathered through the questionnaires, interviews and focus groups. The design research cycles were conducted by the researcher in their role as a learning technologist in the LTSC, as outlined in Sections 1.1. and 2.3.3.

As described in Section 2.3.3, in most higher education institutions there is a support unit charged with leading and supporting the enhancement of learning and teaching with technology, and in the OOI this unit called the LTSC as previously outlined in Section 1.1, run programmes to influence, encourage and support innovation in learning and teaching. The purpose of the programmes is to provide support for staff who want to explore innovative approaches in their teaching practice. This positioning of the LTSC identifies the unit as a "change agent" for the purposes of exploring the use of UYOD in mobile learning. While there are often technology innovation initiatives among these programmes, the emphasis is not on innovating with technology.

The LTSC work closely with IT services to provide a stable technology architecture that is capable of supporting the learning and teaching initiatives that are to run each academic session. In 2011, the institution published an IT development plan which is to be reviewed annually. The plan outlines the delivery of services to meet the needs of the institution around seven themes given as customer service and communications, learning and teaching support, IT services for researchers, delivery of management information, IT governance and benefits realisation, development of a service-oriented IT architecture and resourcing of IT service delivery. In order to meet the obligations of delivering to these themes, IT services have adopted an ITIL (Information Technology Infrastructure Library) approach to the provision of IT services in the organisation (Appendix 15). The ITIL approach as adopted requires that any technical requirements toward supporting the learning and teaching of a module should be presented to IT for consideration prior to the summer holidays. IT services maintain a service catalogue which provides information on the services

supported (Appendix 16). Support for UYOD or the use of mobile devices was not included in this service catalogue. All requests for additions to the catalogue are considered as a project request and assessed in terms of the IT resource need and funding.

This research cycles explores each of the research questions in turn, collecting the data followed by an analysis leading to the guidelines being developed in response to what is being discovered. The three cycles of this are as follows:

3.5.1 Cycle 1: Pilot Study

Following and alongside the literature review, the first cycle of the study was a pilot study for the research and was carried out within the academic term which is a period of about twelve weeks. This cycle was aimed at examining institutional readiness and attitudes towards the use of mobile technologies in learning and teaching. It showed whether or not there was any need to create an environment for using individually owned mobile devices, ascertaining whether there was any appetite for this and identified where the obstacles were. Participants were invited to be interviewed or surveyed about their use of mobile technologies, in particular, mobile devices within the context of learning and teaching. All of these activities refined the goals for this study and identify and bound the scope for subsequent work. The pilot involved an environmental scan of the present status of mobile technologies and their use in education within the institution and observations from a pilot exercise in the use of mobile technologies in a learning and teaching context

The pilot sharpened the focus of the problem to be investigated and determined the feasibility of the research. It also resulted in an initial suggestion for the guidelines proposed which is iteratively updated after each design cycle.

Figure 3.3: The Design Research Cycles with the guidelines continuously revisited and iterated

Start of Study -Literature Review identified the Gap : Guidance to enabling sustainable mobile learning using UYOD in Higher education institutions.

Contributing of knowledge: Understanding of the issues of infrastructure and process around implementing mobile learning with UYOD in the OOI in forms of final framework

Final Framework

Cycle 1

RQ 1: *What are the difficulties around UYOD in learning and teaching?*

Exploration of sensitivities around the use of mobile technologies.

- Interviews with Academic and
  Non-academic staff

- Student Questionnaires

- Implementing mobile technologies within a learning context

guidelines

Cycle 2

RQ 2:*How can policy and practice in an institutional context for UYOD respond to these obstacles?*
Evaluating Institutional capacity

for use of mobile technologies via

2instances of mobile learning:

- Chinese language learning

- Entrepreneurship programme

- Post implementation questionnaires and interviews

guidelines

Cycle 3

RQ 3:*What leadership requirements would be adequate to implement helpful policy and practice to enable UYOD for mobile learning?*

Extrapolating findings to

broader institutional perspectives

- Institutional wide Staff survey

- Institutional wide Student
  questionnaire

- Mobile learning workshops +
  focus group, questionnaires

- Interviews with management and leadership

guidelines

3.5.2 Cycle 2: Investigating Institutional Capacity

After establishing that there was an appetite for UYOD in the OOI and identifying the obstacles in Cycle one, Cycle two examined UYOD in contexts of two case studies, with the aim of getting a better understanding of both the underlying processes and technologies that support learning and teaching while enabling the use of student owned devices. These are registration, collection of personal information for communication with the institution, as well as underlying tensions between the administrative and academic functions. Using the theory of diffusion of innovation as a foundation as proposed in section 5.2.1, the researcher in their role as a learning technologist representing the LTSC assumes the role of being a change agency in driving use of mobile technologies as the innovation. Change agents are described as professionals with expertise in the innovation who have influence in the target community but may not be members of that target audience (Rogers, 2003, p. 28). To overcome the obstacles that may arise from having a different perspective, the change agents work with aides who are homophilous with the target users, these are the gatekeepers through which the change agent can engage with the innovators and early adopters (Rogers, 2003, p. 156). These case studies were purposefully chosen to target lecturers with an established interest in exploring UYOD as part of their practice and who could be receptivity to the idea of mobile learning with student owned devices. These case studies gave the opportunity to productively enhance the learning by utilising forms of interaction (using messaging) that students were likely to be receptive to. In this deployment, the researcher could follow the process of designing, developing and deploying mobile learning solutions that incorporated UYOD and have easy access to the classroom, students, and the ability to monitor the activities in the experience and subsequently allow for generalisation to other contexts. The targeted lecturers were known to the LTSC from their previous interactions and interests. The choice of affordance to leverage for the case study was driven by the desire to use an affordance that would be common to all students regardless of their type of phone- sending and receiving messages. This was so that none were exempted from participating due to the technology. The other reason for this affordance is that the researcher was taking advantage of an existing platform that had not been integrated to test the institutional systems and processes to identify where there was a need for further action.

One of the studies (using messaging to support Chinese language learning) ran for five weeks while the other (Using messaging to support entrepreneurship education) ran for twelve weeks. The twelve-week study used student owned mobile devices as a support mechanism for the course, while the five-week study used it as a tool in the classroom. Both case studies required that students use their own devices in learning experiences that had been designed to incorporate UYOD. The case studies were conducted in collaboration with the lecturers responsible for the modules. The lecturers determined where they felt that the use of mobile devices would add value and a plan was agreed for which technologies would be deployed and the researcher worked in their role as learning technologist to complete the integration including resolving technical issues, identifying issues around managing data and providing support for entering content into the systems by demonstrating to the lecturers and ensuring there were alternatives when a system does not work. Once designed and developed, the implementation was done by the lecturers This extent of work done in the case studies allowed for the opportunity to get insights into what was impacted when UYOD is enabled in a learning context. Following the conclusion of the implementation, surveys and interviews were conducted to explore the infrastructural preparation, student experience and academic staff experience. The results gave insights, as well as researcher's own observations, were then used as a basis for the definition of the approach to be used on a wider institutional level in Cycle 3.

3.5.3 Cycle 3: Revisiting findings against broader Institutional Context

Having established the appetite for UYOD in Cycle 1, Cycle 2 explored two case studies to determine the impacts to institutional and procedural requirements for adopting UYOD to enable mobile learning. In Cycle 3 the goal is to assess the input from the wider audience of the OOI to extrapolate the findings and determine where leadership input is needed. Cycle 3 comprised several activities aimed at revisiting the findings from previous cycles by engaging with a wider audience from across the institution. It is this last phase that enables the results to be generalisable to the OOI and others like it.

1. The activity from previous cycles was used as the foundation for a workshop facilitated with two cohorts of lecturers who were then surveyed via open-ended questionnaires.

The surveys in this phase of cycle three were used as an organisational leadership tool to gather insights from both the student and staff attitudes and opinions on using mobile devices in their practice of learning and teaching. This approach is based on how organisations use such survey to solicit input from their staff so that areas requiring action can be identified (Borg and Mastrangelo, 2009). These surveys also serve to represent the views of the institution rather than a particular group within the OOI community thereby allowing for the logical generalisation of the conclusion to be applicable in other institutions with similar demographics and organisational environment (Section 1.2) and culture (Section2.3.3).

The following were the were sent to all the students and active academic staff in the institution.

2. An open-ended questionnaire was sent out to academic (teaching) staff across the institution to gauge their readiness to use individually owned mobile devices for teaching. Responses were received made up a random sample of the academic staff.

3. A questionnaire was sent out to all students in the institution to gauge their awareness of using their mobile devices within the institution; examine the current use and their readiness for future use. The period of availability for this survey was limited to 10 days due to the proliferation of surveys being conducted at this time. This resulted in a random sample of the students in the OOI which allows inferences to be made about students in similar higher education institutions.

The last phase of this cycle engaged specifically with the leadership of the institution. Interrogating staff whose roles can influence the goals and strategies of the organisation is instructive for ensuring that the guidelines to be proposed are feasible.

4. Interviews were held with the representatives of the management and executive leadership teams. The participants were chosen as key informants with leadership insights.

The three cycles of this research come together to form a single investigation into the implementation of a mobile learning enabled environment by incorporating UYOD in learning and teaching practices in the OOI to produce

the guidelines in the form of a conceptual artefact which has been iteratively revised through the cycles and contributes to the knowledge in the field.

3.6 Data Collection and Analytical Processes

In this section, the actual mechanics and instruments of the data collection and analytical processes are set out. Figure 3.3 below maps out the questions identified in Chapter Two as research objectives aimed at addressing the broader aim of the research of enabling UYOD as a mechanism for sustainable mobile learning in an organisation such as a higher education institution.

Figure 3.4: Mapping of research objects to data sources used to address them

	Research Objective	Data Sources
Cycle 1	To determine difficulties around UYOD in learning and teaching?	Literature Review, Interviews, Questionnaires, Pilot Mobile learning implementation
Cycle 2	To determine the how policy and practice can respond by investigating the capacity for using a "Use Your own device" (UYOD) model in learning and teaching contexts?	2 exploratory case studies of mobile learning implementation. Questionnaires, Observations, system usage data, public documentation records,
Cycle 3	To establish the the leadership requirements from an institutional perspective to enable UYOD in mobile learning practice?	Workshops + Feedback via questionnaires, Institution wide questionnaires to staff and students.

Each research cycle used multiple data sources as illustrated in Figure 3.4, the data collected from these sources includes both qualitative and quantitative data. Within each cycle, the data collected is converged rather than treated separately to get a more comprehensive understanding of the research objective being explored (Baxter and Jack, 2008). The results are then used to inform the guidelines yielding a different iteration at the end of each cycle. While the techniques used for analysing each piece of the data are explored in more detail in Chapter Four, some of the instruments used include semi-structured interviews, focus group, workshop and questionnaires.

Semi-structured personal interviews were used where a schedule of questions was designed to elicit responses from participants around particular issues. A focus group approach was used to observe participants discussing their use of mobile technologies after a common experience in an exploratory case study. In

the focus group, the researcher acted as the facilitator to ensure the conversation stayed on track. Lastly, a group workshop was used as a way to stimulate a group exploration of mobile technologies. Following the workshop, participants were invited to share further information and insights by completing an open-ended questionnaire based on the agenda of the workshop. To get input and extrapolate to a wider audience, institution-wide questionnaires were also used to collect data from the wider population. Other sources of data included public documentation and system log usage, and researchers own observations. In the following section, the validity and reliability or the research methods and instruments are considered and the extent to which the results can be generalised is outlined.

3.7 Validity and Generalizability

There are two aspects to be considered when establishing the validity of a research study - the first being internal validity, which determines whether the conclusions from a research work are supported by the methods used in the investigation. The second aspect is external validity where the goal is to establish whether the findings from the research are applicable to other settings - also referred to as "generalisability".

It has been stated that "there can be no validity without reliability (and thus no credibility without dependability), a demonstration of the former is sufficient to establish the latter" (Lincoln and Guba, 1985, p. 316). However, in considering the *understandings* that make up validity (descriptive, interpretive, theoretical, generalizable and evaluative), Joseph Maxwell puts forward the suggestion that validity is relative because it is dependent on the community on whose perspective an account is based, and any challenge to those accounts amounts to expanding the community concerned in the study (Maxwell, 1992). As has been outlined in Section 3.1, this research is a case study which is underpinned by constructionist views which posit that social constructs are produced as knowledge from engagement with the technology and the community in which it is used. The social constructs, or knowledge, are subject to the time and conditions that prevailed, at the point, the research was conducted. This means that as a researcher my interpretation of the data may be coloured by my perspective and interests, so I must adopt strategies to ensure the validity of the inferences drawn from the *understandings* of the accounts given in the course of

the research and data collected (Maxwell, 1992). One of these strategies is triangulation by engaging in multiple methods for sourcing data collection and analysis to eliminate bias, increase researcher truthfulness and lead to a convergence of themes and categories (Golafshani, 2003). This includes sharing interview transcripts with interviewees where possible to ensure it was an accurate reflection of their responses.

Other methodological strategies to establish validity as far of the findings were applied. Audio recording of interviews which allowed for checking the data to ensure accurate representation of participants' accounts, as well as allow cross referencing against other data sources such as questionnaires.

Figure 3.5: Inquiry Audit for validity checking

Research Phase (DBR Cycle)	Method used	Validity check
Cycle 1	Literature review Interviews, Questionnaires	Triangulating the sources Audio recording of interviews
Cycle 2	Interviews, Questionnaires, Researcher Observations, Secondary data (Institutional documents), communication, focus group, group interviews	Audio recording of interviews.
Cycle 3	Focus group, Questionnaires	Audio recording, comparison of sources.

Also, the maintenance of an audit trail for the research process and product of the research as shown in figure 3.5 and the inclusion of "rich and thick verbatim descriptions of participants' accounts to support findings"(Lincoln and Guba, 1985, p. 317). Other opportunities to confirm validity include regular debriefing sessions such as supervisory meetings and annual reviews.

This is a case study of a particular organisation and its characteristics and peculiarities, and the DBR cycles were responsive to the activities as they unfolded. It is acknowledged that the existence of local conditions can make it more difficult to generalize explicitly (Lincoln and Guba, 1985, p. 124). It is argued that "the aim of qualitative research should be to make logical generalisations to a class of phenomena rather than probabilistic generalisations to a population" (Popay et al., 1998, p. 348).

To make such logical generalisation in the case of the OOI as a higher education institution, the last cycle of the research involved the interrogation of the wider population of the OOI. The samples sizes in this phase enable logical generalisation to this population and having situated the OOI as a higher education institution by describing the function, structure (Section1.2) and having a shared culture with others similar to it (Section 2.5.2); and by giving richer and detailed accounts of the work carried out in the following chapters, other researchers will be to be able to replicate the study in their own organisations and adapt as required where needed to account for local conditions. .

3.8 Ethical Considerations

To identify any ethical issues as pertaining to the research proposed, the current research was viewed from the standpoint of the participants, and in the case of any potential "harm" psychological or otherwise, measures to counter this are highlighted (Kumar, 2010). In addition, it is highlighted that given the exploration of UYOD in this research, it is necessary to consider the ethical and legal challenges around mobile learning (Traxler and Bridges, 2004). To address these points, once the research had been approved by the supervisors, ethical approvals were obtained from both the University of Nottingham where I am a student and the "home institution" the OOI where the research was carried out. My role and responsibilities as the researcher are highlighted by identifying my relationship with the research, as well as the roles of the lecturers where there were groups or students and staff engaged.

3.8.1 Informed Consent

As part of the ethical approval process, application for ethical review including the proposal of the research planned had to be presented to the OOI's research ethics committee, as well as the University of Nottingham research ethics body. Using the guidelines provided by the institutions, the applications submitted address how to withdraw from participation, associated risks were identified; and the handling and use of data obtained were specified (Appendices 1a, 1b,1c). The documents ensure that participants understand the nature of the research, their involvement and the duration and outlined that:

1. Participants made an informed decision to take part in the study of their own free will. To achieve this, they were given a participant information sheet which outlined the study.

2. Participants were not exposed to any risks as a result of their involvement. The research outline also explained how data would be handled.

3.8.2 Privacy, confidentiality and anonymity

In these documents, the anonymity of participants was assured, and to this end, names have been removed from this thesis write up, and the home institution is also masked by referring to it as the "Organisation of Interest" (OOI). There was no tracking of individual mobile devices or gathering of data from these.

However, while endeavouring to maintain anonymity for the participants by obscuring their names and the institution, it is acknowledged that given the small community of education technology research in Ireland, the institution might be easily identifiable by insiders. This is especially the case for the lecturers involved in using mobile learning in their teaching practice. However, what obscuring their names and the institution does is make it more difficult to obtain their details and affiliations and explicitly identify them.

3.8.3 Voluntary Participation

Where interventions were embedded into the coursework of students, the researcher made it clear that their participation or non-participation in the research had no impact on their grades and they could withdraw at any time. Non-participating students could simply return blank sheets or none at all, and where discussions were taking place could either be excused or simply not contribute. For the questionnaires sent to the wider student and staff populations, there was absolutely no way of identifying participants beyond their departmental affiliation as recorded by them.

As indicated in section 3.10.1 in the implementations to test UYOD approaches to mobile learning in formal learning contexts, students were informed that they could withdraw from participation and alternative ways of completing the activities or sending out the information were available for such students.

3.8.4 Protection of Data

All the data collected in the current research had to be held on an encrypted drive. Any physical documents had to be kept securely held. All of this data will be destroyed upon submission of the thesis.

3.9 Conclusion

This chapter has put in place the foundation for the research to be done and explained the choices on instruments as well as the ethical considerations made. The research was described as a case study of a higher education institution within which a DBR approach was taken to iteratively address the research questions and build the guidelines for creating a mobile learning enabled environment.

The purpose of utilising a DBR approach to the case study was to explore the interaction and dynamics of the relationship between culture, policy around use of mobile technologies, the requirements of infrastructural architectures, and practice of the use of mobile technologies in learning and teaching contexts. The data collection methods and analytical processes used have been outlined with explanations of how validity was ensured. The generalisability of the research was specified to be achieved as the understanding of the requirements for a mobile learning environment in a higher education environment facilitated by the detailed account of the research as given over the next three chapters leading to the guidelines proposed.

4. Design Research Cycle One: The pilot Study, Identifying Perceptions and current obstacles around Use Your Own Device (UYOD).

Introduction

In the previous chapter, the research methodology underpinning this study was outlined and explained. In this chapter, the techniques and instruments used in Cycle one are described as they are applied through a narrative of the research.

4.1 Objectives of Cycle 1

This first cycle follows the literature review which explored the trajectory of ICT in higher education. The literature review outlined changes that have occurred with the emergence of ICT in higher education learning and teaching environment, identified factors that influence ICT adoption, the integration models often used and explored how mobile technologies have been integrated into the infrastructure and processes in higher education institutions so far, as well as what has been researched about mobile technologies in higher education. The literature review led to the proposition that to create a mobile learning aware environment within a higher education institution that takes advantage of student owned devices, there needs to be some strategic guidance. Cycle one was a pilot study aimed at addressing the following objectives:

- Determining current institutional appetite for mobile technologies and their use in learning and teaching in the OOI to establish what the current obstacles around the use of UYOD were.
- Determining where the obstacles in deploying UYOD for mobile learning were in by using the pilot as a lens to observe activities around the implementation of mobile technologies for learning.

Establishing the current appetite and unveiling obstacles around the use of mobile technologies in learning and teaching would also be useful to ascertain the scope of the proposed research to identify where the research should focus on.

The procedures and methods used to collect and analyse the data that address the aims outlined are explored in the following sections. These methods and procedures are inclusive of all stakeholders involved in an implementation of a

strategy that is intended to make a significant difference in the way in which people and systems work with and alongside each other (Sharples, 2002) to integrate the use of mobile technologies.

4.1.1. Methods for Data Collection

The *data-corpus* for the current research was collected using a variety of instruments across all cycles of the study illustrated in figure 4.1.

Figure 4.1: Data Corpus and instruments used

Start of Study - Literature Review identified the Gap : Guidance to enabling sustainable mobile learning using UYOD in Higher education institutions.

Cycle 1

RQ 1: What are the difficulties around UYOD in learning and teaching?

Exploration of sensitivities around the use of mobile technologies.
- Interviews with Academic and Non-academic staff
- Student Questionnaires
- Case study of implementing mobile technologies within learning context

Cycle 2

RQ 2: *How can policy and practice in an institutional context for UYOD respond to these obstacles?*

Evaluating Institutional capacity for use of mobile technologies via 2instances of mobile learning:
- Chinese language learning
- Entrepreneurship programme
- Post implementation questionnaires and interviews

Cycle 3

RQ 3: *What leadership requirements would be adequate to implement helpful policy and practice to enable UYOD for mobile learning?*
Extrapolating findings to broader institutional perspectives
- Staff survey
- Student questionnaire
- Mobile learning workshops + focus group, questionnaires
- Interviews with management and leadership-

Interview

Interviews were used through the study to gather data from certain stakeholders to get their perspective and experience of mobile technologies within the organisation. Interviews allow participants to discuss their point of view, and allow for deeper exploration of complex issues but can be subject to interviewer bias and interviewee fatigue (Cohen et al., 2007). To counter such bias and fatigue, using a schedule of questions as a guide to underpin the interviews, interviewees were allowed to choose a time that suited their schedules. In designing the interview schedule, open ended questions were used in order to elicit more than a yes/no answer, and initial questions were designed to make participants feel at ease and build rapport. To clarify and validate the interview schedule, it was piloted with non-participants prior to commencing the actual data collection. All interviews were tape-recorded and later transcribed.

There are two broad types of interviews: standardised interviews which include interviewer administered questionnaires and non-standardised interviews which

include two categories of which are one-to-one and one-to-many (Hofisi et al., 2014). Within these two categories there are a number of types of interviews such as those used in this study:

- **Semi-structured one to one interview**

  As a method for data collection, the semi-structured interview allowed for the use of a list of indicative questions and allowed for being responsive to the answers being given by the interviewee.

- **Group interview**

  The group interview is used to get the benefits of the interview when there is limited time to interview all the participants engaged in an experience. It can also be used to elicit information from participants who may not be as forthcoming on their own.

  (Cohen et al., 2007, p. 373). In the group interview, the data emerges from the interaction of the researcher as the interrogator of the group.

- **Focus group**

  The focus group is a 'one to many' interview type and is similar to the group interview in the sense that it is an engagement between the researcher and a group of participants. It is an interview on a specific topic with a small group of people with similar backgrounds (Patton, 2002, p. 385) who also have similar experience and expertise in relation to the topic of interest using mobile technologies for learning and teaching in higher education. The focus group allowed a group of participants with interest in the area to clarify, extend and challenge the data derived through other methods. The use of focus groups in this manner is referred to as *member validation* (Bloor et al., 2000, p. 14).

  However, unlike the group interview in the focus group interview, the researcher facilitates a conversation between the participants who discuss the topic of interest in order to negotiate a position. The data thus emerges from the interaction of the members of the group with each other (Cohen et al., 2007, p. 376) with the researcher being a facilitator.

In both focus and group interviews, participants were able to stimulate each other, thereby highlighting shared views, as well as varying opinions while being guided by the researcher.

As well as interviews, other instruments used were:

Open ended and Closed Questionnaires for surveys

The use of open-ended questionnaires allowed participants to voluntarily give more input than would be allowed in a closed questionnaire. Other questionnaires included a mix of both closed and open-ended questions including Likert scales.

Case Studies

Exploratory case studies to investigate the use of mobile technologies in learning and teaching contexts within the existing infrastructure.

Observation

Other sources of data were publicly published institutional documents, communications pertaining to the support of technical systems such as emails and non-personal information from systems, such as usage logs. Where emails are included in this thesis, the sender information is redacted in order to protect privacy.

4.1.1.1. Methods for Data Analysis

The data analysis methods are used to enable an understanding of the relevant issues associated with the implementation of mobile learning-enabling technologies and processes from the data collected. The starting parameters to be examined were identified by breaking down the definition of mobile learning proposed in section 1.6 which comprises of all the factors to be examined: Mobile learning is the use of individually owned interactive devices along with enabling technology infrastructure to access resources for learning and participate in learning activities independently and within formal and informal learning contexts irrespective of location**.**

This definition comprises of 4 different facets of the use of mobile technologies for learning which are investigated in this study. These are:

- **Mobility of Learners:** Learners are mobile as they are not bound to location or even learning contexts.
- **Personal Technologies:** Mobile devices are individually owned (such as smartphones, tablets, media players, watches, glasses) - the use of

these within formal learning and working environments rather than officially issued ones has now been tagged with the label of "Use Your Own Device" (UYOD).

- **Infrastructure:** The underlying institutional digital infrastructure and processes that enable the use of the mobile devices in public communities.

- **Accessing learning resources and/or participating in learning activities:** refers to how the devices and infrastructure enable learning and teaching processes and the activities that support them.

Bearing this breakdown of the definition in mind, the data collection was done to reflect the areas where personal technology (mobile devices), along with public infrastructure and processes were used to facilitate gaining the access of learning resources and participation in learning activities within the context of the higher education institution and irrespective of location of the learner.

In all instances where interviews were used, a similar approach was taken to start the analysis of the interview dataset being worked on. First, the interviews were manually transcribed word for word. In this transcription process, the identity of interviewees was anonymised by replacing their names with letters which identified them to the researcher for example "CSJ" or "SSAM." The letters were chosen to be personally meaningful and identifiable to the researcher using the school where the research was done and the name of the interviewee and entered in the researcher's own journal along with other clarifying notes that added context to the data.

The data set resulting from the transcription was entered into Microsoft Excel for subsequent analysis. Open-ended questionnaires followed the same process with the handwritten responses entered into the excel sheet (Figure 4.2).

Figure 4.2: Example of coding framework

ID	1. Read through interview transcripts and extract insights (example statements)	2. Use descriptive coding to label data/responses (descritive code)	3. Sort Codes into themes
CHS	Wi-Fi is absolutely terrible and on the day of the class of class I was trying to connect but it just wouldn't just could load or anything	wifi connectivity issues	infrastructure
CHS	it will be easier if I have a modern phone. Like with a touch phone you can really see the question you know the way like see example like an iPhone message, like a conversation, but mine is not like that	not having a modern device,	equity
HHS	I check my twitter account to read about stuff…I suppose for checking information and when I am on the train.	twitter, checking information	current usage
HHS	When I get a document from the university, it is usually 20 (exaggeration) pages long, and I don't read it. I was looking at the texts because they were only about 140 characters. I think the brevity of the medium forces the bureacratic system to seem more friendly	brevity forces bureacratic system to be more userfriendly	benefit

The thematic analysis of the interview and questionnaire data provided a flexible and useful way to analyse data by identifying and recording themes in the data (Braun and Clarke, 2006, p. 6). It was a process in which the steps were not always linear. The analysis was a six-step process of constant moving back and forward between the entire data set, the coded extracts of data being analysed, and the analysis of the data being produced (Braun and Clarke, 2006, p. 15). The first step was to get familiar with the data by repeated reading and transcription of audio. The initial code was then generated by going over the data set and labelling sections or responses in the dataset with descriptive words or phrases. The third step was searching for themes identified at a semantic level, that is, the surface meaning of the coded data or what the respondent said. For step four, similar or related codes were then grouped together to form themes, following which the themes were reviewed against the initial data to ensure they reflected what was expressed. The final step was the production of the report of the analysis.

The next section and following chapters give a detailed and thorough account of how the instruments for data collection and analysis that have been outlined in 4.1.1 were executed.

4.2 Cycle one activities

4.2.1 Sampling

The insights gleaned from the literature review carried out at the start of the current research led to a selection of possible stakeholders from across the institution who would be involved in incorporating UYOD and furthermore, triggered questions for the initial interviews. This selection includes students, academic staff and non-academic staff across the OOI. The literature review also identified a starting point for the research as eliciting information from relevant stakeholders across the OOI. The stakeholders who accepted the invitation are interviewed to start the generation of data which is then analysed. Insights from these interviews will be explored further and analysed to lead to other participant selection suggestions for subsequent cycles.

4.2.2 The design and implementation of a learning object for mobile learning

The purpose of this phase of the research cycle is to identify the environmental factors such as the processes around registration of users, user management, data sharing and the infrastructure that are affected when facilitating student-owned devices for mobile learning. For the development of the learning object being reported in this cycle, funding was acquired for a mobile learning project in 2011. The project presented an opportunity to use a mobile learning design and implementation requested by a lecturer as a pilot exercise and then get a rich account of the experience. The aim of the pilot exercise was to tease out the procedures and processes that would be involved in the implementation of a mobile learning artefact that required the students to use their own devices. The project was a collaborative effort between the OOI and another higher education institution and was funded by the National Digital Learning Repository (NDLR) and led by the OOI's Learning and Technology Support Centre (LTSC).

4.2.2.1. Recruitment of academic staff participant

The project was to be a fixed term task so it was determined that the participants to be invited should have a recent track record in the exploration of enhancing their teaching practice which they could improve on by using mobile technologies. This was to make a compelling case for continuity in order to access the funding to support the project. Three members of the academic staff

in the OOI who had recently completed projects with LTSC for a teaching award which recognised the use of innovative teaching approaches were identified by the head of the LTSC and invited to participate in the NDLR study. Only one of these three lecturers (Dr Z) invited had the flexibility to participate in the study during the time period of the study. Under a teaching fellowship award, Dr Z had previously created a series of videos for teaching students on geospatial disciplines how to use equipment such as theodolites. A theodolite is a measuring instrument used in land-surveying. The videos on how to use theodolites and other equipment had been created and made available online via YouTube. However, despite these videos being available on YouTube, the lecturer had expressed a concern about their discoverability and use in context such as while out on field trips when students needed to know how to use the tools. Some students had downloaded the videos to their phone but did not often use them because they were not sure about what video was applicable at the point of use. As well as the input gathered from Dr. Z's experience, data was also gathered from staff and student who are interrogated in this cycle.

4.2.2.2. Opportunity to be addressed: Challenge on Fieldtrip

Field trips were a part of the curriculum where students had to learn how to use the tools in the context of a real life geospatial study and engage in discussions with their classmates and Dr Z. However, supporting an increasingly large group of learners spread over a wide area who were learning to use tools of the trade was getting increasingly difficult. It was also prevented having deeper and meaningful learning discussions around the theoretical aspects and foundations on which the field trip exercises were based. Instead, a majority of the time was spent on repeatedly demonstrating the use of the tool. This was further compounded by the limited availability of teaching assistants.

UYOD provided the opportunity to provide the proposed solution to make it easy for students to access the video relevant to the equipment they had identified for use. The conditions for the funding stipulated that the solution had to be reusable, easy to share, thereby contributing to instigating a culture of sustained deployment of a mobile learning initiative.

4.2.2.3. Design and Implementation of the solution

As the videos were already online and available, the problem being addressed was ensuring discoverability – that students were able to access the right video

for the particular tool they needed to use without depending on the lecturer or a TA. They needed an efficient way to access the how-to videos. The solution proposed by the researcher in their role as learning technologist was to develop an efficient presentation mechanism that incorporated the use of student-owned mobile devices within a framework customised for the content illustrated in figure 4.3.

Figure 4.3: Overview of solution (NDLR, 2011)
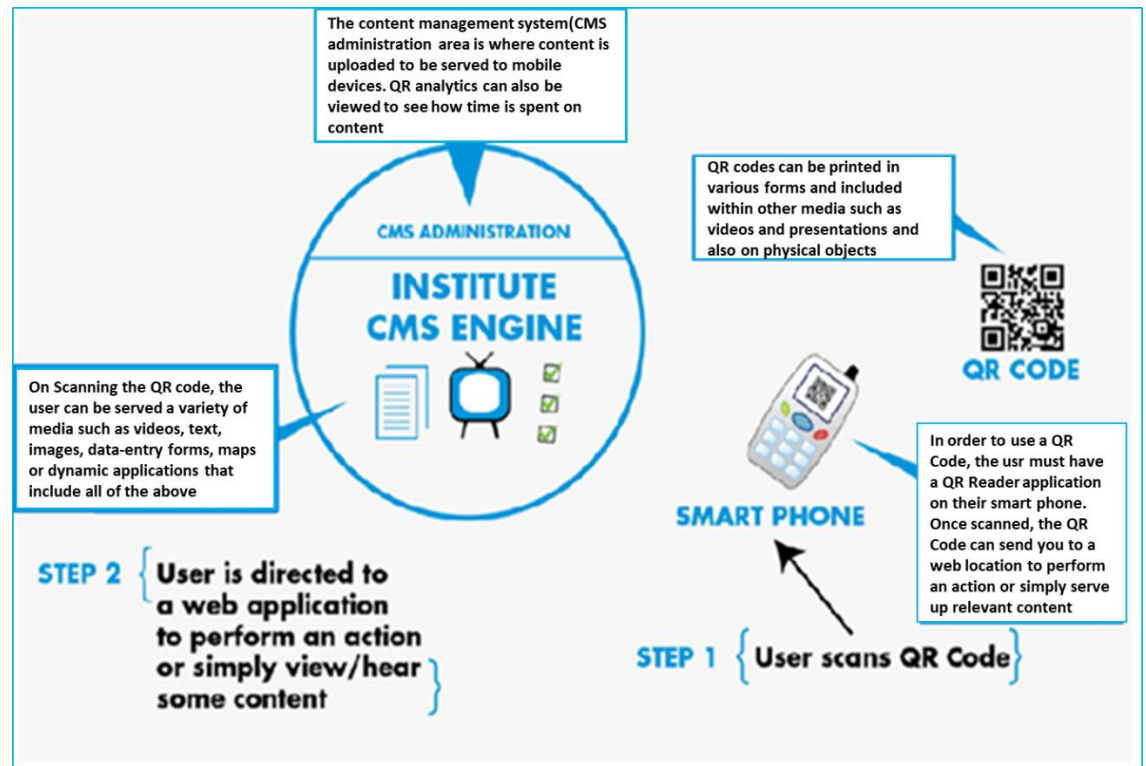
This framework consisted of:

1. A content management system platform adapted for the project. The videos were embedded within the framework that allowed for cataloguing and embedding.

2. QR-codes were generated which linked to the videos. These were printed and fixed to the equipment as circled in Figure 4.4.

Figure 4.4: Theodolite with QR-code

4. The field work activity involved students identifying the right equipment to use, and then complete the tasks required using the equipment they had identified. However, as was outlined in section 4.2.2.2, after working out what equipment was required; students often needed instructions on how to use the equipment. By using their mobile phones to scan the QR code fixed on the equipment to access the demonstration instruction video such as that shown in figure 4.5, students were less reliant on the lecturer.

Figure 4.5: Video Menus as seen on student's phone
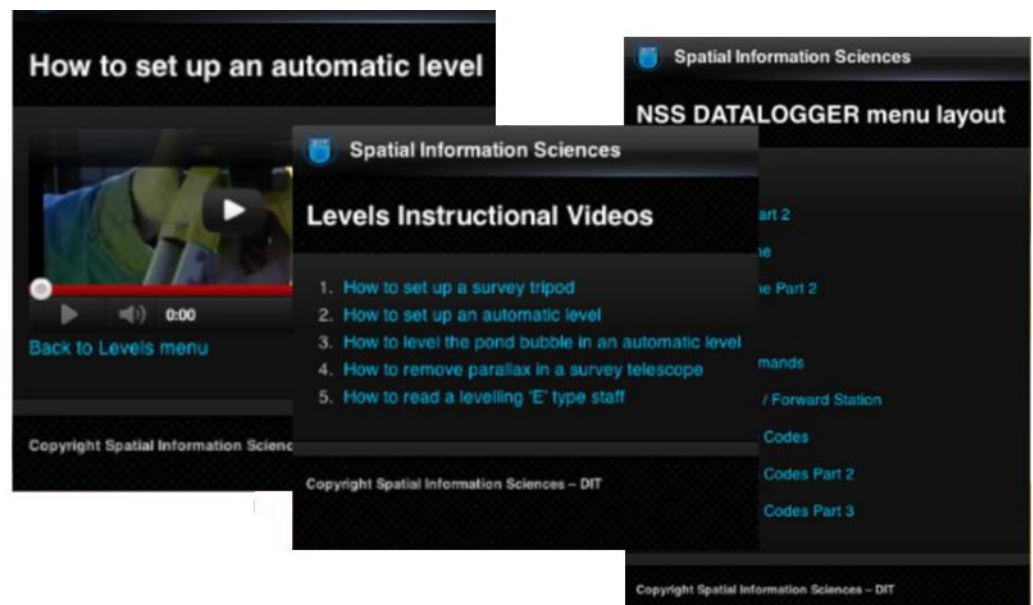
The solution took advantage of the following affordances:

- Portability as students could easily access their phones while out on the fieldtrip;
- Native app: code reader app
- Phone camera which is used by the code reader app to view the QR code; and Access online resources: to view the video relevant to the particular equipment.

While not representing the full range of affordances as illustrated in Section 2.3.3, this use case provided the stimulus to derive the data needed to address the goal of this cycle- establishing the appetite for UYOD and unveiling what obstacles surround this.

Initially, it was intended to embed the framework within the institution's virtual learning environment (VLE). While this approach allowed for easier usage tracking, it also introduced unnecessary interruptions in the user experiences such as having to login to the VLE and navigating through it to find the videos rather than using a direct link. Given the constraints of the project in time and funding and the lack of a ready space to deploy the framework from the most feasible approach to hosting the framework was to have it on servers owned by the second partner in the project rather than the OOI. The second partner had servers publicly available which could be configured for this purpose. However, hosting the framework outside of the OOI in this way did not meet the requirements for access control of institutional systems and information (figure 4.6). The design could not use any mechanisms that would require any Personally Identifiable Information (PII) that would have information security or data privacy implications such as student names, or their credentials. It was developed as an open system in the context of investigating and identifying the environmental factors around mobile learning. This highlights the considerations that must be in place in order to handle information around user management, registration or interoperability with the existing infrastructure.

Figure 4.6: OOI Information Security policy

5 Access Control

The organisation's systems shall be managed by suitably trained and qualified staff to oversee their day to day running and to preserve security and integrity in collaboration with individual system owners. All systems management staff shall be given relevant training in information security issues.

Access controls shall be maintained at appropriate levels for all systems by ongoing proactive management and any changes of access permissions must be authorised by the manager of the system or application. A record of access permissions granted must be maintained.

Access to all information services shall use a secure log on process and access to the organisation's business systems shall also be limited by time of day or by the location of the initiating terminal or both. Where systems store data classified as "Confidential" or "Strictly Confidential", additional steps must be taken to prevent unauthorised access. These may include encrypting the data, ensuring appropriate separation of duties, logging all attempts to read or access sensitive data, and reviewing log reports to monitor access to this data. Please refer to the acceptable usage policy for staff and students for further details and account eligibility. All access to information services is to be logged and monitored to identify potential misuse of systems or information.

Inactive connections to the organisation's business systems shall shut down after a defined period of inactivity to prevent access by unauthorised persons.

4.2.2.4. Lecturer's view of Student Participation

This process of deploying a mobile technology-enabled approach to addressing the discoverability of online videos while on a fieldwork learning exercise was intended to ascertain if students in the OOI would use their devices for mobile learning and determine the current levels of institutional readiness while observing the activities around an implementation. With this in mind, the lecturer was interviewed after the field trip to get insights into the experience of having students use their mobile devices as a support in such a learning context. The interview was semi-structured with a set of seven pre-prepared questions which allowed the following up on interviewee's responses to identify areas for further investigation:

Q1: Are you familiar with the concept of mobile learning?

Q2: Please describe the project you have just concluded.

The first two questions sought to establish that Dr Z could explain what mobile learning meant to them. After confirming an understanding of the concept of mobile learning in Q1, Dr Z was asked to describe the project as in doing so, it would give the lecturer the opportunity to contextualise mobile learning in their own situation as is done in the description given as:

"enabling access to online materials via student's own mobile phones while immersed in practical situations such as out on fieldwork".

The next questions were intended to probe their observations of the experience while out with the students and to identify the challenges they encountered:

Q3: Please describe your observations of the student's reaction to this application of mobile learning.

Q4: Were there challenges you would like to highlight?

According to Dr. Z, students tended to work in groups while out on field trips so they shared devices and this ensured that the few without mobile devices were not excluded from the exercise. It was also pointed out that from a previous survey of about 300 students in the department, conducted prior to putting the videos up on YouTube, most of the students had phones that were less than two years old- mainly androids and were capable of accessing the internet. Students were expectant of using mobile learning as a resource, and so were receptive to it (Martin, 2011).

When asked if any challenges were encountered, Dr. Z highlighted that there were concerns around accessing the internet beyond the wireless network provided by the institution. There are three main Mobile Network Operators in Ireland and unlimited data plans tended to be expensive for students depending on the network. The quality of the data connection was variable with the cheaper networks which tended to be more popular with students being of lower quality and less reliable as has been confirmed in an independent report (Parker, 2016). Dr Z pointed out that if the challenges around data and internet access could be addressed, the use of mobile phones in learning would increase.

4.2.2.5. Effects on teaching

The next question was aimed at finding out if there had been any negative or positive impacts from using the mobile devices as has been done:

Q5: What effects did using the mobile technologies in this way have on your teaching practice?

Dr. Z had not used mobile technologies to support learning in the classroom, as they felt that they had less confidence about whether students were looking at learning material or otherwise distracted talking to their friends. They felt that using the technology in the classroom called for purposefully designed interactive exercises, stating:

> *"I haven't used interactive mobile exercises in the classroom,*
> *so that is something that I'd like to explore"-Dr Z*

Dr. Z reported observing effects on the teaching beyond the obvious one of the students being able to find out how to use the equipment from the videos. They were also able to engage in discussions that delved deeper than the surface of how to use the tool. Dr. Z identified that from this experience, they felt that this type of application is most beneficial when aimed at addressing the fundamentals of the topic being learned such as how to use a tool. From a teaching perspective, not having to repeatedly show students how to use the equipment, freed up time while out on the field trip. The time saved from reducing repetition led to opportunities for deeper discussions about the theoretical aspects around the field trip, as well as discussions of the results coming out of the use of equipment or even choices of equipment used. There was also less use of walkie-talkies while out on the field as by using their own mobile phones to communicate by sending text messages, the students experienced fewer issues with interference on open channels used by walkie-talkies. At this time, Dr. Z envisaged that for the time following this project, fieldwork presented the largest opportunity in their discipline to take advantage of student ownership of mobile devices.

4.2.2.6. Future Direction for use of the mobile solution

The last two questions sought to understand what may impede further work incorporating the use of mobile technologies in learning and teaching contexts:

Q6: What are your observations around the support available for lecturers interested in exploring the use of mobile technologies?

Q7: What are your thoughts on doing further work with mobile technologies?

Having experimented with using mobile technologies for this project, Dr Z felt that time is always an issue when producing materials or content such as videos which can date or require updating, especially if there is no further funding as funding was usually used to cover the cost of such development work. Furthermore, while having an interest was motivation to try to do this regardless of funding, the equipment in some disciplines goes out of date so quickly that there are questions about the efficiency of the DIY approach when it takes a long time, as would be the case if the videos were not ready at the start of the pilot. This also raised the issue of technology support for the lecturer and guidance in the design and implementation of mobile learning initiatives. Without further support and funding, it would not be possible to continue the project beyond the pilot phase. Creating the videos required cross-departmental support that was funded by a teaching fellowship (Martin, 2011). In order to extend the work done, a significant marketing exercise would be required and partnering with the LTSC which is a more central and visible department in the institution contributes to this. The visibility of the QR-code on the equipment was a visible flag that alerted others to the project, leading to interest in exploring the expansion to other disciplines. This process of increasing the body of active users of mobile technology for learning is reflective of the process by which an innovation is diffused by communication through certain channels over time among members of a social system (Rogers, 2003, p. 10)

From Dr. Z's perspective, there was adequate support for what was done in this project in terms of the pedagogical support as well as the media and IT support, as long as they were willing to drive it and maintain ownership of the project. However, there is also a reliance on the goodwill of the support staff, as this is not a core institutional project and the time demands of the development of media as used in this project.

The scope of this project was not sufficient to yield data for determining institutional readiness, due to the open approach to user management adopted in the development of the solution. The solution did not require students to go through registration as discussed in section 4.2.2.3 and did not meet the

requirements for holding personal data as outlined in figure 4.6. This highlights that innovation, such as the use of mobile technology, needs time and wider adoption to become sustainable and justifiable.

These factors outlined so far identify the need for a strong owner or *innovator* to drive the project and influence support. In order to further investigate the issues that prevent wider adoption, the second part of this research cycle in the following section explores the perspective of other staff including both academic and non-academic on the use of mobile technologies for learning and teaching.

4.2.3 Staff Perspective on use of Mobile technologies for learning and teaching.

The previous section which reported the first part of Cycle one, identified the areas that presented a challenge to further use in the process of enabling the use of students owned mobile devices as experienced by a lecturer engaged in using these in their practice. Examples of these are: there should be a project owner or innovator to drive a mobile learning initiative, a clearly defined area for application, time for development of resources, provision of internet access either via cellular data or WIFI, adequate technical support and accountability mechanisms to ensure project deliverables.   These expressed concerns are reflective of a recognition that innovation requires nurturing which can be difficult when faced with innovating while still accomplishing goals and maximising resources to do so. In the next phase of Cycle one, a wider group of stakeholders in the OOI are queried to get a fuller understanding of what the obstacles and perceptions of mobile technologies for learning are.

4.2.3.1. Recruitment of staff Participants and Data Collection

To get staff perspective on the use of mobile technologies within the organisation, stakeholders from various departments were invited to be interviewed. These stakeholders included both administrative staff such as those from IT, library services, registration services, learning development offices, institutional management, and academic staff. The participants were contacted either through a manager or directly by email and a phone call. Suitable time for interviewing was scheduled by telephone with the staff who responded. Responses were received from all staff contacted but registration and library services did not participate as they had been unable to identify an interviewee, five members of staff were interviewed. Interviews were recorded with consent

from the interviewee as required by the ethical considerations described in section 3.10. As directed by the local ethical guidelines, interview recordings were held on an encrypted drive. In all, five interviews were conducted at this stage. This was a formative step to get to the next cycle so having a small sample size in this section of the data gathering is not a risk to validity or reliability of the overall research for the following reasons:

- The data is intended to make meaning rather than derive generalised hypothesis
- It was more important at this point to capture the viewpoint representing the groups from which the staff came and follows the concept of saturation which holds that further collection of data in this context would not shed more light on the issue being investigated.(Mason, 2010)

Semi-structured interviews were used as this allowed for some level of control over the interview and at the same time, give enough opportunity for staff to offer their perspectives and views and allowing for clarifying questions to be asked. The initial schedule of questions used to guide the conversation with these staff was based on the areas which had been highlighted in the implementation described in 4.2.2 and after the analysis of the feedback from Dr Z. The Questions here are meant to highlight what staff see as mobile learning, and their attitudes towards mobile learning, any perceived barriers as well as their expectations.

First three questions established their familiarity with mobile learning in general and whether they had used it in their practice and if they had, the extent of their experience with using mobile devices and establish how the initiative had been implemented to identify whether they were the primary instigator or it had been applied in a particular discipline or defined area of application:

Q1. Have you read the primer and do you understand what mobile learning is?

The next two questions were intended to probe

Q2. Have you encountered any sort of mobile learning use in your practice (teaching/support)?

Q3. If yes, what were they and describe what worked and what didn't? -If no, why not?

If they had not used any sort of mobile learning, then they were asked how to consider how it might be useful to encourage thinking about possibilities rather than blockers at this point:

Q4. How do you envisage mobile learning might be useful? *(Ignoring current constraints)*

Having imagined how mobile learning might be useful, the next questions explored obstacles that may be encountered. The previous exploration with Dr Z had highlighted issues such as time for development, provision for internet access, and accountability mechanisms. By asking about the obstacles they thought they might encounter, there was an opportunity to observe if similar issues were raised and if they were adequate to support the needs identified when they thought about using mobile devices from the student perspective and in how it may impact teaching, and what would concern them about using student own devices as part of a learning experience.

Q5. What difficulties do you envisage with using mobile technologies in learning and teaching?

Q6. How do you think students use mobile devices (phones, iPods, iPads, etc) for learning outside of school work?

Q7. How do you support your own learning using mobile devices and technologies?

Q8. What would concern you about using student's own mobile devices for school related work?

Q9. Do you think using mobile technologies impacts on teaching? If yes, how?

The five interviews formed a data set which was then put through a thematic analysis from which resulting themes emerged. The figure below is an example of the coding framework in this regard.

Figure 4.7: Example of the coding framework showing response, descriptive code and theme arising.

Interviewee ID	Interviewee's comment/response	descriptive Code	Theme
CSJ	It would mean a lot of extrawork...	Worried about extra work	workload
CSJ	I see students googling in class, accessing webcourses, and asking questions about what they find.	Sees students using in class to access, find info to generate questions about their discoveries. Getting engaged	driver
CSJ	concerned about use for cheating, communicating during tests	worried about cheating being made easier	Policy
CSJ	I like that it is new media and is engaging. I see an opportunity to engage the students in their work as well as the technology because they are alll about their technology	sees mobile tech as new and engaging...an opportunity to engage students	driver
CSJ	a huge issue is that there is no WIFI. The WIFI is boosted at certain spots at certain times	identifies issue with connectivity	infrastructure
CSJ	Another issue might be privacy. Need to be able to turn off, and not be accessible	identifies privacy protection as issue, the need to be able to switch off	privacy

4.3.2.2. Analysis of Cycle 1 Interview Data

As described in section 4.1.1.1, the raw interview data – recorded interviewee responses were first manually transcribed word for word giving a verbatim account for all verbal utterances made in response to the questions in the schedule. This transcribed data was then entered into Microsoft Excel as shown in Figure 4.7.

Once in Excel, the interviewee comments and responses were labelled with a descriptive phrase as code such as "worried about extra work", "worried about cheating being made easier" or "identifies issues with connectivity". The codes are used to capture what is interesting about the response regarding the use of mobile technologies in learning and teaching.

When all the data from interviews had been labelled with the descriptive codes, the codes were in turn labelled in order to sort them into themes. For example, "being worried about cheating" was labelled with "policy"; "issue with connectivity" was themed as "infrastructure".

The themes allowed the codes to be grouped and a narrative to emerge about the view of interviewees. The themes also defined categories for the responses and identified the areas of concern to the staff interviewed. The emergent themes were reviewed to ensure that the codes in them accurately mapped to the themes they fell under, and also if some themes could be merged.

The next sections outline each of the themes that emerged from this analysis.

4.2.3.3. Current use of mobile in general and for supporting learning and teaching

All the staff interviewed were aware of the increased use of mobile technologies and mobile activity – especially the use student owned devices. Both academic and administrative were aware of students being heavy mobile users. While agreeing that there was enough activity in the space to warrant some investigation into the use of these technologies in learning and teaching, there was a lack of clarity as to how to proceed and where the direction should come from. The staff interviewed all used smartphones to varying levels to support their teaching and administrative work in an informal capacity. Mostly, they made calls and sent text messages, no different from when using an ordinary feature phone. In terms of their own personal development or learning, only a few used the phone to access online content and social media, and none of them had mobile tablets which they use in any way connected to their teaching or professional practice. Some used social networking such as Facebook but did not use this as part of their professional practice.

4.2.3.4. Privacy

For staff, the main concerns around using personally owned phones were around privacy and being able to define expectations around how available they (staff) were to be. It was felt that using mobile technologies- particularly mobile phone would blur the boundaries between their personal and professional lives and cause the expectation of constant accessibility.

> *"....privacy. Need to be able to turn off, and not be accessible" (Pilot interview, CSJ).*

> *"I don't really want all my students knowing my phone number...." (Pilot interview, SSAM)*

Staff members suggested that they might be more comfortable with using tablets either personal or provided by the institution rather than their personal mobile phones.

4.2.3.5 Knowledge and Expertise

In the year prior to this study, the institution had purchased a system through which staff could send bulk mobile messages to students. The system was set up such that staff did not use their phone numbers, however, despite the fact that the system had been demonstrated to interested staff, there was a lack of understanding that the use of mobile technologies did not automatically require sharing of phone numbers.

The interviewees also identified a lack of skills in designing learning to take advantage of the affordances of the mobile device, as part of the reluctance to do more and at a more basic level time.

> *"Didn't think it (mobile learning) was important to the work*
> *that I was doing at that time, and couldn't see it as applicable,*
> *as a novice, I like to see how other people have implemented*
> *this." (Pilot interview, CSJ)*

4.2.3.6. Impact on Existing Workload

As with starting to use any technology, the first time, lecturers felt that it would mean a lot of extra work and have a significant impact on their workloads which were already heavy.

The extra work referred to here includes a range of activities that accompany the integration of technology that is not widely available. This includes getting support from and working with the IT department to set up the technology and required support for the initiative. This usually happens alongside learning how to use the technology and getting comfortable enough to be able to support students in using it and pre-empt any issues that may come up while using it with a class of students. Ideally, all of these activities need to happen before students resume in September, this can mean a lot of work within a small window of opportunity. This work is dependent on the prioritisation of the IT departments and any other departments involved. Typically, organizational changes involving the integration of new technology are proposed by a department that manages the pertinent function. Then with support from senior

leadership and local champions, it is rolled out to the rest of the organisation. Such changes should be clearly linked to a business need. In the case of the OOI, the business need was linked to the strategic goals identified in the roadmap.

4.2.3.7. Lack of Time for development.

While considering the possible impact on their workloads, perceived lack of time was also considered as a concern in developing materials for use in mobile learning or mobile learning strategies and investigating the supports available. This challenge tended to make staff stick to what they know would work. However, they were open to using their mobile devices to address the administrative workload:

> *"As I do both lecturing and admin, my workload is diverse and heavy. Using my smartphone means I can use normal idle time such as on the train to reply emails, send texts instead of waiting till I get to my desk." (Pilot interview, LTBF).*

4.2.3.8 Drivers

All of the staff interviewed recognised that there were already several instances of activity in terms of use of mobile technologies, in particular from the student perspective. Students were using their devices in class to check for information online, download notes, watch videos, check email and communicate with each other. They however, were unsure as to whether students would be willing to use their devices for learning in ways that were directly relevant to classwork and if there would be enough guidance and support for both the lecturers and students to do so.

4.2.3.9. Infrastructure and Policy

Infrastructure and policy themes were merged following a review of the themes as they tended to be interrelated in the data and both determined by the institution's management directives. Technical issues were cited such as irregular connectivity across the institution, even within buildings, and compatibility of devices with existing systems and platforms. Along the technical tangent, technical ability on the part of the staff was again highlighted, expressed as a lack of knowledge about what was required for mobile learning and a need for guidance on existing provisions and opportunities for mobile learning. The need for policy or guidance to define terms around the use of

mobile devices was also highlighted as lecturers were not sure about the institution's position on using student-owned devices and allowing them within the learning context. As of the time of this research, the IT policy (Appendix 10) defined access to wired and non-wired network access, and university systems and portals but did not have any directives on individually owned devices. The IT policy specifies measures around institution-owned equipment but is vague on individually owned devices. Some of the responses highlight the need for a disciplinary aspect to the policies:

> *I have concerns about students using their phones for cheating and communicating during tests"- CS1*

> *"I do envisage problems if they are texting, with regards to manners...ringtones going off, if it became an issue I would not allow it." CS2*

Other staff concerns around the policy pertained to the infrastructure and administration around user information:

> *"We haven't had a policy, for instance, our blackboard system is not yet fully compatible with mobiles."*
> *- LBTF*

It was pointed out that in 2011, the biggest attended workshops conducted by the LTSC team was on using text messaging with students. In terms of attendance, a hundred people came through the sessions but the uptake has been incredibly low. When prompted about the reason for this, it was identified that the system needed to be populated with students' phone numbers however, there had been a challenge trying to persuade the registration department to get mobile phone numbers as part of the registrations process. As was mentioned in section 4.2.3.1, the registration department did not participate in this study as they had been unable to identify an interviewee, so the reasons for this challenge were not identified. In order to use the texting system, lecturers have to collect phone numbers individually, and there was nothing in the policies that indicated students had to share their personal telephone numbers as part of their learning in class.

Following the themes arising from the interviews with staff and areas of possible challenges identified from the design and implementation of the mobile learning

initiative in section 4.2.2, there is an evident appetite for the use of mobile technologies in teaching from a staff perspective. There is a willingness among staff to explore mobile learning as long as the issues that have been identified are addressed, thereby creating an enabling environment. The following section investigated this from the student viewpoint.

4.2.4 Student use of mobile devices in learning.

The IT department monitor network activity on the institution's network infrastructure in order to detect, address and report on issues as well as plan for capacity accommodation and change. To do this, a number of network monitoring tools are used. To get a perspective from the student view and also to gauge the readiness of students, a snapshot of network usage was taken using networking monitoring tools and an open-ended questionnaire was distributed to two student groups through their lecturers.

To confirm that the behaviour of the local population of students in the institution reflected what has been reported observed by staff, traffic connected to the network was monitored over the busiest and quietest weeks on campus and the average of this exercise is shown in figure 4.8. It shows an overview of the distribution of the types of devices connected to the network.

Figure 4.8: Snapshot of view from network monitoring system dashboard
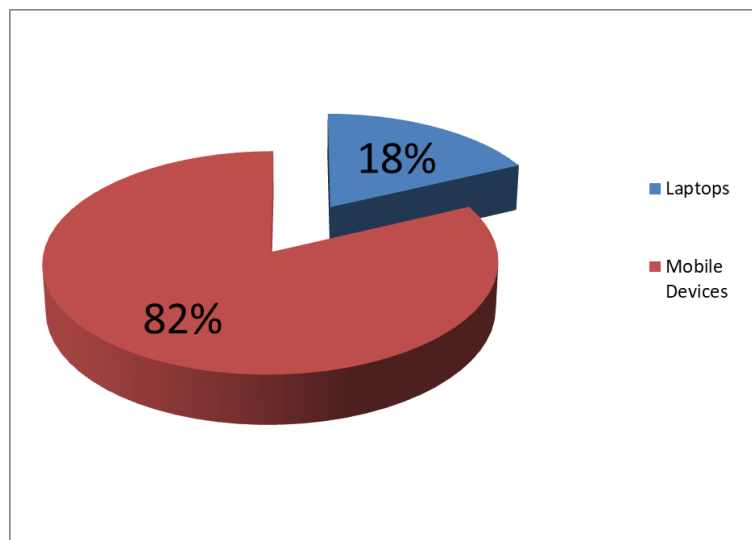
While the monitoring exercise information confirmed that there was a significant presence of mobile device traffic from individually owned technologies on the institution's wireless network, it did not capture student's context of use or their perception of using their mobile devices for learning. This

snapshot did not include the institution owned computers on the Ethernet network. In the next sections, the student perspective of using mobile technologies in learning is explored and emerging concerns are highlighted.

4.2.4.1 Recruitment of Student Participants

The first part of Cycle one (section 4.2.3) focused on the staff perspective and concerns around the use of mobile technologies for learning and teaching. This second part focuses on the perspective of the students. To do this, a cohort of 63 students was recruited via the lecturers who had been interviewed for the staff perspective. During class time, the researcher introduced and explained the purpose of the study to the class and then explained the concept of mobile learning using the one-page primer (Appendix 2).

4.2.4.2 Research Method

As the population size was small, an open-ended questionnaire was then administered to the students in class. The open-ended questionnaire was used to gather organic responses from the understanding of the students so as to establish an understanding for the current level of readiness for the use of mobile technologies.

The questions in the questionnaire were:

Q1. What technology have you used in your learning?

Q2. Do you now understand what mobile learning is and can you describe what it means to you personally?

Q3. Please describe how you use your mobile device. *(Mobile devices include devices such as mobile phones, tablets (e.g. ipads); media players such as ipods, other mp3 players)*

Q4. How do you use mobile technologies to support your learning?

Q5. Where do you see an opportunity to use your mobile devices in formal and informal learning?

Q6. What concerns would you have around using your own mobile device for mobile learning?

Q7. What effects do you think there might be from using your own mobile device within your formal learning contexts and settings?

Students who did not want to participate were asked not to fill in the sheet but simply return it blank as they could withdraw from the study at any point up till

after the data had been collected. This was also indicated in the consent form and participant information sheets (Appendix 1). As the survey was anonymous there was no way of identifying who the non-respondents were once the data had been collected. At the end of the class, all the sheets were collected and results were subsequently entered into a spreadsheet for analysis. There was only one non-respondent. The following sections highlight the themes from the student responses. The bar represents the students who specified the response indicated in the axis label, and the resulting categories represented in the bar charts are not mutually exclusive.

4.2.4.3 Student Awareness of Technologies for learning

The first question asked what technology students used in their learning. The purpose of this question was to establish the level of student's awareness of technology usage in this regard.

Figure 4.9: Student self-identification of technology used in learning
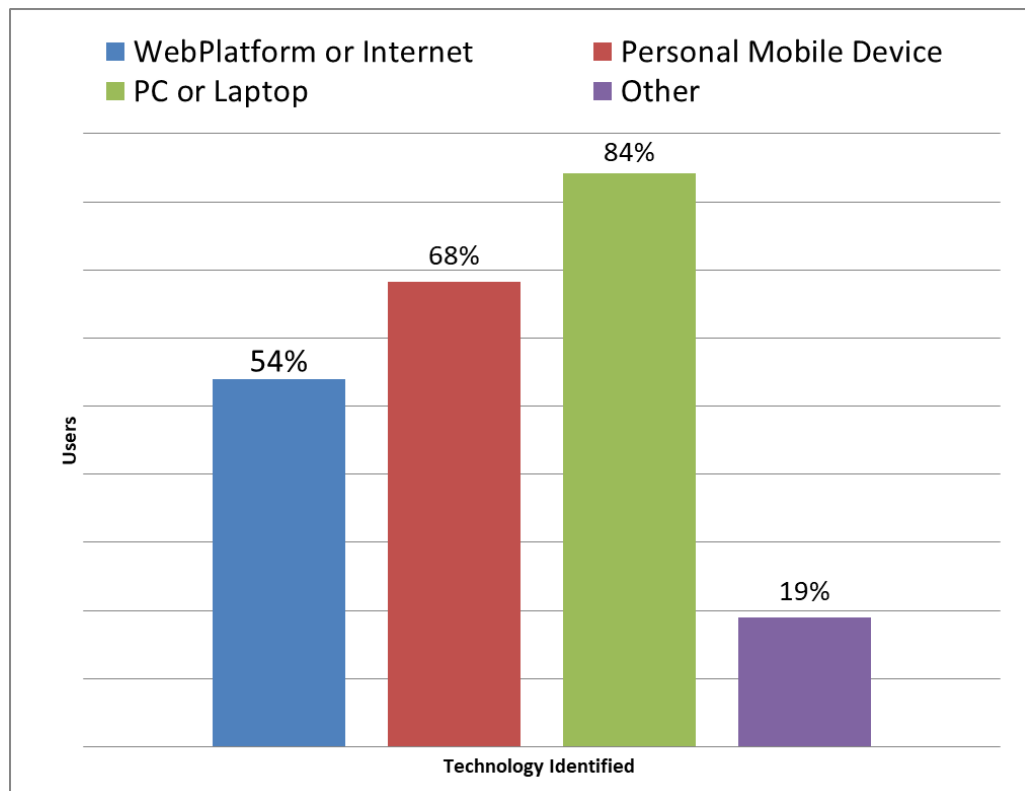
The question did not ask about their devices in particular but rather sought to extract what they interpreted to be technologies in learning.

When asked what technology was used in their learning, 68.25% of the students answered by identifying some type of mobile device (iPhone, android, itouch, tablet or iPod). Alongside this, 84.13% identified laptops or personal computers as being used on their own or in combination with mobile devices. Other responses, while not mentioning either a mobile device, personal computer or laptop, specify applications that are accessed through either of these devices. Such applications include web-based applications such as the Virtual Learning Environment (VLE), Facebook, Wikipedia, online journals, google and the internet in general, as well as applications such as PowerPoint, Word, websites, forums and blogs. A smaller proportion of students,19.05%, identified other technologies such as projectors, game consoles, radios, televisions, DVD players and mentioned lecturers as a part of their interpretation of technology as shown in figure 4.10:

Figure 4.10: Categories of other technologies mentioned
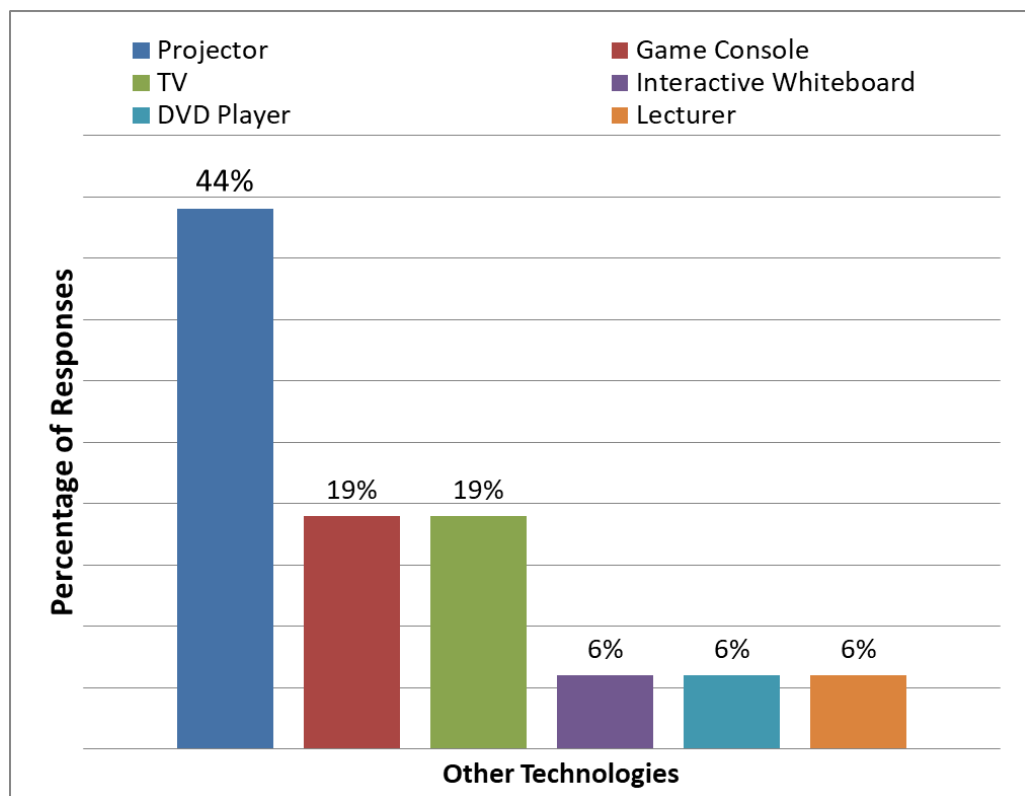
Having established this picture of students familiarity with technology, the next question probed their understanding of mobile technologies by asking what mobile learning meant to them personally.

When asked about what mobile learning meant to them personally, over 90% of the students were able to articulate what "*mobile learning*" meant to them in a

way that included a combination of accessing content, retrieving information, communication, and using technology while mobile. From their personal interpretation and understanding of mobile learning, categories of what mobile learning means to the students are identified (Figure 4.11). The remaining 10% did not have any response to this question.

Figure 4.11: Student understanding of mobile learning
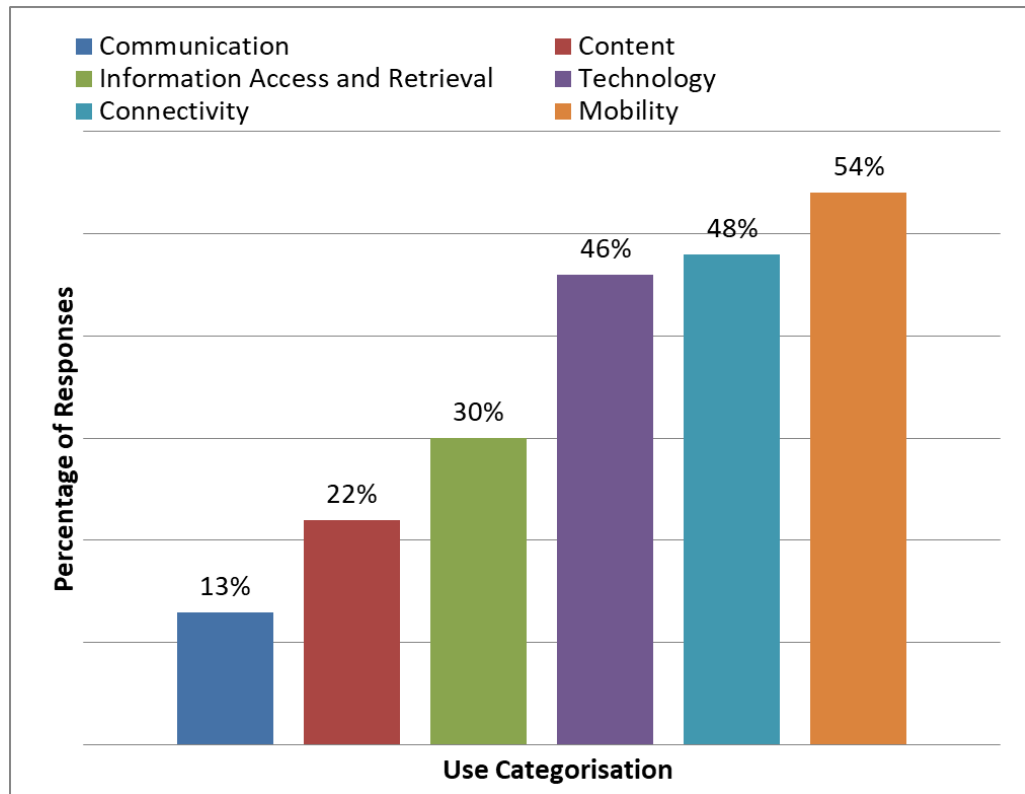
Content as Mobile learning

Among the students, 22% referred to some form of content when explaining what they understood as mobile learning. To these students who mentioned content or some type of content in their definition, it was important in the context of accessibility and mobility.

> *"I could download books to my eBooks library"-ST10_1*

> *"Mobile learning means the ability to access content relative to my course"- ST22_1*

> *"Being able to check assignments and content on the move"- ST13_1*

> *"Being able to get material for learning easily from anywhere not just in college"-ST62_1*

> *"Mobile learning is being able to access resources on the move"-ST48_1*

Content in this sense referred to individual resources which they accessed such as the eBook, notes, and study material.

Information access/retrieval was also highlighted as an important aspect of their mobile learning experience. Information retrieval was different from content in the sense that it is about the access to more personalised information such as email or information that is personally meaningful to the student who retrieves it. Examples of this are schedules, results, emails.

> *"For me, it means that I can check college emails and pdf files on the go"-ST58_1*

> *"Mobile learning is using handheld technology at any time when you need to know something"-ST44_1*

> *"Mobile learning makes it easier to access information in different places"-ST39_1*

Connectivity and Technology

Connectivity to others was implied as an enabler of learning in about 54% of the responses as an important aspect of the mobile learning experience. Features such as email, texts, communication require connectivity to a network and other users to function.

> *"Learning and gaining knowledge from online sources and friends"ST35_2*

> *"A convenient method of gathering information quickly, a means of keeping in touch with friends"ST11_2*

While connectivity through the networks makes up one part of the infrastructure, another aspect is the devices used themselves. Technology encapsulates both the underlying connectivity and 46% of the users refer to the technologies in saying:

> *"Learning from mobile technologies which are available on a daily basis"-ST35_2*

> *"I think it is easier to find out about assignments and stuff on the mobile internet"ST89_2*

> *"Useful portable way of learning"ST90_2*

As well as the connectivity and technology, the mobility of the learner was also a highly occurring theme.

Mobility which is referred to by 54% of the students when they talk about being "on the go" while using their devices. While mobility may have been inferred in the previous categories, it is explicitly called out as a category because it defines the manner in which the access or retrieval of information or use of technology happens.

> *"...means learning on the move and not tied to a desk"ST96_2*

> *"Learning while being outside the college"ST79_2*

> *"Learning without having to attend a listed classroom or structured timetable"ST118_2*

> *"Being able to get material for learning easily from anywhere not just in college"ST124_2*

> *"I use my iPhone for basic research, finding websites before using my PC for full research ST291_5*

For some students, mobile learning was not a part of their practice:

> *"Yes, I have dabbled with mobile learning, personally it would not be integral to my study or learning process as I own an older phone (not a smartphone) so wifi is an issue"ST100_2*

> *"I have no experience with this type of learning"ST121_2*

4.2.4.4 Student General use of mobile technologies

To understand the general context of use of mobile devices, students were asked about how they used their phones and their responses were categorised based on the function they identified (Figure 4.12).

Figure 4.12: Student use of mobile device
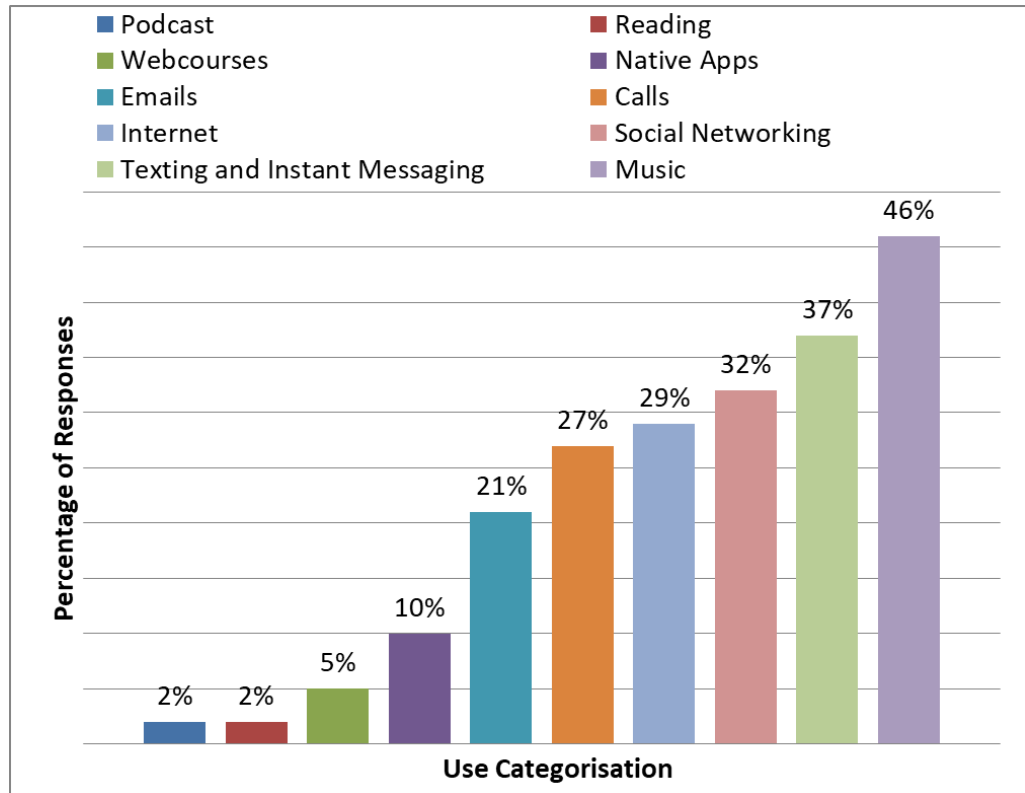
Of the students surveyed, 27% specifically mentioned using their device for phone calls, and 37% used it for texting and messaging. It is important to note here that while the responses indicated here do not imply that 73% don't use their phones for calls, as many will have thought it too obvious to mention. In the responses, there were references which also related the calls and texts to learning:

> *"I use text messages to contact friends and to ask them questions about my course" ST142_3*

There were some who indicated an interest in using their phones for more than texting and calling –for example for accessing the internet but considered the cost an obstacle to doing so and stated that

> *"I make calls, send texts, rarely go online because of cost and it's an older phone so it's slower to load information and errors are common"ST163_3*

For others, it was also a way to manage their time such as maximise their time in class or using idle time:

> *"It helps to save time by learning while you would normally be bored: on the bus, train, waiting at doctor's appointment, etc."ST189_3*

> *"Use in class for notes/note taking. Sometimes record myself speaking my notes and listen to them while travelling"ST177_3*

> *"On my iPad, I download books, pdf's etc. from online sources to broaden my knowledge on particular subjects. I jot down notes in lectures which I can research later in greater detail" –ST160_3*

It would seem that students use their phones in a variety of ways:

> *"I use my mobile device to listen to music, look at pictures, watch videos, play games and access numerous social network sites and texting…"-ST168_3*

The most common use of the mobile device was for listening to music at 43%, and 2% also mentioned using it to download and listen to podcasts.

Having gathered this information relating to how students used their mobile device in general, it was necessary to understand how they used the devices to support their learning to start to investigate the implications of using mobile technologies in learning and teaching context, as is the aim of this cycle.

4.2.4.5 Student use of mobile technologies to support learning

Students did not tend to see mobile devices as a replacement for traditional personal computers or laptops. When asked about how they used their mobile technologies to support their learning in particular, most cited using it for research or searching the internet, looking for information, and accessing learning materials such as their notes.

"Checking definitions on google through my phone when I
don't understand in class. Informal: looking up intriguing
information when bored on the bus"-ST294_5

This indicates that the use of mobile technologies in learning by students is mostly for receiving and consuming information. This is further confirmed as when asked to suggest other opportunities for the use of mobile technologies in learning contexts, they continued to focus on ways of accessing and receiving information and content while mobile and as a way of spending idle time.

"On the bus/Luas/Dart when on the way to college. Many
people spend an hour or so getting to college"-ST305_5

"When travelling. During lunch. In class may be somewhat
distracting"-ST304_5

A few other opportunities identified included cheating in exams as a result of being able to get information quicker.

"...In your exams to cheat, help get information quicker"-
ST267_5

This is useful information for academic staff as they move to use more computer-based methods for testing learning and as the institution use fewer invigilators in some examination halls, more so when considering the use of student-owned devices. In general, students were ready and willing to use their devices for learning and supporting their learning and in fact would seem are already doing so.

4.2.4.6 Concerns around use of mobile technologies and implications of use

From the student perspective, there were areas of concern around using mobile technologies including the devices and underlying technologies. The responses from students were coded with labels which described concern expressed, and these labels were then categorised into broader themes as shown in figure 4.13.

User Experience

The user experience category considers all issues around the experience of using the device in learning including their interaction with the device such as the screen size, the content, and consideration of the target user in this instance, the

student. Of those surveyed, 32% of the students had concerns in this area. Some of these concerns were the health implications of interacting with mobile devices:

> *"I cannot use it while I'm travelling as it makes me fell ill (travel sick). Screen is too small"-ST373_6*

> *"Small screen of mobile devices is hard to use, and affects eyesight…"ST379_6*

> *"Radiation poisoning"-ST329_6*

> *"Possible eye problems in the future from eye strain reading small screens. Arthritis of the thumbs from button pushing/manipulating mobile learning devices"-ST353_6*

Figure 4.13: Student concerns with using mobile technology
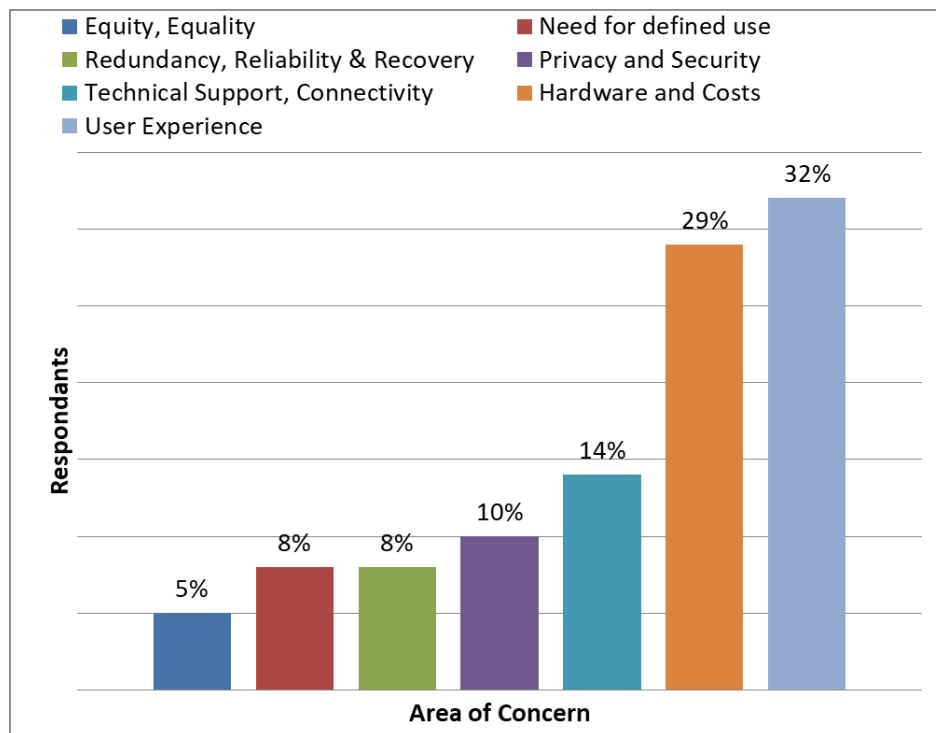
These health concerns are based on the student's own earlier understanding of mobile learning and are also reflected in their other user experience concerns, where their responses are about access to content or information and the size of the screen for viewing or manipulating content.

> *"Websites may not be mobile friendly…"ST323_6*

> *"Mobile phone screens are a bit too small to work on"-ST342_6*

> *"Content isn't supported at good quality"-ST371_6*

> *"Mobile phones are a bit small for writing"-ST337_6*

> *"The quality of webpages on a phone are not good enough"ST372_6*

Sometimes, the concern is more about how the use of technology would change the status quo.

> *"....danger of neglecting traditional methods" ST290_5*

Alongside the usability concerns, students also identified the need to a clearly defined use for the devices.

Need for Defined use

Defining the use for mobile technology is necessary to address concerns that it may be used because it is available or a new technology. Where there is no such definition for use, 8% of the students highlight this by stating that:

> *"I may get distracted from the topic on hand"-ST350_6*

> *"Getting distracted by irrelevant websites. This would mean you are not listening to the lecturer and therefore not benefitting from the lecture"-ST326_6*

> *"Get distracted by other thing on the device i.e., internet, music, apps, games etc"-ST368_6*

There was also a fear that without a clear purpose, mobile devices would be over used:

> *"Overreliance on mobile phones etc. No enforcing of learning without referring to material"-ST375_6*

As well as the need for clearly defining the use application in learning, students identified issues around equity and equality as a concern around using the mobile devices.

Equality and Equity

Issues around equality and equity were of concern to 5% of the students with comments such as:

> *"I do not have a smart phone and would not be interested in buying one just for lecture"-ST320_6*

> *"If people can't afford to buy one what happens"-ST362_6*

There is a concern about what happens to students who do not want or cannot afford a mobile device.

> *"People can't afford it, technical issues, some devices may be greater than others giving an unfair advantage"ST362_5*

This is also raised as a hardware and cost issue even though students expected and preferred to own their devices:

> *"I think using my own device would be more comfortable. I would worry if i had ot be responsible for some one elses device"ST429_7*

Hardware and Cost

The need to consider how to deal with addressing the hardware and costs of the devices were raised by 29% of the students in a variety of ways, such as fears around losing their phone and therefore not being able to participate in learning:

> *"Bringing them around with you often means they could break easier"-ST337_6*

> *"Could become lost, broken"ST338_6*

Other concerns here were specifically about the cost of ensuring ownership of an up to date device:

> *"Also there is a broad range of different devices used by people could be difficult to get standard, the cost of the devices is also a factor"ST351_6*

> *"That my iPhone would be good enough to get info for me"-ST318_6*

124

> *"You might lose your mobile device and not afford to replace it"-ST319_6*

> *"Finish my credit on my phone"ST434_7*

While students did not identify any concerns with technical help needed with using their own devices, their need for technical support was around infrastructure.

Technical Support and Connectivity

For 14% of the students, the technical difficulties cited as concerns were around Wi-Fi connectivity and accessing content or information quickly.

> *"General concerns would be accessibility throughout the entire campus"- ST355_6*

> *"Availability of Wi-Fi"-ST369_6*

> *"Quick internet access to materials"-ST378_6*

Around using the infrastructure and mobile devices, students were also concerned about the provisions for redundancy and recovery in case of technical problems with the infrastructure.

Redundancy and Recovery

The 8% of students who cited issues pertaining to the reliability of the infrastructure and mobile devices were worried about what would happen if there was a break down in the system, and what the implications would be if the technology was not available.

> *"Danger of over reliance on mobile learning tools, what happens when the wifi network goes down?"ST353_6*

> *"Phone might not work anymore"-ST325_6*

> *"If the systems was not working at the time important info could be missed"-ST319_6*

> *"Loss of data."ST322_6*

While considering how lost data would be recovered, privacy and security concerns were also indicated.

10% of the students responded to indicate that they would be concerned about security and privacy issues while using their own devices within learning contexts. They mentioned the security of the systems in general:

"That other people could hack the system"-ST347_6

"Getting a virus"-ST356_6

"May not be secure connection"ST323_6

"My number being public (big concern)"-ST360_6

"Personal information on your mobile"-ST340_6

"Giving away phone numbers"ST325_6

*"I would be concerned about possible misuse of the text
service e.g. text spamming"-ST336_6*

The student's concerns around privacy and security highlight an awareness of security and privacy issues around using personal mobile devices on networks. This awareness emphasises the need for an institution wide policy that addresses how personal data is handled through the networks connections, how student own personal contact details such as phone numbers are made available and used, and how safe the systems were from intrusion such as hackers.

4.2.5 Foundation for Guidelines: Obstacles around Use Your Own Device

The goal of Cycle One was to gauge the sensitivity in the OOI for the use of UYOD in learning and teaching contexts and to get some insight into the readiness of the institutional systems for supporting such use. To do this, a mobile learning initiative was implemented and students and staff in the OOI were interrogated on their use of mobile devices in learning and teaching. Based on the data examined in this chapter, students are ready and willing to use their devices for learning and supporting their learning, subject to reservations, and in fact were already doing so at a very basic level to access information and content on the go. The students' concerns and insights highlighted here, emphasized the need for faculty to use a technology integration strategy that encompasses the areas identified here. It also demonstrates while there is some

recognition that mobile technologies offer a range of possibilities to enhance learning experiences, most students are reliant on their lecturers to come up with strategies and approaches that go beyond providing content and information. They rely on their lectures to take advantage of the affordances of their mobile technologies and their devices while maintaining some of the structures that ensure familiarity and prevent distraction and isolation.

> *"Honestly, endless possibilities for mobile learning in both,*
> *although there could be a danger of neglecting traditional*
> *methods of learning. If everyone is texting everyone else in*
> *one room, is that progress or just a lot of people avoiding*
> *physical social learning?"ST290_5*

> *"We would have to adapt to being taught a different way*
> *which people might find difficult"-ST405_7*

While the data from the survey has confirmed the observation in section 4.2.4 of increased activity on the network with mobile devices, there is no evidence in this study so far to indicate that students are particularly expert at using the technologies in innovative ways in their own learning practice.

4.2.5.1 Findings from Cycle One

Following the literature review where the purpose of this study was established, the aim in this cycle was to explore current obstacles to determine if there would be any reception to the incorporation of student owned mobile devices for supporting learning in the OOI. This was done by determining:

- The current institutional appetite for using UYOD in learning and teaching, thereby establishing an understanding of the current perception of the use of UYOD in mobile learning.
  And,
- Recognising areas of obstacles around using UYOD in learning and teaching contexts by using the pilot as a lens to observe activities around the implementation of mobile technologies for learning.

It was also intended that this would define the scope of the proposed research and identify where the research should focus on in the next cycle by identifying themes for further analysis.

A pilot study was carried out involving the use of a low stakes mobile learning intervention. The intervention is referred to as low stakes as while it was intended to enhance the learning experience for students and maximise the time spent with the lecturer while out on a field trip, there was no grading associated with the use of mobile in this context and it was not a part of the teaching plan but rather an enhancement to add relative advantage. The implementation of mobile technology in a learning context here involved the use of mobile devices to access educational videos on how to use relevant equipment while out on fieldwork. This resulted in freeing lecturers up for other support tasks, and deeper engagement with more students. In this study, students used their mobile phones to access pre-prepared content by scanning a QR code attached to the equipment. In consideration of how the project was approached, the funding being acquired from external sources is typical of many mobile learning implementations and while the desire to continue was present, it was dependent on the availability of support available within the OOI. The videos used were hosted on a publicly accessible platform and the engine was accommodated outside of the institutional infrastructure. The findings from this cycle are as outlined in the next paragraphs:

Current Institutional Appetite

In terms of establishing the current institutional appetite for the use of mobile technologies for learning, both staff and students engaged in the study indicate being receptive to exploration. From the interviews conducted with various staff stakeholders, it would appear that while there is some awareness around mobile technologies, there is the perception that the OOI does not have the appropriate infrastructure, architecture or support system in place to implement a UYOD strategy for learning and teaching. This leaves each lecturer exploring mobile technology use while relying on goodwill as was pointed out in section 4.2. In a similar manner, there is not enough clarity around what types of mobile learning interventions would be implemented by the staff or what the opportunities for mobile learning are. Most students are familiar with using mobile technologies and are willing to use them in learning and teaching contexts subject to reservations such as the concerns highlighted in section 4.2.4. While there was recognition of the possibilities, students did not offer any innovative uses and

would appear to look to their lecturers to come up with strategies for implementing the use of mobile technologies.

Summarising areas of obstacles

The areas of obstacles around using UYOD are the areas where the deployment of the systems used in this cycle did not interoperate with existing systems and processes. The gaps in policy around use of personal mobile technologies have been outlined in section 4.2.3 where staff raise concerns about discipline, handling of user information, the need for more knowledge and support. Students raise similar concerns in section 4.2.4.6, adding concerns about equality, equity, privacy and security of systems and data. Both groups highlight the need for clearly defined use in learning contexts with students relying on teaching staff to give the direction in this area. Given the lack of clarity around possible applications and strategies, the implications of the use of mobile technologies cannot be determined at this stage. This demonstrates that there is a need for a more in-depth study into how the stakeholders engage in the processes that enable and support learning with mobile technologies within the existing technological infrastructure and physical environment.

The findings from Cycle one are confirmed in a study of students experience of BYOD in a science classroom which highlighted the policy guidance, network infrastructure or data plans as being main considerations in the use of individually owned devices in institutions (Nykvist, 2012). A key learning from this cycle has been that institutions need to address obstacles that prevent innovating with UYOD when systems needed are not currently in place in the institution or have a process to provide suitable alternatives. This was highlighted when the institutional systems did not support the delivery of the preferred designed solution in section 4.2.2.3 which led to the decision to use the project partner's server.

4.3 Conclusion of Cycle one and next steps

Having ascertained the existence of local appetite in the OOI for using UYOD in learning and teaching by consulting with representative stakeholders, and identified the need for further investigation into the infrastructural capacity to support UYOD, the scope of the next cycle of study focuses on evaluating the institutional capacity by examining the areas of obstacles around the actions of

the people, the processes they engage in and the technologies they use when incorporating UYOD for mobile learning in the OOI.

The themes for further analysis identified in the pilot study (Sections 4.2.3 and 4.2.4) are aligned against the three categories presented in figure 4.14 to specify areas which should be further studied to evaluate institutional capacity.

Figure 4.14: Elements for further investigation

Environment and Infrastructure

Comprises of the learning environments and infrastructure. Integration with current systems and Technical support, connectivity challenges, redundancy and recovery, policies around use and user considerations

Processes

These include the main activities of the OOI: Learning, teaching, administration and support.

Administration and management underlying processes are those involved in providing and managing access, providing backups, defining support and clarifying expectations of same.

People

These are the stakeholders and takes into account the considerations that impact them as individuals in their roles:

Students: User Experience, Need for definition of use, equality and equity, hardware specifications and cost considerations, privacy and security

Staff: Privacy, Knowledge and Expertise, Impact on Existing workload and development time

The next chapter outlines Cycle two of the study and focuses on the exploration of the question:

How can policy and practice in an institutional context for UYOD respond to these obstacles?

To do this, UYOD would be implemented in case studies that allow for the observations of the processes and interactions that enable that type of innovation in practice within the OOI environment and infrastructure. Having learned about obstacles around integrating a new system, the focus of the next cycles is on UYOD so the choice of the mobile affordance to be explored was to be messaging. Messaging took advantage of a system which had been purchased but not fully integrated or deployed. Of the workshops conducted by the LTSC team, the one on using messaging had the highest attendance so it was considered by the researcher that it was more likely to have users at an "early adopter" phase of innovation who would be willing to try out a new approach in their practice. Additionally, even if students had feature phones, they would not be excluded from participating.

5. Design Research Cycle Two: Testing institutional capacities for mobile

Introduction

The previous chapter presented Cycle One of this research which focused on gauging the perception to UYOD and identifying obstacles relating to the use of mobile technologies for learning by engaging representative stakeholders. The Cycle established the need for further investigation to evaluate institutional capacity and the impact on existing systems and processes by using an application of messaging as common to all devices.

Section 2.4.2 established that mobile technology integration frameworks were necessary to scaffold the implementation of technologies into mature or tested institutional processes and infrastructure. From the literature review carried out in Chapter Two, it was determined that none of the existing mobile learning frameworks or models reported in the literature so far addressed how the capacity for mobile learning can be created or enabled- particularly with respect to incorporating UYOD. The review established the need for guidance to support higher education institutions to enable the capacity for mobile learning in a manner that mitigates risks, enables opportunities to capitalize on the affordances of the technologies while balancing their organisational culture and ensuring that all these provisions are future proofed to support the technology as it continues to evolve. By providing this guidance, this research addresses an identified gap in knowledge for higher education institutions to remove any friction in enabling UYOD for mobile learning experiences. In Cycle one, the use of UYOD was investigated to identify the proclivity for and obstacles within the OOI. In this cycle, UYOD instances are used to test the institutional systems in two separate case studies to determine the institution's capacity to address the areas of difficulty encountered and identified to be elements to consider in Figure 4.14.

This chapter starts by presenting how Rogers' Diffusion Of Innovation (DOI) theory is used to guide the investigation into the use of a mobile technology within an organisation and community, as well as within the prevailing organisational culture. The theory is used to determine how users were targeted

and situates the role of the researcher (as learning technologist) in the activities in this cycle.

This chapter presents the second cycle in this research and outlines the tensions registered when a UYOD approach to using mobile technologies was implemented in two learning and teaching contexts. This cycle is aimed at addressing the second research question posed in section 2.5: How can policy and practice in an institutional context for UYOD respond to these obstacles?

5.1 Responding to obstacles relating to UYOD for mobile learning

Sections 4.2.3 and 4.2.4 highlighted the need for focusing on considering the obstacles around using individually owned devices when enabling UYOD for mobile learning within institutional environments. To pursue this focus in this cycle of the research, a framework or scaffold was needed to provide a mechanism for further exploration, with a purpose that is consistent with the goals of the research stated in Section 2.5. That purpose was to derive guidance on what institutional systems and processes need to be considered to build capacity for adopting UYOD for mobile learning within an organisation such as a higher education institution. Building mobile learning capacity means widening participation in the adoption of UYOD for learning and teaching purposes, while creating the required support structures, and ensuring that the environment, both physical and organisational is fit for purpose. In this cycle, the theory of Diffusion Of Innovation (DOI) along with recognising the role of organisational culture is used as basis in the sampling to recruit participants in the Cycle two of this study

In this chapter, Roger's DOI model (Rogers, 2003) which was determined in Section 2.3 to be a suitable scaffold for thinking about the adoption of UYOD as an innovation, is used as a foundation for engaging with the potential participants . This utilisation of the DOI model provides a mechanism to expand the use of mobile technologies in learning and teaching contexts in the OOI while considering the various categories of users that exist and how to reach them. The use of mobile technologies envisaged is the integration of appropriate tools and platforms at an organisational level as well as the enablement of a UYOD approach so that academic staff can create mobile learning experiences in which students can use their own mobile devices. Organisational culture as it

impedes or enables the adoption and spread of use of technological innovations is also highlighted by explaining how the OOI pursues its goals by specifying a defined strategy for IT service provision and describes the relationships between the LTSC, IT services and academic staff as they interoperate and determine the resources to accomplish the organisation's goals.

Against the background outlined so far, the implementation of mobile technologies in this cycle took advantage of a platform already in the process of being implemented, but which had not seen an uptake in use. The next section is a demonstration of two implementations of the use of a mobile technology platform for messaging while testing the capacity of the OOI environment and processes.

5.2 Deployment of Messaging in learning and teaching contexts

The literature review and pilot carried out in Cycle one, determined that the implementation of mobile learning should be done using an approach that employs a technology that is familiar and so non-threatening and provides a way to integrate into the existing infrastructure and processes with least disruption. By classifying mobile learning implementations (Section2.3.3), it was also concluded that mobile learning interventions should also not be discriminatory of devices and be applicable in a number of contexts to engage a varied number of users. In section 4.2.3.3, it was mentioned that in terms of phone usage, lecturers mainly used their mobile devices for making calls and sending texts, while it was shown in sections 4.2.4.4 that student use of texting and instant messaging was second only to use of native apps on the devices. In concluding Cycle one it was determined that using messaging provided a means to ensure no students were excluded and also took advantage of a system that was not fully integrated. Confirming the prevalence of messaging use, in Section 4.2.3.9, it was pointed out that the workshop with the highest attendance conducted by the LTSC team was on using text messaging with students. The reason for the low uptake in use of the tool was given as the lack of integration with the institution's registration systems. This lack of integration meant that students' phone numbers were not in the texting system but rather, had to be manually entered by the lecturers.

Cycle Two is the implementation of messaging by deploying the SMS platform along with enabling a UYOD approach in learning and teaching contexts. The

messaging platform enables a lecturer to send a message (SMS) to specified students. While messaging in itself is not a new concept, its application in learning to take advantage of UYOD is the innovation to be studied in Cycle two as it requires configuration of the systems and processes to target devices owned by the students. The deployments of messaging in the two instances in this chapter allow the determination of the capacity of the systems and processes affected when a "Use Your Own Device" (UYOD) model is enabled in learning and teaching contexts. The following sections outline how the lecturers who participated in this cycle were recruited and describe the two implementations examined. To ensure that the deployments were fit for purpose, the lecturers who participated worked with the researcher to design a plan for integrating the messaging into the module delivery plan.

5.2.1 Sampling

Based on the high-level perspective of the culture of the OOI as described in Chapter one and the decentralised management style adopted in the OOI, early stage trials of using mobile technologies are more likely to interest the innovators and early adopters as they are risk takers. While from the researchers' perspective this may restrict the choice in available participants, it was important to work with participants who were comfortable with working with the deployment of UYOD and SMS message. By instantiating the DOI model, it is determined that the researcher acting as learning technologist is the "change agent". It is the change agent's role to influence the innovation decision. At this early stage, and the innovators and early adopters are risk takers who are ready to try out an innovation before it is considered mainstream.

The lecturing staff who were involved in Cycle one were first approached to participate in this phase, but they declined due to time pressures and existing commitments to other projects. During workshops on using a bulk messaging system, the LTSC facilitator (the researcher) presented the study and invited attendees to take part. These workshops filled the purpose of the first three steps of the innovation adoption steps as specified in the DOI model (Rogers, 2003, p. 21):

1. Imparted knowledge about the messaging application and use of UYOD in learning and teaching.

2. Encouraged participants to consider and decide on a favourable or unfavourable attitude toward the use of messaging in learning and teaching.

3. Gave the opportunities to engage in activities that lead to a choice to adopt or reject the use of messaging.

Academic staff who were known to the LTSC and had been identified from previous interactions as being willing to try new approaches and take some risks were also asked to participate or advocate as change agent aides for participants in their departments due to their influence as opinion leaders in the use of technology in their subject areas. The change agent aides through their peer networks shared information about the messaging application and through all their activities, three members of staff were identified who were willing to take part in the study. Two of these were selected to participate because they could identify an addressable challenge in their subject areas of Entrepreneurship education and Chinese language learning respectively thus engaging at the fourth innovation step of the DOI model which is the implementation of an innovation. After determining how they intended to use messaging to support their course, the tool was demonstrated to both lecturers and they were given a bulk allocation of messages in the system from which they would send their messages. For both of the implementations described the cost of the messaging was borne by the LTSC as this was an exploratory project. It is intended that in the future the department using the tool funds the messaging charges.

The following sections describe the strategy used to integrate the use of messaging in their teaching contexts.

5.2.2 Use of Messaging to support learners on the Entrepreneurship Education Programme (HH Group)

5.2.2.1 Background information

The entrepreneurs programme II was phase two of an entrepreneurship accelerator programme run by Enterprise Ireland with the OOI. Enterprise Ireland is the national support body for entrepreneurship activity in Ireland while the OOI supported this through its Innovation and Technology transfer office. The entrepreneur programme II aims to support or groom entrepreneurs to successfully start and grow their businesses. It did so by providing funding

support for each participant, subject to rigorous and frequent assessment of performance and progress.

To support the assessment of performance and progress, a number of teaching methodologies were applied: lectures, seminars, assignments which are linked to milestones and presentations on learning applied in context to individual projects. While the students participating in this programme did not pass or fail, a lack of progress disqualified them from continuing on the programme and/or proceeding to the next phase. The duration of the programme was 12 weeks and classes were held twice a week.

5.2.2.2 Participants

Participants on this programme were all mature students and professionals in their various disciplines who were doing this alongside starting up their businesses. There were 11 students in the HH group. The Programme Coordinator (PC) was responsible for the design of the programme.

5.2.2.3 Resources used

The programme used support services from the OOI such as learning and teaching support during normal working hours, similar to the rest of the institution. PC was the central resource personnel for the participants and the lecturers on the module and was responsible for uploading any files and general administration of the space for the programme within the Virtual Learning Environment (VLE) used (Moodle). The Learning and Teaching technology team acted as a resource for advice around using the technology and on request, troubleshooting problems with the technologies in use.

5.2.2.4 Implementation of Messaging in Entrepreneurship support programme

Upon enrolment in the programme, students in the entrepreneurship programme were assigned usernames and passwords to access the learning management systems. At this point, their mobile numbers were also confirmed if already in the system, or collected and added to the messaging system. The implementation of messaging in the Entrepreneurship programme is an example of persuasive technology for learning. Persuasive technology is based on the principles of the Fogg Behaviour Model (FBM model). The FBM model is the use of information technology systems to encourage learners to participate in a subject area or complete a learning module without using coercion or deception and asserts that

three factors must converge for a desired behaviour to occur: sufficient motivation, have the ability to perform the behaviours and be triggered to perform the behaviour (Fogg, 2009).

On the first day of the programme, at the start of the module, there was an induction session. At this session, Moodle was introduced as the platform to be used to disseminate notes and receive assignments and submissions, amongst other administrative activity such as scheduling events. Messages were to be used to augment the information in Moodle throughout the programme and provide triggers. (wanting to accomplish tasks required to reach the next stage of the programme)

For the 12 weeks of the programme, the VLE (Moodle) was used as a central repository for notes, sharing resources, and a discussion space supporting the acquisition of skills and knowledge required to complete the tasks. Details of assignment and tasks to be completed were verbally stated in the class. The text system enabled the PC to login from a computer, and send a batch of texts as at any time which included:

1. Informational texts*:   These are texts that simply send information to the students about upcoming events, date or venue changes, and updates to Moodle.
2. Call to action/prompts: There were a series of lectures and workshops delivered by guest lecturers. Based on these, and the feedback from the guests, specific assignments were set and information about these were sent to the students in a text message*.
3. Reminders: Tied to milestones. Participants get triggers in the form of text messages* as milestones approach to remind them of their commitments.

*Students did not need to reply to the text as it was a trigger. They simply performed the assigned activity. They did usually reply when they could not complete the activity even though this had not been the instruction.

While it was recommended that the plan for the module should be finalised and all documentation uploaded to the system prior to the start of the course, and the text messages finalised, this was not possible as many of the weekly guest speakers would not send their content prior to the start of the course. The

compulsion to use the system derived from the fact that students often did not log into the VLE or check their emails often enough to get all relevant messages when information was disseminated. For students who did not use the text system or wish to receive texts, the burden of keeping up to date was on them as they needed to check their emails and the VLE frequently since they would not receive these prompts.

5.2.3 Use of Messaging to provide contextual opportunity for practice of sentence structuring in Mandarin/Chinese. (CH Group)

5.2.3.1 Background information

In this second instance of using messaging to enhance the learning experience, it is intended that students are to further progress their command of Chinese with emphasis on the written language. The module is taught entirely in Chinese with the following aims:

- Reinforce the student's knowledge of the structures of Chinese with a particular focus on written characters.
- Ensure that students have an active knowledge of approximately 1200 characters and a passive knowledge of approximately 2000 through the use of press articles, contemporary stories, and television broadcasts.
- Further develop student's knowledge of Chinese grammar.
- Acquire the skills of formal letter-writing (Chinese and Taiwanese style).

5.2.3.2 Participants

Unlike the HH group, the participants in this group were all undergraduate students. They were 10 full time students enrolled in the OOI. The lecturer on this module was a full time academic staff with the languages department and had access to the full range of resources in the institution including the services of the LTSC as a support. They were also responsible for determining how the technology would be implemented with advice from the LTSC and the prepared a plan for the module (Written Chinese) which describes the strategy for the use of mobile technology (Appendix 13).

5.2.3.3 Resources used

In this module, the lecturer used the messaging tool without integration to the virtual learning environment (VLE) as they did not usually use the VLE. A mobile phone was also provided due to technical challenges as detailed in section 5.3. The lectures were held in a classroom rather than a computer lab.

5.2.3.4 Implementation of Messaging in Chinese Language learning

To meet the aims of the module, the lecturer delivered the class speaking only in Chinese and for the first five weeks, the students were invited to interact via the mobile devices. They would do this by responding to questions or carrying out tasks such as writing specific types of messages. It was intended that students use their own devices participating in activities in class in response to the prompts given in the messages they receive from the lecturer. The application of using messages in language learning has been effectively used to develop vocabulary in other languages such as Afrikaans and English as a foreign language for Iranian students (Tabatabaei and Goojani, 2012);(Lawrence, 2014).

In the Chinese language course, students participated by crafting their message in a text as they would in day-to-day interactions. For example, people tend to send texts from holidays or if they are running late to meet a friend. The students were taught to write informally to send greeting cards, postcards, and casual or informal letters or messages. They were taught to describe appearances, summarise key points in a message, put up notices, and leave notes. Messages were designed around the content to be delivered and the objectives for the week.

It was intended that when the timetable for the semester was confirmed and information of students received, the timings for sending out the messages would be ascertained. The messages to be sent by the lecturer would then be entered into the system through a web interface (Appendix 4) and set to a schedule for sending. However, due to not receiving the student information prior to the start of class, phone numbers were collected by the lecturer at the start of the class and entered into the messaging system at that point. After the first class, the lecturer scheduled the texts associated with upcoming classes.

Upon receiving a text prompt on their phones such as "it's Mary/John's birthday tomorrow, remember to send them a birthday message expressing your wishes for them," students responded by crafting a message in Chinese to respond.

Students were also given the option of submitting their responses by handwriting if they preferred not to use their phones or did not want to be part of the study. The following section details how the infrastructure and processes were employed in preparation for the implementation described so far.

5.3 Infrastructural Preparation for using mobile technology in learning

Setting up the messaging service required a range of activities that involve different functions across the institution and allowed for observation of the interplay between these. The elements identified from the exploration in Cycle 1 and presented at the end of Chapter Four (Figure 4.14) forms the foundation for considering the integration of the use of student owned devices and an organisation level system like the messaging platform. In Figure 4.14 the considerations identified in the pilot study (Sections 4.2.3 and 4.2.4) were aligned against three categories to give a map of suggested activities for evaluating institutional capacity as illustrated in figure 5.1 below.

5.3.1 Considering concerns raised by staff and students

The privacy of the lecturer was protected, as the system did not require the use of their own phone numbers, except if they were to receive the text messages along with the students. However, students needed to give their numbers to the lecturer as the system needed to be populated with students' phone numbers in order to enable sending messages to them. In keeping with law pertaining to data privacy and protection of personal information, students must be informed about how their information is to be used.

As at the time of these implementations, as was mentioned in section 5.3, students' phone numbers were not being routinely collected as part of the registration process and so were not populated into the system. There was no information given to students that their phone numbers may be needed to participate in activities to support their learning. There was also no expectation across the institution that students would own a mobile device of any kind and no provision for considering equity or equality when individually-owned devices were brought into the learning environment. For these studies, the lecturer presented the plan for the modules and asked for student's phone numbers in class. Students who did not own mobile devices or did not want to

use their devices were invited to complete their work by writing out on paper and submitting it to the lecturer within an allocated time- usually by end of class.

For this implementation, the LTSC provided technical support where needed in class for both staff and students.

5.3.2 Processes and Environmental Integration

The infrastructure and processes are considered alongside each other. The messaging platform was supported by the LTSC team and technical obstacles with handling messages were escalated to the vendor. While testing the system, it was discovered that it was not capable of handling incoming messages with Chinese characters. The implication of this was that when students responded to messages received, their responses were not received in the inbox assigned to the lecturer. From the communication with the vendor of the messaging system (Appendix 5), it became clear that the problem with handling Chinese characters would not be resolved in time for the start of the class in September. Due to this delay in a solution being provided, the decision was made to use the system for outbound messages from the lecturer. For the inbound messages, students would respond via an instant messaging tool called "WhatsApp" or by direct text messages to a phone bought specifically for this course.

The phone was purchased from the LTSC budget and loaned to the lecturer for the duration of the module. This allowed the lecturer maintain their privacy by not sharing their personal phone number but continue with the plan they had put in place for module delivery. Messages pertaining to the module could also be stored on a device dedicated for such use.

The room designated for the class was only known a week before classes resumed, thereby leaving insufficient time to ensure that there was adequate WIFI and data connectivity to support the activities the class would be engaging in.

5.3.3 Summary of the impact of creating an experience that uses UYOD as approach to a mobile learning experience with the existing environment

The consideration of the concerns raised by staff and students in Chapter Four gave a starting point from which to consider what needed to be in place to create a mobile learning enabled environment that utilises the UYOD approach. Figure 4.14 illustrated the categories of the elements to be observed and reported on.

To commence the investigation of systems and processes affected when a UYOD approach is implemented with a messaging system (Cycle two), specific activities examining the elements identified in the Figure 4.14 are carried out. These are highlighted in Figure 5.1:

Figure 5.1: UYOD elements considered in Cycle two

Environment and Infrastructure

Comprises of the learning environments and infrastructure. Integration with current systems and Technical support, connectivity challenges, redundancy and recovery, policies around use and user considerations

VLE, Mobile messaging system configuration Student Registration System, Devices to be used, Back-Up devices, Network connectivity, Integrating VLE with Messaging systems, Budgetary considerations associated with the messaging application

Processes

These include the main activities of the OOI: Learning, teaching, administration and support.

Administration and management underlying processes are those involved in providing and managing access, providing backups, defining support and clarifying expectations of same.

Student registration, Linking telephone numbers from registration system, specifying expectations of support.

People

These are the stakeholders and takes into account the considerations that impact them as individuals in their roles:

Students: User Experience, Need for definition of use, equality and equity, hardware specifications and cost considerations, privacy and security

Staff: Privacy, Knowledge and Expertise, Impact on Existing workload and development time

Information on how their devices may be used in learning, range of devices supported, support available for purchase and ongoing usage, assurances or privacy and security, support for designing use cases and deployment, clarifying expectations around roles to manage time.

In Cycle two, by deploying the messaging system for use in the two mobile learning instances, the impacts on the existing infrastructure could be ascertained and reveal that:

1. The requirements on specifying how user data associated with mobile device usage is handled need to consider privacy concerns of the teaching staff and the students. The gap in the existing policies around mobile device use as part of ICT usage and support is highlighted.

2. Operational rhythms in the institution support students from when they register. Up until the time of registration, the students are not attached to any modules in the student database, and the lecturer does not have a formal list of students. If it is a core module, they may have an idea of how many to expect from how many students there are in the year, as

was the case for the CH group, but they wouldn't have their information in any systems.

3. The administrative tasks associated with using the messaging system, such as drafting and scheduling the messages can therefore not be completed until the user information is available. Funding the use of the technology when there are costs associated can also be a challenge depending on the priorities of the department and the influence of the lecturer.

4. With the HH class group, a VLE is used in parallel to the messaging system with no integration between them. Even though the messages were supporting the activities in the VLE, the lecturer needed to log into the separate system and this created inefficiencies and additional administration. In the CH class, while no other systems were used, in testing the messaging tool, it was identified that it was not capable of receiving incoming messages in all languages. The tool could not handle incoming Chinese characters or other non-GSM characters such as Arabic and Cyrillic. The backup plan of using a separate mobile device protected the lecturer's privacy and enabled the class to continue as planned. In general, there was no integration between the messaging tool and any other systems in the infrastructure, which meant lecturers had to manually administer the system to add or remove users. Integration with the Banner system used for registration and also within the VLEs used would remove the need for such an administrative overhead.

5. The lack of clear policies and guidelines to define the terms around accessing and handling user information, as well as the lack of integration with existing infrastructure, has caused significant challenges in setting up the implementations of using messaging.

The following section presents the methods used for collecting the data that gives an account of the student experience when using their own mobile devices. The student experience is as it occurred in the implementations of mobile technologies to support learning within the institution's environment and infrastructure.

5.4 Students Experience of the Messaging based Mobile Learning Intervention

Within this cycle of investigating the capacity of the environment for using UYOD in mobile learning, the purpose of interrogating the students is to get an insight into their view of the experience of using their own devices for receiving messages as deployed in the instances in this cycle. Their feedback gives their evaluation of the use of messaging within the existing systems and processes and identifies the areas of friction which should be addressed in the guidelines subsequently proposed.

5.4.1 Methods used for Data Collection

The messaging intervention as was implemented in both the CH and HH contexts (Section 5.2.2 and section 5.2.3) was a mechanism through which to get students and staff to consider the impact of using mobile technologies and individually owned devices in learning and teaching contexts.

There was both qualitative and quantitative data gathered from these two implementations by using:

- Interviews with the students: one focus group interview with 10 CH students participating and individual telephone interviews with five HH students.
- Survey of CH and HH students by sending them a link to an online questionnaire
- Individual interviews with the lecturers involved in both implementations following the students' surveys and interviews.

The questions in the questionnaire in Table 5.1 probed the student's perspective of when using their own devices in the mobile learning experience using a Likert scale to gauge their responses.

Table 5.1: Cycle Two Student Survey Questions

Q1: **What type of mobile phone did you use for the duration of the course?**
Students were asked to identify the type of phone they used for the course to determine the distribution of types of phone. While it was expected that most

students would have smart phones, there had been no prior confirmation of this and students had not been informed about needing to have phones for the course. This question set the scene for exploring how to accommodate a diverse range of devices in the learning environment and infrastructure. Answer choices included: iPhone, android, other smart phone and ordinary feature phone.

Q2: Did you also have a tablet which you used?

Recognizing that some students may have preferred to use their tablets, the second question was intended to capture how tablets were used alongside mobile phones. If students answered "yes" they were presented with an open ended question to describe how they use it.

The next questions were around the use of SMS and mobile phones as showcased in the two implementations described in sections 5.2.2 and 5.2.3. Responses for the options under each question were rated along a Likert scale of scale of strongly agree; agree; neither agree nor disagree; disagree and strongly disagree:

Q3: **The use of texts in this programme was...**

- Nice to have but wouldn't miss it if it wasn't used in other such programmes.
- Intrusive
- So useful that getting work done for the course would be more difficult without it
- Made me feel more connected to the programme

Q4: The use of texting to support learning as incorporated in this programme…

- Encouraged me to get my work done in time
- Seemed seamless with other supports provided
- Could be extended beyond how it was used
- Made me feel I was progressing at the right pace
- Please enter any other comment on the use of texting

Q5: What types of functions would you like to use your mobile phone for more in a course like this?

- The ability to reply to texts would be a useful enhancement
- Being able to do more on the VLE via the mobile phone for example, upload content to VLE
- Being able to interacting with class members on the go as individuals and group
- Other (please specify)

Q6: To support your learning outside this course context, you use your mobile phone for:

- Researching on the internet
- Participating in social networking spaces such as LinkedIn, Facebook, Google+ .
- Planning my schedule and activities
- Tracking activities and events.
- How else do you use your phone?

Q7: Would you like to see the use of mobile on this course more reflective of the way you use your phone (as described in previous question)

And the last question was open ended and provided an opportunity for respondents to give information and feedback about their concerns in their own words:

Q8: What concerns if any do you have around using your mobile phone in a course like this?

In order to get deeper insights into the responses from the survey, students on both programmes were also interviewed. Two different approaches were used with the HH and CH groups. For both groups, the schedule of questions used for the survey was adapted to be used as the interview guide with clarifications asked during the course of the interview. Table 5.2 is a mapping of the question in the survey to the rephrased question used in the interviews and focus group session.

Survey Questions (From section 5.4)	Interview schedule questions
Q1, Q2	How do you use your mobile devices generally? (Including mobile phones and tablets)
Q3, Q4	What do you think about how you used your phone to support your learning as in this course?
Q6	How do you use your phone to support your learning in general?
Q5,Q7	Do you see an opportunity to use your mobile devices in formal and informal learning other than as it was used in this course?
Q8	What concerns would you have around using your own mobile device in learning contexts similar to what was done in this course?
Q8	What challenges did you encounter in using your own mobile device in this module?

With the HH group, it was not possible to get them in one place at the same time for a focus group interview, as their class sessions were held one evening a week in the evenings. Many of the students had busy daytime schedules, which made it difficult to get them in one space for a group interview. Out of the 11 participants on the module, 5 were interviewed via phone individually, and at the end of each interview, the transcript was shared with them to confirm that it accurately captured what their responses were and gave an opportunity for further comment.

The approach used with the CH group was a focus group interview comprising of all 10 students in the class, which was scheduled to be during a class period with the agreement of the lecturer. Many of the students also worked part-time, so this was the best time to have most of them attend and participate. The focus group interview approach was also more suited to the CH group as they were

more forthcoming in a group-setting where the students were more at ease about communicating their opinions.

The qualitative feedback from the 16 participants along with the survey responses from all the 21 students allowed the researcher to draw conclusions on the student experience of the UYOD approach within the processes and environment of the OOI as this implementation required infrastructural, procedural and environmental considerations as described in section 5.3.

Before commencing both the HH interviews and the CH focus group session, a brief oral overview was given of the project and participants were informed of the purpose of the interviews as a follow-up to the survey that they had completed. They were assured that their responses had no bearing on their work for the module, but the purpose was to get their input on the experience of using their mobile devices. They were also asked to complete a participant consent form as detailed in Section 3.10. With the permission of the students, all interviews were digitally recorded.

5.4.2 Data Analysis of Student Feedback

A mix of quantitative and qualitative data was gathered from the surveys, interviews and documents pertaining to the planning and preparation for the courses such as emails. Quantitative survey responses are presented in the charts to summarise the results. The qualitative data from the interviews were analysed to get a richer understanding of the results and also to probe for previously unknown themes. An overview of the coding framework used in the analysis of qualitative data was described in Section 4.1.1.1. That framework is applied here to get fuller insights into the responses from the survey. The responses and feedback gathered from both the individual interviews with the HH group and the focus group with the CH group were transcribed verbatim. Interviewees were anonymised and their responses entered into Excel.

Thereafter, initial codes or labels were attached to identify the salient point being raised by that particular response. When all of the data had been coded in this way, the codes were combined into overarching themes and a narration of this is used to address the research questions for this cycle.

In Figure 5.2 the research questions identified in Chapter Two are broken into questions that are addressed by the data sources outlined Section 4.1.1 and in Section 5.4.1.

Figure 5.2: mapping of research questions to data
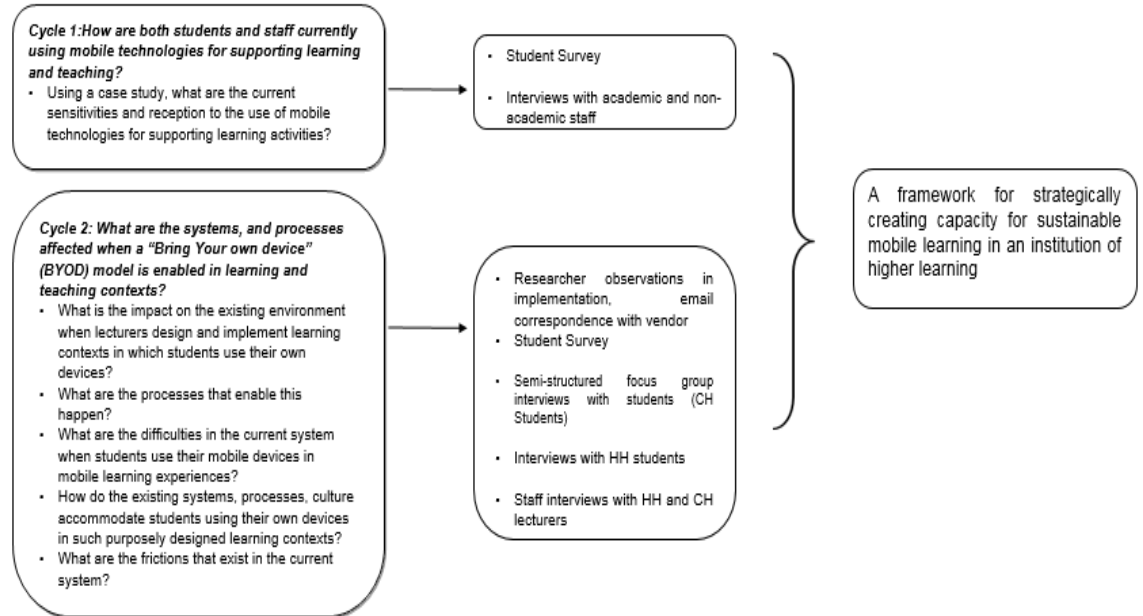
5.4.3 Ownership of Mobile Devices

For both groups, the type of mobile learning being implemented was based on the use of messages to engage in and support learning as described above and to include all students. The proposal to use messaging in both programmes assumed that most students would own a mobile device suitable for use, so the first question on the survey probed to confirm this. The responses showed that 60% of the students in the CH group had smart phones while the remaining 40% had ordinary feature phones. Tablet ownership was at 20% for the HH group and 10% for the CH group.

Figure 5.3: CH Mobile Phone ownership
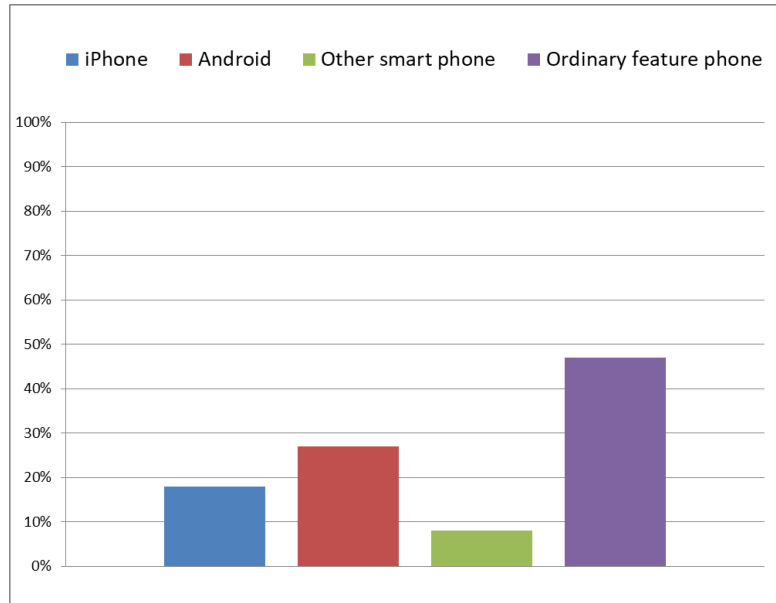
Figure 5.4: HH Mobile Phone ownership
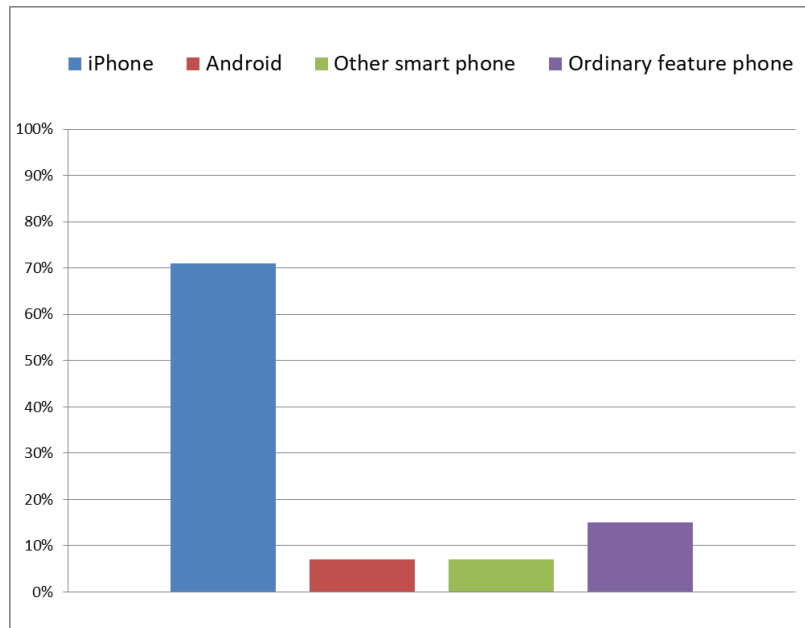
Following the confirmation that all had suitable devices, the next question aimed to gauge how they students felt about the use of messaging in the context of the application in the programme from their perspective.

5.4.4 The use of messaging in the programme

In both the CH and HH groups, over 60% of the respondents agreed that the ability to use their mobile as part of the programme was nice to have but they

wouldn't miss it if it was not used (Figures 5.5 and 5.6). Approximately 10% disagreed with this statement.

Figure 5.5: CH Students view on messaging use

The use of texts in this programme was….

Statement	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Nice to have but wouldn't miss it if it wasn't used in other such programmes.	10%	10%		60%	20%
Intrusive	80%		10%	10%	
So useful that getting work done	20%	30%	40%	10%	
Made me feel more connected	10%	10%	20%	60%	

Strongly Disagree   Disagree   Neither Agree nor Disagree   Agree   Strongly Agree
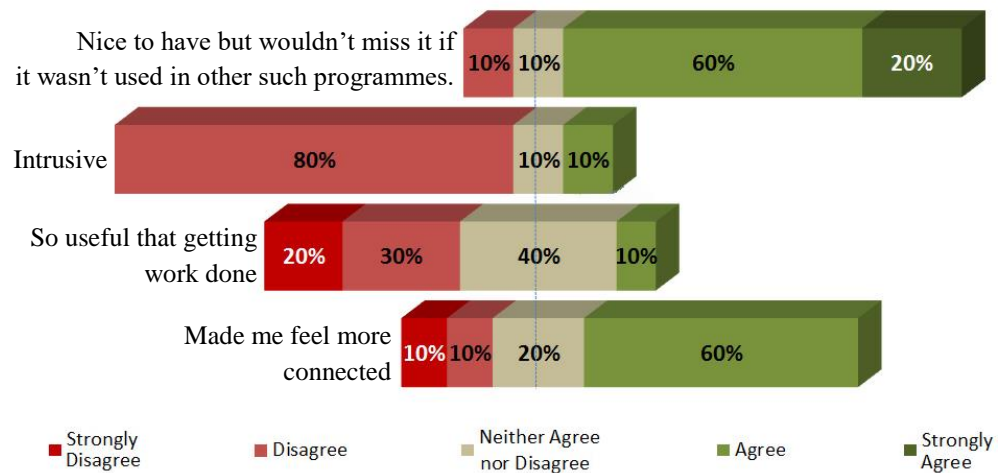
Figure 5.6: HH Students view on messaging use

The use of texts in this programme was….

Statement	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Nice to have but wouldn't miss it if it wasn't used in other such programmes.	9%	9%	9%	64%	9%
Intrusive	9%	64%	27%		
So useful that getting work done would be more difficult without it	18%	9%	55%	9%	9%
Made me feel more connected to the programme	9%	55%	27%	9%	

Strongly Disagree   Disagree   Neither Agree nor Disagree   Agree   Strongly Agree
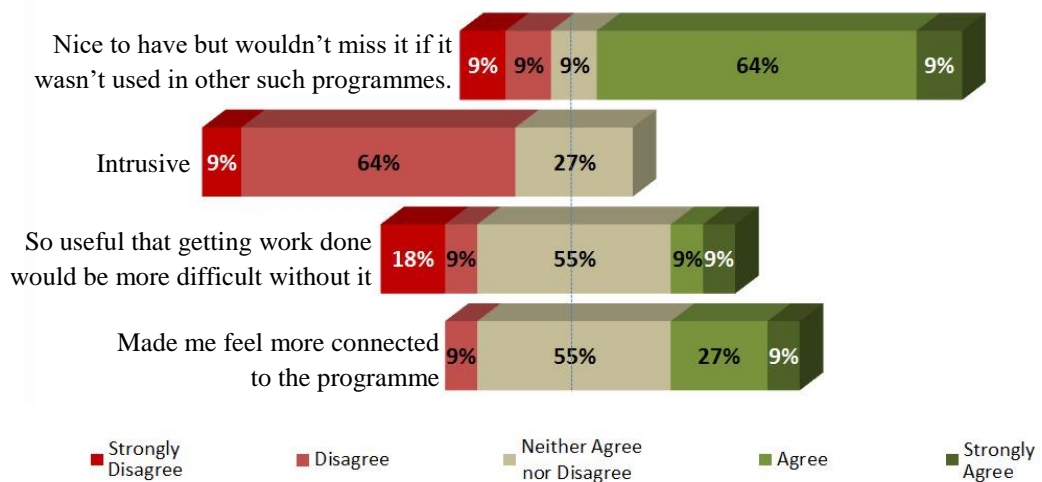
When probed on the question of the use of messaging in this course in the interviews, students indicated that while they would like to be able to use it as it had been intended, it was difficult to do so because in their classroom locations, the network connection was not reliable. According to the module delivery plan (Appendix 13), the use of mobile devices was to enable students to complete the in-class activities using their own devices. Some of CH group students sometimes waited until they got out of the class to complete the messaging task,

but then in the rush to get to their next class forgot about it until they saw the text prompt later.

For the HH students, as their tasks were not usually to be completed in class, it was highlighted in the interviews that the messaging was a more reliable and succinct way of getting information instead of having to log on to the VLE or the usual emails which tended to be much longer.

> *"It was grand. Perfect. When I get a document from the university its usually 20 pages long and really for both emails and I looked at it because it was just 140 characters. I actually liked the lack of contact. The brevity of it and it forced the bureaucratic system to be very specific and that's what I loved about it."*
> - HH Student

They felt that it was difficult to keep track of information coming on email, and the VLE, and that finding information on the VLE was difficult as there was so much. The texts were for them, a way to filter what was important. Getting a text reminded the students in the HH group that they had a task to complete or got information to them in time. It also created a sense that the work was important:

> *"The texts worked well by reminding you about the key access points."*
> - HH Student

When discussing the messages being intrusive, 60% of the students HH students and 80% of the CH students did not feel that the texts were intrusive. The 10% of students in both groups who felt that the texts were intrusive explained that they had not got enough information prior to the start of the programme to understand that they would be expected to use their phones in this manner:

"If you missed the first class, you just started to get these random texts…"
- CH Student

"Yeah I did the Chinese character, but I was not here the first day so I did not know what was going on. I got the text and it was showing messed up text"
- CH student

Information about the module for both groups had been given to students on the first day of class and they were given the option of not receiving the texts. They

had also been informed that they could withdraw at any time up until data had been collected (Section 3.10).

"I was opposed to the texts. I found it invasive and asked on 3 separate occasions for it to be stopped. They never asked permission and I feel if they had asked for permission at the start it would have been okay…"- HH Student

While students could choose not to participate in the study or receive texts, the alternative medium they use is negotiated and agreed with, it was up to the lecturer to remove them from receiving the texts. They could however simply opt out of participating in the survey and interviews with no further discussion.

While the texts were generally considered helpful, it was also pointed out that texts needed to be appropriately used or they would become intrusive:

> *"Texts used inappropriately for non-critical activities give an air of intrusion. I would add though that a reminder text for critical items was helpful during the past few months."*
>
> *- HH student*

Even though most of the students on both the CH and HH programmes appreciated the value of using their mobile devices, 64% HH and 60% CH did not agree that the use of messaging was so useful that getting work done for the course would be more difficult without it. Of the CH students, 60% felt that receiving the messages made them feel more connected to the programme while 55% of the HH group felt this way. They felt that the use of mobiles made their learning more like what they did all the time. They also expressed that they would have liked to get messaging from the OOI while away on a field trip.

> *"Typing in Chinese makes you feel like it's just a thing you do, not separate from normal stuff…"*
> *- CH Student*
>
> *"We just got back from China, it would have been nice to use mobiles to stay connected with OOI while away…"*
> *- CH Student.*

The following question continued to probe the students' perspective on the use of messaging in how it supported learning and integrated with other systems they used.

5.4.5 The use of messaging in context of learning and other systems

In considering the use of messaging in learning and other systems, the learning effectiveness is viewed as the degree to which the approach of using messaging fit the purpose for which it had been designed. For the CH group, the purpose was to enable the students to receive and respond to messages as they would in day-to-day interactions. For the HH group, the messages were a stimulus toward some action such as completing an assignment but did not require them to send back a message. Across both of the groups, the students did not feel that the use of messaging was completely seamless with other supports provided. As there was no assessment of learning based on the design approved by the lecturer, the student feedback below gives a gauge as to the effectiveness of the approach.

Figure 5.7: CH Students view on use of messaging in the context of the wider system

The use of texting to support learning as incorporated in this programme:
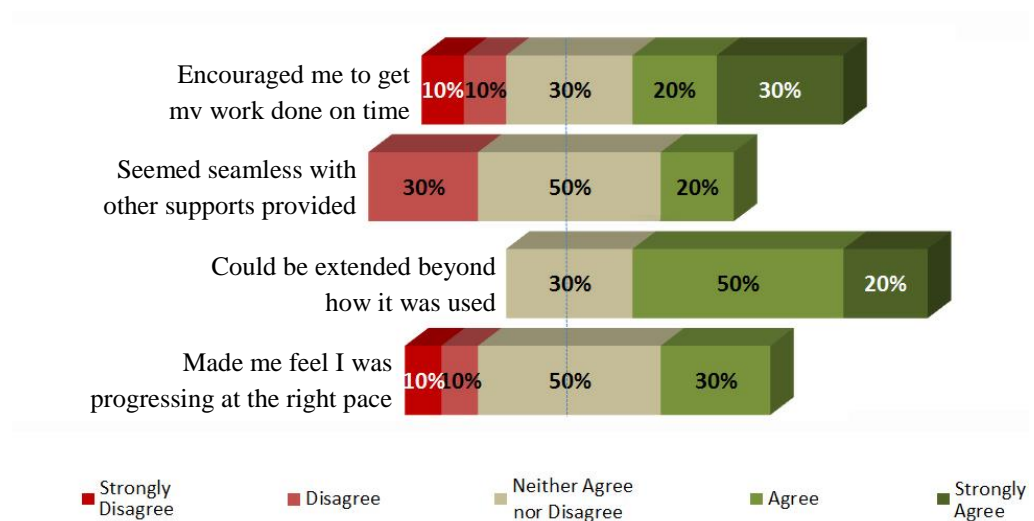
For some of the HH students, the use of texts in the face of everything else happening in the programme was a contrast to the more bureaucratic systems and processes normally encountered:

> " the whole system is very bureaucratic and when you
> question it you are just given more bureaucracy as the answer

and that becomes very frustrating For example, but when it's
'you've got to do x, y and z because that's the way we do x, y
and z in this place' that becomes very frustrating. So yes I
liked the speed of it. The use of texts in the face of everything
else made the more bureaucratic system seem friendlier.

-HH student

And for others, they wanted to see closer integration with the other systems to make the experience more usable:

"The difficulty with texts in particular is the linking back to
either an email or a Moodle activity. Texts, emails & Moodle
should all happily co-exist and support each other. If they're
disconnected then it limits the usability of the system"

- HH Student

Figure 5.8: HH Students view on use of messaging in the context of the wider system

The use of texting to support learning as incorporated in this programme:
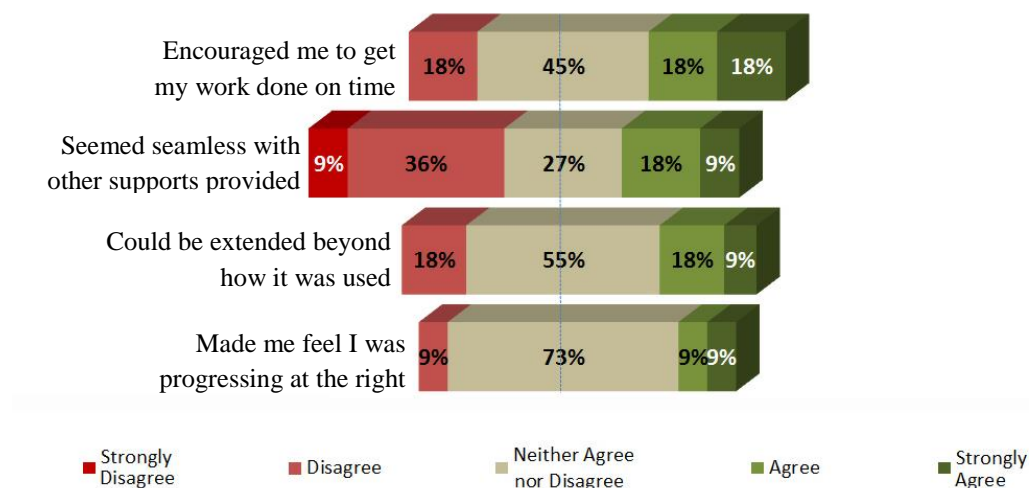
In the CH group, the messaging system was not integrated with a VLE. The students highlighted that they would like to see the use of the messaging integrated into their general experience stating that in the focus group interview. The CH students wanted to be able to use the VLE or an app similar for supporting their learning:

I think if everything was integrated into the VLE or an app type form where with a calendar as it was updated from lecturers and we will be able to look at it and view what we have to do we have to do this the week, next week and next month it will be easier because will be able to plan out what will need to do rather than relying on memory or not knowing when things are changed."- CH Student.

"So like phone notifications, there should be like, something with the deadline as has been set just like on the main system like the Chinese one was. You (referring to lecturer) set the assignment there and whatever time it is due, and make it official and we see it, even if we are not here"- CH Student.

Another student clarified that they wanted to use their phones to:

"know where you stand as a student and have an integrated thing to do this through the phone even through the VLE"

The main educational value of the approach in this particular instance of using messaging is in the simplicity and familiarity of the approach to the extent that students suggest further integration into institutional systems and other ways in which messaging can be incorporated into their learning experiences. Having considered the use of messaging, their mobile devices and other systems in the institution, the next question explores what else students may consider using their phones within a learning context.

5.4.6 Exploring further use of mobile technology to support learning

Students in both groups were able to see other ways in which they would like to see the use of their mobile phones integrated into courses. While both groups wanted to be able to reply to messages, this was stronger reflected in the HH group where 80% agreed the ability to reply was a function they wanted to use compared to approximately 40% in the CH group.

What types of functions would you like to use your mobile phone for more in a course like this?
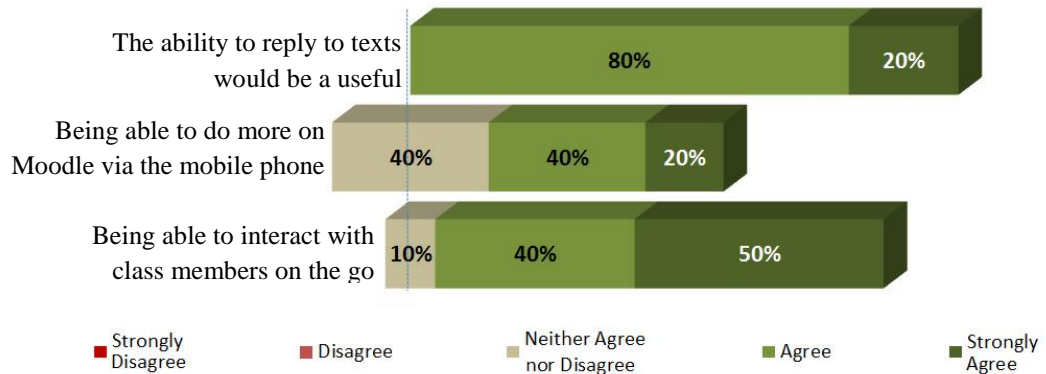
The HH group use of messaging did not facilitate receiving responses from the students. The students stated that they liked the use of text but wanted it more coordinated and integrated so that they didn't have to use both text and email. The students stated that this created two streams of information which could get confusing and suggested that rather than text and email, an integrated app where messages could be tracked easier could replace both:

> *"Text does get the message out very quickly, but, trying to locate a text even a few hours after receiving one can be very confusing. So it does get the message out but it led to a more fragmented approach leaving people wondering did I receive this information by text or by e-mail but one coordinated app will help." –HH Student*

Students in the HH group who referred to connection with others expressed that they did not feel it was necessary:

> *"To extend the ability to send and receive messages from what its being used for at the moment I think would be too much though."- HH Student*

Their reluctance can be ascribed to the fact that they felt they already had too many streams of communication with using the VLE (Moodle), email and text.

What types of functions would you like to use your mobile phone for more in a course like this?
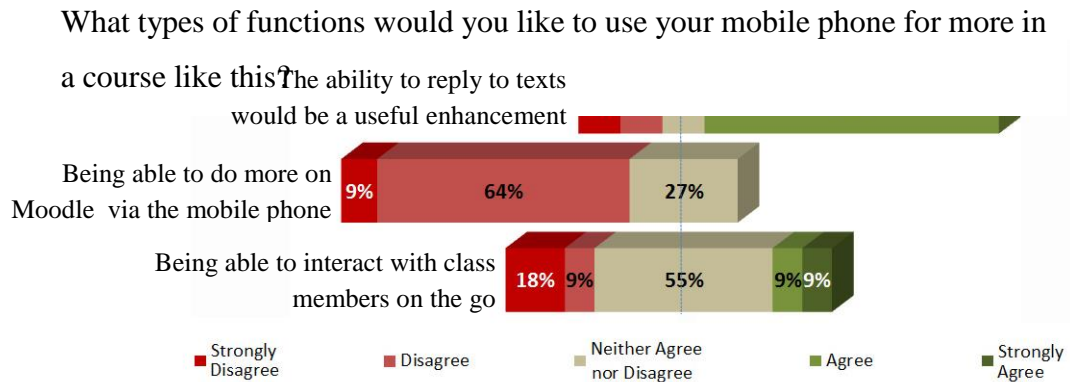
On the other hand, this theme on connecting with others from the analysis arising from how else students wanted or liked to use their phones, showed that the desire to interact with other class members was stronger in the CH group as they identified and agreed in the focus group that:

> "Maybe if we were connected to everyone in the class and
> there were some sort of connection app or group where if you
> send a message everyone gets it" –CH Student

In further exploring the use of mobile technology, students on both the CH and HH programmes were asked about the use of their mobile phones outside of the context as used in the programme:

Figure 5.11: CH Students on using their phone their phone for learning outside the course context

To support your learning outside this course context, you use your mobile phone for:
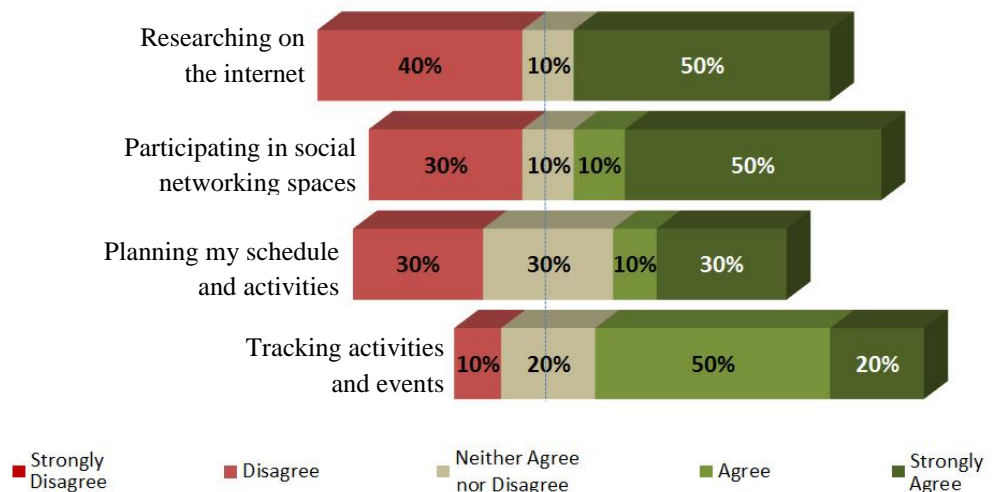
Both groups strongly agreed with using their phones for researching on the internet, participating in social networking spaces. In the use of their mobile phone for planning and scheduling their activities, and tracking activities, and events, while both groups use their phones, this was far more predominant in the HH group at approximately 80% strongly agreeing.

Figure 5.12: HH Students on using their phone their phone for learning outside the course context

To support your learning outside this course context, you use your mobile phone for:
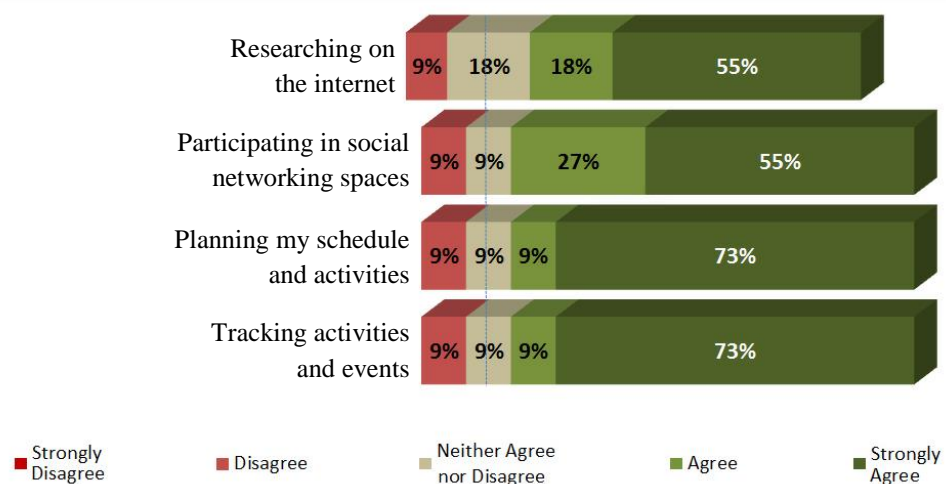
The CH students felt that the ability to use the phones for more was hampered by the WIFI connectivity on their campus:

> "... Wi-Fi is absolutely terrible and we do have few classes in
> (name of campus). Like, one of the day a class was cancelled,
> I was trying to connect to make sure it was really cancelled
> but it just would not load or anything."
> –CH Student.

It was also used by students in both groups for referencing or checking information on the internet. While doing this, the need for lecturers to be aware that students may look at content on mobile interfaces was highlighted:

> "Really I just use it for referencing. If I was in a car or on a
> train somewhere I would just take out my phone and read. I
> think one of the more helpful things would be if the Moodle
> portal had a real mobile optimised version and some of the

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> *actions required had to be done on the fly. Like filling out*
> *surveys or ticking boxes. Otherwise it's just reference*
> *material. The size of the screen affects how comfortable you*
> *feel using it as most material the lecturers put up is not mobile*
> *friendly anyway."*
> *- HH Student*

The use of mobile is not seen as separate from the rest of the infrastructure used in the OOI.

Both groups of students would like to see the use of mobile on their course more reflective of how they use their phones in researching the internet, participating in communication via social networking spaces and planning and tracking activities and schedules. However, there were 10% of students in the CH group who disagreed with this. These students felt that they needed to be convinced about the benefit of using their mobile devices in what they were learning. There were also students in this group who had ordinary feature phones rather than smart phones.

> *"It (his phone) was a smart phone but not too smart…"*
> *CH student*

> *"..What I have is like this basic phone not an iPhone, it just*
> *has normal text message so you don't see any history, I don't*
> *benefit like those on the iPhone where it shows the thread."*
> *- CH student*

Use beyond texts for these students would have to be justified for them to invest in a smart phone.

Figure 5.13: CH Students on how they would like to see the use of mobile

Would you like to see the use of mobile on this course more reflective of the way I use my phone (as described in previous question)
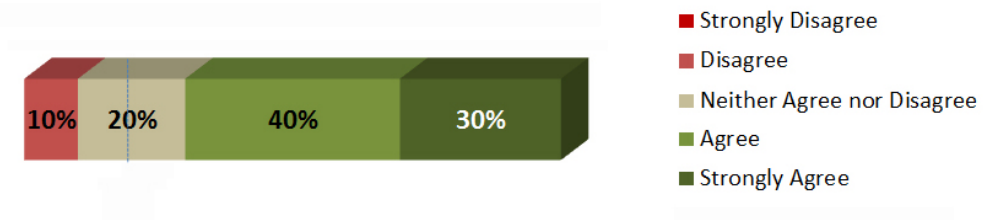
There was a stronger agreement in the HH group for the use of mobile devices to reflect their own style of use outside the programme context. They however felt that existing systems needed to be made more mobile friendly to complement the use of mobile:

> *"You would need to find a better suited mobile optimised*
> *version of Moodle and other systems that are better suited for*
> *just in time learning situations and referencing reading*
> *material." –HH Student*

Figure 5.14: HH Students on how they would like to see the use of mobile

Would you like to see the use of mobile on this course more reflective of the way I use my phone (as described in previous question)
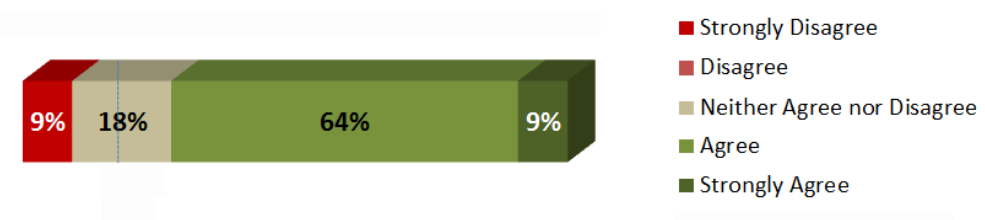
When asked what concerns they had around using their mobile phones as they had done in the course, students highlighted a number of areas of concern arising from their experiences and observations, which they felt would be inhibitors to further use of mobile technologies in learning contexts.

Confidence in technology usage

Some students were not confident in their use of technology and expressed a need for support which could be technology based:

> *"Not very good with technology in general, would have liked a tutorial that went through things like how to download and set up stuff, etc."-CH Student*

For other students, they wanted the support relating to how the technology was being used in the learning context and felt comfortable enough to figure it out after that:

> *"Like on the first day, if someone just ran through thing to show this is how you are doing it and here you go, because I can figure out technology in general." -CH Student*

As well as not being confident in their own use of technology in learning contexts, the students were also apprehensive of their lecturer's capability in using the technology and being able to support them. They did not have confidence that their lecturers could use the technology and highlighted this. Both groups expressed that they felt that both the OOI and the lecturers needed to learn to use mobile technologies before deployment for learning and teaching:

> *"Well, I think there it has come up to that point you (referring to lecturer)have to learn about this it just not the student or anything I think the lecturer need to learn so." -CH Student*

> *"... if you're going to go mobile you need to learn to walk before you can run. It (use of mobile technology) needs to be processed right through, from end to end" – HH Student*

In addition to the lack of confidence in the technological capability to use mobile devices in learning and teaching contexts, the students also identified issues around security, privacy.

Security and privacy

Students were also concerned about issues to do with security and privacy. Issues of security also included reliability of systems and the integrity of the data transmitted.

> *"...risk of not seeing the message, loss of work /homework, losing my work…"-CH Student*

> *"Need to be sure that OOI systems are secure enough…"* –
> *HH Student*

Students were also concerned about the physical security of their devices and personal information and the impact stolen information may have:

> *"I am worried whether too much personal content can be*
> *gotten if a phone is robbed."*
>
> *- CH Student*

Alongside security and privacy, students also expressed concern about being unable to participate or keep up due to not having a suitable phone or being able to get phone credit if the institutional network was not available.

> *"Texting was constricting (constricting was clarified to mean*
> *prevented from participation) because it didn't work well on*
> *my phone"* –CH Student
>
> *"I don't have a smartphone so cannot use apps"*- CH Student

5.4.7 Summary of obstacles in current system from student experience

This part of Cycle two identified what the obstacles in the current system were when students used their own devices in a UYOD learning context (Figure 5.2). It was confirmed that most students owned a mobile device and for those who did not, they needed a convincing rationale for why it would be relevant to their studies to get one. In a mobile-enabled environment, there are a number of factors which prevent students from being open to engaging in activities that require the use of their own mobile devices.

Not needing to learn to use their phones in a particular way for learning was important. They wanted to have their phone use be similar to how they used their phones in general, with no additional learning curve. The need for integration with existing systems such as email and the virtual learning environment was seen as important for a more seamless learning experience for users. Being informed about issues that affect them such as upcoming deadlines and events was also important.

Students also wanted to have the option of being able to formally be connected with other students in their classes, as long as this did not result in replication of

information. Outside of the formal learning context and institutional use, students were comfortable using their devices for researching, participating in social networking spaces and planning and scheduling their activities, but despite this, there is a need for support within the learning context.

When considering use in formal learning environments, students wanted to be sure that the type of phone they had would not be a disadvantage when completing their learning tasks. It was also pointed out that there should be considerations to manage risks such as loss of phone or data. They also had concerns about the WIFI provision in the institution, security and reliability of the systems. Security risks such as what happens to their personal information and learning data if devices are lost or stolen are also a concern.

They wanted assurances about the readiness and capabilities of the institution and their lecturers in being able to use the devices and support them in using them.

These include lack of confidence in the existing systems, processes, perceptions of adequate security and privacy in the use of their devices, as well as a questioning of the technical competence of their lecturers in managing the technology in the learning context.

In the following section the impact on the existing environment when lecturers design and implement learning contexts in which students use their own devices is evaluated by interrogating the lecturers involved in doing so and the frictions are identified.

5.5 Academic Staff Experience of SMS based Mobile Learning Intervention

Both of the lecturers received similar support from the LTTC. The HH lecturer used the web interface for the messaging system. Due to technical challenges with the handling of Chinese characters in incoming messages, the CH lecturer was provided with an android mobile phone to which the students sent their responses. Following the implementation of the messaging in their learning contexts, the lecturers were interviewed using the schedule of three questions below as a guide, with clarifying questions asked as required:

- How did the implementation of mobile learning you planned work out?   - What is your impression of the student's experience of this implementation?   - Given this experience, what would you need to continue with this type of implementation?

It is acknowledged that interpretation of the results is done through the lens of the researcher as a learning technology practitioner. As a member of the LTSC staff, the researcher had knowledge about the institutional context, including associated social and cultural issues and have used this to give further insight into the areas highlighted. To this end, verbatim quotations are used from the interviews to further clarify the point being claimed.

5.5.1 Reflecting on Implementation

Both lecturers had determined how messaging would support their teaching and had specified the purpose of using messaging in the strategy for delivering the module. The HH lecturer did not have a finalised plan at the start of the semester. This was due to having multiple guest speakers who had not sent through their content prior to the start of the term, and the order in which they would deliver was also flexible. Due to this flexibility in delivery, the messaging tool allowed the lecturer to send out notifications to alert the students when material was added to the VLE, and also to send reminders about upcoming deadlines.

For the CH lecturer, there was a finalised plan where messaging was to be used to send messages as prompts to the students who would need to respond by texting a reply that addressed the instructions in the prompt. The use of messaging in the CH context was considered to be reflective of the interactions and messages that were being created by the students. Due to obstacles with the messaging system with incoming messages in non-GMS character, a mobile device was provided by the LTSC to which the students replied. The CH lecturer felt that they would consider using it during the year abroad when students were supposed to be building their vocabulary.

Both lecturers were invited to reflect on the experience of deploying mobile technology by integrating the use of the messaging system and student owned devices as had been planned. Both also indicated that in practice, the implementation did not work out as had been planned. They felt that while the implementations of UYOD had engaged the student more, and was an appropriate application of mobile learning for their context, the obstacles encountered made the experience frustrating for the lecturers themselves as well as the students. They attributed this difficulty in part to not being familiar with the systems being used and thus in trying to figure it out creating a larger task when they had to do it on their own:

> *"...Issues with Moodle (the VLE) have been a big frustration which really was largely to do with lack of familiarity in using them as much by myself and spending enough time to allocate the headspace to understanding why it is not working. And in terms of the text system, we started off well, and then it was taking so long to complete it each time.*
> *–HH*

The initial messages were set up under the guidance of the researcher in their capacity of Learning Technologist and when the lecturer was left to work on their own, they found it difficult to do so.

However, the obstacles to using the technology extended beyond the lecturer's familiarity with the systems and these are outlined in the following sections.

5.5.2 Technological challenges and support

Both lecturers questioned the suitability of their hardware for use in general and the lack of adequate access to more up to date technologies to properly engage in the type of activities such as that in the study.

> *"The technology is my biggest challenge. Sometimes, we need to install special software, and then it works only outside of the OOI's network"- CH*

Students had reported, and the lecturer had confirmed, that some apps such as keyboard apps integrated into messaging apps that they wanted to use such as WeChat did not work on the OOI's network except when students used their 3G

data. WeChat was the preferred messaging platform for use by the CH lecturer, but due to these obstacles in the firewall settings which prevented WeChat, WhatsApp was used instead. There were also obstacles with integrating the messaging system into the VLE as it was not enabled for single sign-on- a process which enables the user to log into one system and seamlessly transition into another.

> *"The text system would not integrate with others ("Others" refers to the other systems used such as the VLE, google calendar) so it therefore became yet other task and so managing it outside of Moodle generated an administrative overheard, for example for a student who wanted to be unenrolled from all communication, but that was more of a personal issue…"* HH

The ideal use scenario would be that while in the VLE, there was the ability to specify the text to be sent in support of each learning item. Being able to use the messaging system while within the VLE and administer users such as exempting students from particular messages would have been preferred. This prevents the situation where due to having to juggle the multiple systems, removing a student as requested from receiving the messaging messages, got forgotten.

5.5.3 Organisational structural and cultural capacity

In both cases, the lecturers did not feel they had enough support from their departments for engaging in using mobile technologies or other technological enhancements. The CH lecturer identified that there was a tendency to stick with how the subject had always been taught and gave an example stating that:

> *" I made an application. I said I needed a laptop to demonstrate to students and to explore different things, I didn't get it because my subject is language and we only use old ways of teaching."* CH

They wanted to be able to explore different teaching methods in the classroom and needed a laptop, as the tools for language learning were not installed on the podium computer. They wanted to be able to demonstrate learning to draw Chinese characters by using a laptop with a drawing pad connected. However, this request was refused. As well as a tendency to resist change, it was also

identified that the OOI technology was often not as up to date with mobile technology. This lack of cohesiveness can lead to frustrating experiences for students and lecturers:

> *"the promise of the mobile technology is wonderful but at the moment a lot of the OOI technology are years behind so it still is a fairly big overhead and most students end up getting very frustrated and pass that frustration to the lecturers."-HH*

From an observation as an LTSC staff member, it seemed that staff were not often aware that there were requirements that needed to be considered to use the mobile technologies within the infrastructure and that IT needed sufficient time to prepare- often as long as a full semester depending on the complexity of the project. As described in Section 5.1.2, the institution adopted an ITIL framework approach to the provision of IT services and had published an IT service catalogue (Appendix 16) which lists the specification for IT services for eLearning as shown in Figure 5.15.

Figure 5.15: Specification of IT services for eLearning in Service Catalogue

IT Services for e-learning	Installation, development & ongoing maintenance of systems in support of e-learning
	Identification of business requirements
	Provision of support documentation
	Backup and recovery of business data
	Provision of performance reports
	Testing and deployment of system upgrades
	Extended support for peak-season business activities

Within this specification, there is no provision for mobile technology such as incorporating student owned devices, use of apps on the student own phones, and provision of support for this. There is also no communication to academic staff to invite the submission of requests or a formal process of receiving requests. Instead, these are treated on a case by case basis by the LTSC and a "best effort" approach is adopted to accomplish the learning goals proposed by the lecturer. This approach leads to a lack of cohesiveness in the learning experience, but also creates a burden of administering multiple systems.

As a result of the lack of adequate support, both lecturers indicated that they tried to encourage the students to take more ownership of their learning and be more independent by searching for appropriate apps and software themselves.

*"I was talking to one of my colleagues, earlier he also think
it's a great idea to let the students try things, so he also urges
the students to by iPhone because iPhone has the Chinese
software inside already, he also asks his students to download
some useful Chinese apps"* –CH

Leaving the onus on the student to try new applications to support their learning by themselves raised concerns about the financial implications and considerations of equity and equality.

5.5.4 Financial Constraints and considerations of equity and equality

Both lecturers were concerned about the financial implications of expecting students to have devices capable of being used in learning situations, but acknowledged that becoming competent with using the devices to access relevant and timely data and information was an important aspect of the student's learning experience- especially with the CH students who were full time undergraduate students:

*" I think it's a good idea to use mobile phones because
nowadays everyone has a mobile phone, but it depends the
kind of mobile phone you have, 12 students in my class, but
only 4 or 5 of them has an iPhone, I guess we cannot give the
students the same phone, we cannot supply the phones?"- CH*

As the CH students spent a year in China, their lecturer also felt that being prepared to use mobile technology opens up more options of support and learning for them:

*"Both using the desktop and mobile are I think, equally
important because when they go to China or Taiwan for
studying for a year, it's useful to contact other people, and
using text to communicate in Chinese."- CH*

Both of the lecturers felt that messaging was an effective way to accomplish their plans for delivering their modules, however, this was provided the issues they experienced were addressed.

5.5.5 Summary of Academic Staff Experience of existing systems, process and culture

Within the existing system, using mobile technologies within learning and teaching contexts requires additional administrative tasks due to the lack of systems integration and an institution-wide approach to administering systems. Without a process to specify software to be enabled through the firewall when needed, lecturers have to find alternatives.

Again, within the existing organisational structure and culture, processes are not always clear. Lecturers do not feel supported to engage in using mobile technologies, as there is a tendency to stick to what works in certain cases and not risk working outside of the institution's range of technology which may not be up to date for the desired application.

The specification of support provision by the institution does not include mobile technologies or a UYOD mobile device implementation approach in learning, so these are viewed as fringe activities supported by the LTSC. With no specified support available for academic staff or students to adopting a UYOD approach in learning, lecturers tend to make suggestions to students as to what apps to get and use to enhance their learning. However, while these are not formal learning experiences, there is a concern that this approach will favour students who can afford to get the applications on their phones and therefore introduce inequity into the learning experience.

5.6 Introducing the Guidelines

This section summarises the study so far and discusses how the guidelines have evolved as a response to the activities in this cycle. Cycle one considered whether there was interest in adopting UYOD in the OOI and identified the potential value and obstacles for staff and students. The obstacles identified were proposed as the elements to be considered when evaluating institutional capacity for mobile learning (figure 4.14) and comprised of three main categories. The categories identified were: the concerns of people who would be impacted as the stakeholders in the use of the mobile technology, the processes these stakeholders were engaged in as part of participating in or supporting learning and teaching as well as the environment within which they operated including

the physical environment and IT systems or infrastructure within which the mobile technology would need to operate.

The research question addressed in cycle two explored the three categories of the obstacles while engaging in the deployment of two UYOD implementations, to determine the capacity in the OOI systems, and processes affected when a Use Your-Own-Device" (UYOD) model is enabled in learning and teaching contexts. This activity evaluated the institutional capacity when these implementations were deployed and recorded the tensions that showed up in the institution's systems and processes that were affected. Thereby identifying the policy and practice gaps to enable an institution respond to the obstacles identified in cycle one.

From the student experiences described in Section 5.4.3, it was noted that there were diverse types of mobile phones and devices used by students. When these were brought into the learning environment as was done in both the CH and HH cases, it was highlighted that the plan to integrate them needs to consider how this diversity in devices can be supported in a way that ensures no student is at a disadvantage due to their technology. The process of integrating student owned devices to use within the institution's systems also needs to consider that the devices are personal. Due to this personal nature of mobile device ownership, the associated use has a culture of personalisation and expectation of privacy associated with it, which makes the integration different from other technologies such as laptops. From the researcher's perspective, the biggest surprise was that students wanted to be reassured about the value of using their own devices as part of learning experiences even though they already owned them and were usually experienced in using them.

In its simplest form, mobile learning is simply being able to send and receive messages as has been done in Cycle two of this research. Having engaged in the use of messaging in their learning contexts, participants are able to identify the limitations of the text form and seek to use more advanced applications such as accessing and exchanging multimedia, connecting with others in a structured and directed manner and having access to information on demand (pull or push). They begin to think about using more functions of the mobile device to complement learning and teaching

While most students own smart phones, there are still some who don't and for them, it is important that the issues around equity and equality are carefully considered. Information about the students who will take a module needs to be determined before the module starts. Additionally, the information about the need to own a suitable device to complete the learning activities in the course, as well as any applications required should be made available along with the course information to enable students to prepare. There should also be provision by the OOI to cater to students who are unable to afford the devices or have lost their devices in the course of the semester- whether via loan scheme or a payment plan. Higher education institutions can partner with network providers to provide schemes which students can avail of; an example of one of such schemes being the O2 student discount scheme which gives discounts on devices and plans. While handsets do not need to be specified, narrowing and specifying the range of operating systems that are supported ensures that students are guided in their choices of devices.

This is alongside the issues concerning the technology infrastructure capability to adopt the use of personally owned mobile devices. As was pointed out in the pilot study in Cycle one, buying a mobile device and even knowing how to use it is not sufficient to ensure that lecturers are in a position to carry out mobile learning activities. The environment within which the mobile devices are used, and the learning and teaching activities that occur need to be able to accommodate and facilitate them by putting in place the mechanisms that address the issues raised in sections 5.4.7 and 5.5.4. The provision of the technologies that enable mobile learning has to be a dynamic and integrated process involving of stakeholders who may be at different stages in the adoption process.

The technology in question (mobile devices) is personal, so it brings added dimensions such as social, cultural and psychological which present some challenges to existing IT infrastructure and comes with a significant shift in mind-set in the ways things are. This shift gives a chance to examine the relationship between policy, theory and practice in technology implementation. The expectations of students as well as the practices of the staff are determined by the prevailing culture of the institution and how the existing environment supports or inhibits innovative practices. At this time, while the activities were

supported by some institution owned systems, there was no coherent or overarching support for the use of mobile technologies. This meant that for the lecturers who engaged in the use of these technologies, it was seen as a fringe activity rather than a mainstream one aligned to the institution's goals. This is demonstrated in how the obstacles with integrating and aligning the messaging system with registration and the virtual learning environments manifested in the implementations and made the experience difficult to manage from the lecturer's perspective.

In Cycle two, the barriers to adoption of mobile learning were confirmed as those previously identified as lack of expertise in mobile instructional design, lack of awareness of the full scope of costs, benefits, and risks, and lastly conflicting accountabilities, interests, and procedures among content stakeholders, business budget holders and IT implementers (Woodill, 2010). Referring to the terms in Roger's theory of DOI described in Figure 5.1 in section 5.1.1, the relative advantage of the mobile technologies while recognised, is not seen as viable because of its perceived instability.

> *"I would have liked to be able to get the feedback in class*
> *through the mobile device because at the moment again it is a*
> *pain in the b*** for the guys, it was always one of those*
> *things, but our connectivity even on the mobile network is bad*
> *in the rooms we use" – HH*

The compatibility of innovation using mobile technologies with the values, experiences and needs of potential adopters needs to be further clarified. While the complexity will vary depending on the discipline within which mobile technology and individually owned devices are to be used, the extent to which the enabling environment can be experimented with and adjusted will make a significant difference in how the technology is adopted for use. The observability of all of these by means of easy and open communication channels, as well as support from both official and by the work of early adopters need to be an aspect of the process of creating capacity for mobile learning. ***How can policy and practice in an institutional context for UYOD respond to these obstacles?***

The capacity in the systems and processes affected are an indication of the policy and practice response needs in the institution. The gaps in these areas were

identified by deploying the two instances of UYOD model in learning and teaching and observing of the infrastructural preparations and taking feedback from the student and staff experiences. The outline of work presented in the following section proposes guidelines to provide support for how an institution may start to identify these issues in itself and provide structures to address them. The outline of activity captures how the diffusion of innovation is used as a basis for guiding the implementation against the backdrop of the organisational culture as an important factor in creating an enabling environment. This is presented in the proposed workstreams for creating mobile learning capacity outlined in the following section.

5.6.1 Guidelines for creating mobile learning capacity

The guidelines are a response proposed to address the themes raised in the results from this cycle. The activities in the guidelines are aimed at providing adequate technical support for both students and academic staff, suitable infrastructure, appropriate accountability pathways for financial and budgetary considerations. The activities which are based on the DOI model as has been proposed in Section 2.3.2 and applied in Section 5.1 are categorised under the workstreams with the goals of:

- Creating a community to identify the players to be engaged, the activities to be investigated (generating possible use cases,
- Identifying organisational systems and processes to be impacted,
- and
- Determining a programme to scale out the output.

Under these workstreams, the institution can define specific tasks to accomplish the associated goals. These workstream goals are now further explained:

5.6.1.1 Creating a community

To drive organised and trackable activity around UYOD, the creation of a community of practice provides a group of users who will utilise mobile technologies in their practice. This creation of a community stimulates the conversation within the institution on what is needed to incorporate UYOD in learning and teaching settings. A community of practice here is a group of people who share an interest in using mobile technologies and explore this interest by interacting regularly to grow their knowledge and expertise (Wenger et al., 2002,

p. 4). Such communities provide safe spaces for practice and observation without pressure to be immediately active as a contributor.

The creation of this communities starts with the identification of various categories of users, including a core group of change agents who may also act as gatekeepers to the community. The change agents are people who may also be innovators but more importantly, they are advocates about the innovation (Section 5.2.1). They are knowledgeable of the prevailing culture, are able to influence practitioners and identify innovators as well as early adopters in the OOI. Change agents can work with aides who are members of the end user community who can identify directly with their peers. The change-agents and their aides act as recruiters and advocates about using mobile technologies. Such change agents should be empowered to lead the communities of practice and create spaces from which they lead and influence. The change agents are also able to inform other categories of activities because they understand the needs of the end user community. Figure 5.16 illustrates the key steps of the creation of this community.

Figure 5.16: Community creation
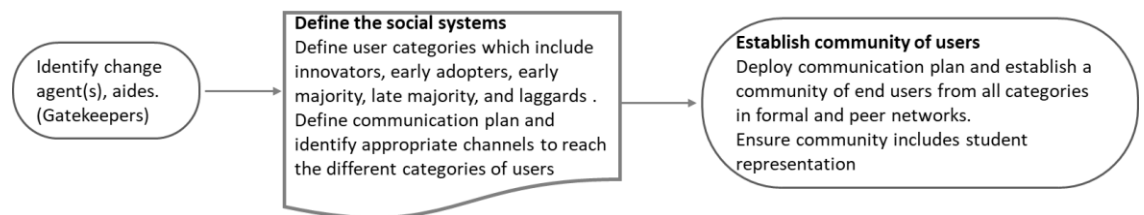
As a result of the engagement in the community of practice, the organisational systems and processes likely to be affected can be identified, specified, and then further validated by the community which consisted of different categories of users from all stakeholder groups. The change agents and their aides with support from the institution use a targeted communication plan through channels to target these formal and centralised as well as less formal peer networks.

Communication channels are established to include and reach across disciplines and user groups. Regardless of whether a staff member is an *innovator* or a *laggard* as defined in Table 2.2 (Rogers, 2003), they should be aware of the institution's capacity regarding mobile technology use. Examples include regular updates through faculty and departmental leadership, workshops to focus on various aspects of using mobile technology in learning and teaching, issues around ensuring ethical and equitable incorporation of UYOD considering the

personal nature of the devices, providing opportunities for innovators to access early trials and have room to experiment with recognition of their work. To encourage participation of innovators in the community, incentives may be offered as has been suggested in Section 4.2.2.6. Such incentives may be used to provide support that minimizes the impact on existing workload (Section 4.2.3.6).

When the community of users is being established, in order to ensure that the end user's perspective is considered, it is important that this community has a representation or engagement with the student perspective. This will ensure that the concerns raised by students in Section 5.4 can be addressed and as the technologies continue to evolve, this type of engagement is an ongoing exercise.

This range of engagement described in the establishment of a community leads to the next phase of identifying where and how the academic staff want to be able to incorporate UYOD in their teaching and the processes and systems likely to be impacted as well as the perspective of students on using their personal devices. It is also the role of the change agent in this phase is to ensure that the range of uses identified takes into account emerging trends and future possibilities to ensure that the changes required in the systems and processes remain fit for purpose into the future. The catalogue of use cases for mobile technologies is important because it showcases the spectrum of learning activities that can be implemented as mobile learning. Use cases can be based on the affordances of the devices (Figure 2.1) and recognise the classifications of mobile learning proposed in Section 2.3.3. The classifications were based on the affordance of the phone and go beyond access to content and information: Mobile enabled platform; messaging; social media; mobile book library; GPS and native mobile apps. The use cases generated by the innovators are a showcase of possibilities which can be used by others interested in exploring UYOD in their practice (Section 4.2.3.5).

5.6.1.2 Specifying organisational systems and processes likely to be affected.

The existence of the community of practice facilitates conversations and activities that provide a library of possible use cases as the members of the community pilot trials of UYOD in learning which capture a range of uses, which can then be explored to in a variety of activities to identify the systems and processes impacted when creating a mobile learning enabled environment

to support UYOD (Figure 5.17). Both successful and non-successful pilots become a source of learning and the library of use cases shows how UYOD had been incorporated. This provides a practical examples and information for staff (Section 4.2.3.5) and reassurance for students that the use of UYOD would be purposeful, informed by practice and supported by the OOI (Sections 4.2.4.3 and 4.2.4.6, 5.5.3) which help to justify UYOD as another way they partake in their learning experience with the OOI (Section 5.4.6.). This phase is dependent on recognising the mobility of users, optimising the user experiences, productivity and recognising boundaries when using personal devices.

The systems and processes that will be affected are not always obvious from the beginning, but often become visible when a particular use case for mobile technology use is explored as was experienced when preparing for the use of UYOD (Section 5.3) and as highlighted by the lecturers in Section 5.5.3. To ensure that UYOD is not viewed as a fringe activity, there should be an alignment with the institution's organisational goals. And following such alignment, identification of procedures to examine the uses cases to be explored and facilitate the related activities on the continuum of enabling them as well taking into consideration the feedback from students as active users of mobile devices for supporting their own learning. The illustration of the activities in the workstreams is thus expanded as shown in Figure 5.17 to include:

a. Identifying possible use cases for UYOD application and conducting an analysis to identify the systems and processes that are likely to be affected in order to incorporate UYOD. These include platforms and applications within the institution, departmental functions and roles to be involved, processes and workflows, physical space considerations, and hardware or other equipment. The impact on existing workload is also considered (Sections 4.2.3.7; 5.5.3)

b. Identifying and defining external forces and determining the degree of response and engagement.

c. Defining the value of implementation of a mobile enabled environment in the context of the organisation's strategic goals and objectives.

Figure 5.17: Assessing organisational systems and processes

Identify change agent(s), aides. (Gatekeepers)

Define the social systems
Define user categories which include innovators, early adopters, early majority, late majority, and laggards . Define communication plan and identify appropriate channels to reach the different categories of users

Establish community of users
Deploy communication plan and establish a community of end users from all categories in formal and peer networks.
Ensure community includes student representation

Determine UYOD range of use
Engage with community to generate possibilities for deploying UYOD in practice (use cases)
Explore how students current use their devices

Assessing Organisation systems and processes
Identify the challenges and roadblocks to the use cases identified.
Consider external forces such as evolving technology and determine how to account for this in any proposed changes
Situate the value of a UYOD environment within the terms of the organisation's strategic goals and objectives
Address student concerns with using their personal mobile devices

Align with OOI strategic goals.
Relate the use cases to the organisational goals to define value to all stakeholder

As the community of users grows, the continuum will continue to expand as the range of uses increases. Managing how the existing systems and infrastructure respond and ensuring that the right skills and knowledge are available to provide support and guidance, as well as foster change-friendly culture within the institution requires a series of activities which will make up a programme for creating capacity in response to issues highlighted in both the students and staff experiences (Section 5.4 and Section 5.5).

5.6.1.3 Determine a programme for capacity creation.

Since this study was a small controlled group, the communication and ongoing support was coordinated by the researcher as a practitioner. In order to scale this to the wider organisational context, it is proposed that there should be a workstream to include a programme for building capacity to support the wider population. The programme for capacity creation for mobile learning should utilise the communication plan, as well as the channels through which the communication will continue to be disseminated to specified audiences. There should also be specifications for incorporating user owned mobile devices on to the institution's systems based on pre-set criteria that define the range of devices supported and other measures aimed at ensuring appropriate IT security and data protection. The components of the programme for capacity creation include:

a. How devices are incorporated into the organisation's systems and processes as well as defining the expectations around their use. This includes defining policies and guidelines that specify expectations around ownership of devices, provision of connectivity for learning support, access to data on the personal devices and outline the privacy and security expectations relating to using personal devices as part of formal learning activities, and when integrated into wider institutional infrastructure and processes.

b. Defined process for how to scale the knowledge, skills and expertise to meet the needs of the communities of users identified. This should include the training and support channels. (Section 5.4.6)

c. Defined support pathways for academics who integrate mobile technology use into their teaching practices that include how to support their students, as well as guidance for the instructional and

technical design of learning initiatives. From the student viewpoint it is established that while they are familiar with their devices, they are not always proficient or confident (Section 5.4.6) in using them in learning contexts.

These activities are added to the updated illustration as shown in Figure 5.18.

5.7 Conclusion of Cycle two and next steps

The activities described in the workstreams (5.6.1.1; 5.6.1.2; and 5.6.1.3) provide guidelines on how a mobile enabled environment for UYOD can be created in a higher education institution. However, they are a response to the issues raised by interrogating a subset of the institution. To apply any conclusions across the organisations' wider community of users and make the logical generalisations as described in Section 3.5.3. the wider community of staff and student are engaged. Additionally, to get leadership buy-in, the areas where leadership at an organisational level is required must be specified. In the next chapter, Cycle three of this study will explore the leadership requirements by presenting the context of the wider organisation through engagement with the broader institutional community and identifying where there is a lack of leadership input.

Figure 5.18: Creating Capacity

Identify change agent(s), aides. (Gatekeepers)

Define the social systems
Define user categories which include innovators, early adopters, early majority, late majority, and laggards . Define communication plan and identify appropriate channels to reach the different categories of users

Establish community of users
Deploy communication plan and establish a community of end users from all categories in formal and peer networks.
Ensure community includes student representation

Align with OOI strategic goals.
Relate the use cases to the organisational goals to define value to all stakeholder

Assessing Organisation systems and processes
Identify the challenges and roadblocks to the use cases identified.
Consider external forces such as evolving technology and determine how to account for this in any proposed changes
Situate the value of a UYOD environment within the terms of the organisation's strategic goals and objectives
Address student concerns with using their personal mobile devices

Determine UYOD range of use
Engage with community to generate possibilities for deploying UYOD in practice (use cases)
Explore how students current use their devices

Creating Capacity
Specification of how to incorporate user owned devices, enabling policies and guidelines
Establishing support and learning pathways.

6. Design Research Cycle Three: Extrapolating by wider Institutional engagement

Introduction

Cycle one (Chapter Four) of this study established that there was interest in the OOI in using UYOD and identified the obstacles in deploying a mobile learning initiative that employed a UYOD approach in learning and teaching. By interrogating a sample of stakeholders using surveys and interviews, a perspective for the current institutional appetite for using mobile technologies in learning and teaching was established, and areas of obstacles in the systems and processes were identified. This led to further investigation to evaluate institutional capacity and the impact on existing systems and processes in the activities of Cycle two.

At the end of Cycle one, the obstacles were categorised into three areas of focus for further examination to determine the response capacity of the OOI. The first of these categories highlights the actions of the academic staff who would be integrating the mobile technologies in their practice, students who are the end users and staff from IT and the LTSC who would have to directly support lecturers and students in their use of the mobile technologies. The second category highlights the impacts of using mobile technologies in learning, teaching, administration and support as processes in the OOI. The third category encompasses the technological and physical environment within which the people and processes operate. These three categories are the foundation of the guidelines for responding as proposed at the end of Cycle two.

Cycle two (Chapter Five), explored what the capacity of the OOI systems and processes are for when a Use-Your-Own-Device (UYOD) model is enabled in learning and teaching contexts. A response to the issues raised in Cycle one was proposed as guidelines for building capacity. In Cycle two, the theory of Diffusion Of Innovation (DOI) (Rogers, 2003) and recognition of the role of organisational culture (Hofstede, 2005) in how technology is adopted in an organisation are used to ground the activities in how they are applied to specify the roles of the players such as the research participants and the LTSC as used for recruitment of participants in Section 5.2.1. The exploration of institutional

capacity for using UYOD in mobile learning was done by examining two implementations of messaging being used to support learning and incorporating the students' phones using a platform that had been purchased by the OOI but had not been fully integrated into its infrastructure.

Cycle two ended by reflecting on the two messaging implementations. A response to the challenges and issues identified in the applications of messaging usage in learning and teaching contexts was proposed as a set of guidelines to plan how to create UYOD enabled mobile learning environment. These guidelines proposed outline purposeful actions to counter the challenges and issues raised identified:

- Creating a community of different types of users and identifying members with the key role of change agents and aides who also act as gatekeepers and evangelists.
- Continuously identifying and specifying the systems and processes impacted by the use of individually owned mobile devices in learning contexts and having the plan to manage such impacts.
- Determining a programme for capacity creation that specifies how to incorporate user owned devices, enable policies and establish support pathways.

So far, the research has engaged with participants representing stakeholders in learning and teaching in the OOI and focused on staff who are identified in the guidelines as innovators, early adopters, and change agents. Since the guidelines proposed address the OOI at an organisational level, they require the buy-in of the OOI leadership and the wider organisation to ensure that the use of UYOD for mobile learning can be sustained post-adoption.

In the current chapter, Cycle three activities will explore UYOD in mobile learning with the wider community in the OOI, to ensure that the guidelines proposed are reflective of the broader community beyond the participants in cycles one and two and determine the leadership requirements from an organisational perspective. In this cycle, there are three phases of questioning via the use of widely distributed surveys which engage a wide range of teaching staff and students who are representative of a higher education institution such as the OOI. Lastly, the perspectives of groups of OOI academic staff leaders, management and senior leadership functions are explored by using

questionnaires and interviews. At the end of the cycle, the emerging guidelines that were suggested in Chapter Five are revised with the reflections from the analysed data of Cycle three.

6.1. Broader Institutional Staff Engagement

In concluding Chapter Five, the guidelines for creating a UYOD mobile learning enhanced environment were suggested in response to the themes of obstacles that had been identified. However, it is acknowledged that organisational wide changes at strategic levels which impact the culture (how things are done and how members of the community interact) need the buy-in of both leadership and the community of target users. Additionally, by interrogating a wider audience of end users from the OOI as a sample, this research can draw inferences that would be relevant to other institutions.

Cycle three now aims to determine the leadership requirements from an institution wide perspective while engaging with the wider community of OOI staff and students. The methods described in the following section are employed to gather the input and insights from academic staff and students across the OOI as well as representatives from the executive leadership and IT management.

6.2. Methods for Data Collection and Analysis

A variety of data collection methods were used to to get the wider organisational input for this cycle. This process of data collection involved getting input from various stakeholders in the institution. The data from each of the sources were analysed in their categories to maintain the perspectives of each of the viewpoints.

6.2.1. Academic Staff Questionnaire

The survey to derive data about use of mobile technologies was sent to a random sample of OOI academic staff. This random sample was acquired by sending the survey to all the academic staff who had completed a preceding survey conducted by the LTSC staff so were known to be in active duty (not on sabbatical, leave, or absent from campus).

In Section 1.1, the LTSC was described as a department in the OOI whose remit is enabling and supporting the use of technology in learning and teaching throughout the institution. As part of the activities to fulfil its remit, the LTSC

staff provide support for innovation in learning and teaching such as the mobile learning pilots in Cycles one and two of this research. The LTSC also facilitate workshops and seminars in the use of technologies and work as consultants to academic staff to support the optimised use of technologies to enhance learning in their disciplines.

Between February and April 2013, an institutional evaluation was carried out to ascertain the awareness and level of usage of technology. The evaluation while not a part of this research provided an initial contact point to introduce the mobile survey and to get a sample for this phase of Cycle three.

Sampling Approach

Being aware of high levels of online survey fatigue and the positive effect of direct communication, the staff in the LTSC made initial contact with academic staff in the OOI directly by phone by using the internal call directory. This initial phone contact was conducted by the team of staff in the LTSC (including the researcher in their role as Learning technologist) in order to ensure that all staff were contacted at least once. With their permission, their anonymous responses to the questions (Appendix 7a) were recorded in a database. The sample generated by this contact method was random and resulted in recorded responses from 18% of the 1200 academic staff in the OOI who were available to take the call and included participants from all the academic disciplines in the OOI.

At the end of each phone call, the interviewee was informed that there would be a further online survey focusing on their use of mobile technologies (Appendix 7b) sent as a follow-up to the telephone survey just completed. The initial phone contact survey while not part of this research, became a warm up for the survey for this research as participants knew the context by the time they received the survey on mobile technologies in learning and teaching.

The online survey was used to get truly open and honest and anonymous responses rather than speaking to the LTSC staff. The online survey was deliberately kept short as a follow-up to the more detailed evaluation work carried out by the LTSC. The three questions in the survey focused on getting a broader insight into the needs of the lecturers on the use of technology in general and mobile technology for teaching in particular. The responses received form the basis for the staff perspective presented in this Cycle three.

Of the 219 lecturers surveyed on the phone, approximately 51% responded to the follow-up survey focused on mobile technology use. The survey was open from February 2013 until April 2013. After the survey had been closed, the responses were downloaded into Excel. The data analysis steps of sorting, indexing, and subsequently interpretation of the data were carried out to derive meaning to the themes which emerged. All responses were encoded with descriptive codes as illustrated in Figure 6.1 to identify the respondent's concern as related to the use of mobile technologies. The data analysed included all viewpoints as expressed by the respondents. These codes were subsequently grouped to form themes to describe the narrative as representing the perspective of the academic staff as they responded to the questions in the survey.

Figure 6.1: Example of Coding

Responses	code assigned						
Regular courses in using ICT such as Webcourses, particularly its more complex aspects	navigating existing structures	exploring innovative uses of technology					timing of available support
Nothing in particular! I have always found that support was available from the LTSC when required					satisfied		
I don't Know Yet?A better faster computer would help.			uncertain	hardware		communication	
Happy with the existing support					satisfied		
Nothing in particular as traning courses are already regularly offered					satisfied		regularity of training courses
Identifying potentially useful technologies and techniques, and training in their use. Advice and help when needed with the existing structures.	navigating existing structures	guidance in exploring innovative uses of technology					
More on-going training on the use of technology, and one-to-one for specific requests after completion of basic training traing					more personalised support	communication	

By using the coding framework, all responses are coded and reflected in the narrative including positive and negative viewpoints. Verbatim quotes are used to illustrate the theme as well as use the interviewee's voice as evidence for the interpretation being presented.

The first of these questions was required to be included in fulfilment of ethical criteria as explained in sections 3.10.1 and 3.10.2:

1. I consent to my anonymous responses here being used within reports, and as part of other publications, about the usage of learning technologies. (If you do not consent to this, then please do not continue with this 3-question survey).

Responses to all the questions below allowed freeform text entry to allow for as much input as desired by the respondents.

The second question aimed to establish the awareness of the breath of support offered by the LTSC and getting insight into the general perception held by academic staff about this support and asked what type of support was needed or desired from the LTSC.

Having established what the awareness of LTSC supports was, the next question aimed to get an insight into what the challenges were that prevented using technology and set the stage for focusing on mobile technology. This was done by asking about any further observations or comments or issues which might prevent the use of technology in teaching.

The last question was focused on mobile technology in particular and asked participants to identify what would prevent them from using mobile learning in particular when they considered technologies used in learning and teaching?

The survey was open from February to April 2013.

6.2.1.1 Academic staff perspective

As has been mentioned earlier in this thesis, the LTSC is a department in the OOI whose remit is to work with academic staff and other support functions such as IT, administration, and any units which enable and encourage the use of technology for enhancing learning and teaching. The activities of the LTSC include providing support for integrating technologies into learning and teaching practice such as the mobile learning pilots in Cycles one and two of this research. The survey starts by questioning the sufficiency of the support offered by the LTSC:

Perception of support currently around using technology for teaching

Contentment with current support

About 36 % of the staff who completed the survey indicated being content with existing support with comments such as:

> *"Nothing in particular! I have always found that support was available from the LTSC when required"-LS3*

> *"Happy with the existing support" –LS4.*

Some of these satisfied staff were still able to identify areas of opportunity which were also highlighted by others.

Communication Gaps

The satisfaction with the services offered arose was indicated by those who had interacted with the LTSC. However, another 29% of the staff surveyed demonstrated a lack of awareness of the full range of services offered and their responses identified areas that were already offered such as training, workshops and videos demonstrations of tools, technologies, and also guidance in how to embed technology and tools in teaching practice:

> *"Introduction to new technologies and workshops on these,*
> *and older ones, ideally in the context of possible learning*
> *approaches or methodologies." –LS43.*

> *"More one-to-one to discuss possible uses of technologies not*
> *currently used."*
> *–LS96*

These comments indicate that there are sections of teaching staff who may not be engaged with the LTSC or with supports available outside of their immediate disciplines and departments, highlighting a possible deficiency in communications from the LTSC and within the departments.

Awareness of New Technologies

For those who had availed of the services or were aware of the LTSC, it was also reiterated that staff believed that the LTSC is effective in the interaction with lecturers at creating an awareness of new technologies and teaching approaches:

> *"The LTSC do an excellent job in making people like me, a*
> *lecturer for 22 years, aware of new ways to reach students*
> *using digital technologies as well as wider learning and*
> *teaching issues to do, for example, with interaction with first*
> *year students."-LS30*

Preference for personalised support

For the staff who interacted with the LTSC, they tended to take advantage of one to one support via telephone and consultancy services to address problems they encountered in using tools they already knew and explore potential applications of new technologies. 17% of the survey respondents requested for more personalised support:

> *"I have a preference for verbal support by phone or in person*
> *when I encounter technical difficulties. Email support is not*
> *suitable. Existing supports are very adequate - staff of LTSC*
> *are very accessible by phone and respond promptly."-LS35*

> *"I would like to have someone on the phone to fix problems*
> *and give advice"-LS84*

As well as the one to one support and technology application consultancy, the LTSC offered a range of workshops and seminars during the term time for exploring technologies and teaching approaches.

Need for Communities of Practice and use case examples

From the responses to the survey, the results indicate that while the technology workshops are valued, questions arise from how to integrate the utilization of the tools into practice. Often time, teaching staff are too busy with the day to day teaching, administration tasks to explore or experiment in meaningful ways on how to use the technologies in their specific disciplines. To this end, there were requests to have examples of integration of technologies. The idea of a community in more local contexts to lecturers would also appear to hold value as such communities provide opportunities for engaging with others around topics of interest such as integration of technology.

> *"I would like the LTSC to continue encouraging OOI staff to*
> *think carefully about learning and teaching. I need to feel that*
> *I'm part of a community that values a considered and*
> *progressive approach to learning and teaching. For me the*
> *PRIMARY function of the LTSC is to provide a focal point for*
> *discussion about how great learning happens and to*

> *encourage people to think about how they can be better*
>
> *teachers (and learners)." –LS91*

> *"Time needed for learning new technologies. Limited IT skills.*
> *Very few of my colleagues use the technologies hence nobody*
> *to bounce queries off"*
> *-LS96*

While the LTSC activities stimulate the initial general conversations about the technologies and their use in teaching and learning, there need to be more local communities built around the disciplines to support the utilization of the technologies in context alongside other staff.

> *"The summer school [1]provided a really good opportunity for*
> *staff to improve their skills. It's a shame that this is no longer*
> *available to staff who have done it before (I appreciate you*
> *can put your name on a waiting list). The summer school was*
> *an excellent way of becoming familiar and confident in using*
> *the latest technologies available." –LS106*

> *"Refresher workshops on specific technologies, with new*
> *ideas and discussion of how other lecturers use technologies."*
> *–LS89*

> *"Introduction to new technologies and workshops on these,*
> *and older ones, ideally in the context of possible learning*
> *approaches or methodologies." -LS45*

> *"a big feature of current learning is through peer and group*
> *learning/projects. Perhaps some resources/links of managing*
> *this process and the use of evaluative tools such as SPARK*
> *plus software to allow for fairness in evaluating the process,*
> *the product, and the peer contributions, etc."-LS76*

---

[1] The summer school is an annual week-long event held at the start of the summer holidays at which staff work together alongside others interested in similar areas to learn about tools, teaching approaches and engage in facilitated discussions and workshops.

Timing of engagement and support events

However, while wanting to be able to meet others to share and learn from and be part of a wider community, the timing of events with opportunities for engagement was often a challenge, as workshops and training sessions are often held during the term when staff were available on campus. This was pointed out by 7% of the staff as they considered the type of support they required from the LTSC:

> *"...To schedule workshops/speakers outside the 13 week semesters; regrettably, it is very difficult to attend such events in an environment where lecturer workload (class contact, assessment etc.) during the semesters is so intense." -LS30*

> *"Workshops held at times of the year when I can attend, i.e. not during teaching weeks, except Fridays; not during holidays" - LS88*

> *"I have found the support from the LTSC fantastic, and really appreciate the help. I need to set more time aside for training, especially in the use of mobile technology." – LS110*

Need for expanded library of self-service support material

To get around the timing of workshops or sessions 13% of the respondents suggested shorter sessions or self-directed follow-up material and highlighted the use of online resources to support such sessions:

> *"Virtual Academy - to be able to see some case study examples online and which LTSC course available matches these. To the beginner, getting general overview of the new technologies and delivery mechanisms needed first to see what might be useful. Most are too busy getting their material together and this leaves very little time to explore or experiment." –LS94*

> *"Short lunchtime - 50-minute introductory snapshots initially and then follow by online courses and resources" –LS94*

Coordinated and cohesive support need

Some of the staff also identified the need for a more coherent support structure across functions and recognised the necessity of commitment from senior leadership to provide such services and support with 7% specifically requiring some level of visible buy-in:

> *"That the learning and teaching technologies we use are set up in advance of course commencing rather than the technologies hindering delivery. This would require in my mind LTSC to be move integrated with other college systems such as registration etc." –LS100*

> *"Commitment from Directorate (executive leadership) to Fund staff and services at LTSC... –LS15*

Summary of Perception of current support

In summary, the academic staff perceived the support offered via workshops and one to one consultancies to be available to be sufficient. However, there is also a need for a communication strategy that reaches all categories of staff involved in teaching to educate them on the services and support available. It is also highlighted that while the teaching staff wanted more opportunities to attend events that involved engagement with a community of other practitioners, it was difficult to do so due to teaching commitments during the term. The LTSC, on the other hand, tended to hold the sessions during the term as during the holidays not many lecturers were available to attend sessions. A more cohesive and integrated approach to enabling technologies for learning and teaching that would not hinder delivery of the curriculum and a commitment from the leadership of the OOI to ensure continued funding and services was also identified as important.

The next question focuses on what staff identify as the barriers to using technologies in general to support and enhance teaching and learning.

Barriers to using Technologies for enhancing learning and teaching

When responding to the invitation to reflect on their observations and give comments about using technologies to support learning, respondents identified

what they perceived to the barriers to their use of technology in their teaching practice. Getting this insight into the general perception into technologies showcases what the current tensions are and enables a positioning of mobile technologies and mobile learning.

Time

Of the survey responses, 27% identified time as a challenge to their use of technology in their teaching context echoing the findings from the previous question. They reiterated that it was challenging to schedule a suitable time to attend workshops and training events to learn how to use and apply the technology giving comments like:

> *"The issue preventing me from using most of the technologies is lack of knowledge in how to use them and lack of time to teach myself. I would love specific training in these technologies." –LS44*

> *"Time of training sessions often clash with teaching commitments" –LS101*

> *"...finding time to get trained can be a problem." –LS97*

It was also pointed out that finding time to reflectively practice using the technology and gain confidence in using it was also a challenge that led to maintaining the status quo rather than improving their practice with technology integration:

> *"LTSC sessions very good but difficult to get time to attend. Then also need to practice so difficult to get time for this."-LS74*

> *"Lack of time for reflection on best way to implement changes or improvements leads to stagnation in subject areas"-LS71*

> *"Time to learn and test is the main problem, in order to have confidence with new tech." –LS102*

> *"Lack of confidence in trying out these new tools especially in relation to technology - need to test prior to implementing in classroom"- LS101*

Existing Workload

As well as the time to attend training sessions and associated practice, 13% of the respondents recognised in their responses that the shortage of time was an impact of the heavy workloads being experienced on the ability of lecturers to engage in activities such as learning about how to use new technology.

> *"Time constraints, teaching and dealing with 400 students is very demanding" –LS21*

> *"Very heavy teaching and admin loads means I don't have the time or energy to engage with new technologies as much as I would like."- LS7*

> *"Too heavy teaching load....not enough time to learn/implement the new technologies" –LS95*

Personalisation to suit disciplinary context

In addition to not having enough time to attend training sessions to get familiar with the technology and reflect at an individual level to consider how to apply the technologies, 8% of the lecturers surveyed identified that applying the technology in their own discipline was difficult. The difficulty they saw was with regards to applying the use of the technology to the learning context of the student and within the particular discipline. A representative statement demonstrating this sentiment is:

> *"The most difficult issues are how to use the new technologies to enhance learning at the student's own pace, and perhaps personal contact, and for the lecturer, how to apply the technologies to one's own discipline."-LS104*

Infrastructural Suitability

Lecturers also faced difficulty with existing technology in the common lecture spaces which often did not have the reliable infrastructure. This was highlighted by 20% of the lecturers who saw the existing infrastructure and environment as barriers:

*"Our classrooms/labs are equipped in most cases with the
basic technology (internet, data projectors), the internet in
many rooms cannot be relied on" –LS30*

*"Many of the technologies available would be used if the time
and facilities were available - some centres have little or no
access to computers for class/lecture/tutorial sessions!" –
LS47*

"Licencing of tools for downloading."-LS101

Confirming the issue with the reliability of the technical infrastructure, the
following respondent wanted to see the technologies become more reliable
before they would use them:

*"The biggest issue is the time investment in mastering the
technicalities and potentialities of new technology. But also
that the technologies are widely available and reliable before
I introduce them to a module."-LS45*

Cultural Expectations and Adherence

Beyond technical challenges, and time pressure, there were also undercurrents
that are attributable to the culture of the OOI as they pertain to how things are
done within what lecturers see as the traditional model of higher level teaching
and learning. 6% of the academic staff surveyed felt that the expectations in the
OOI indicated an adherence to traditional lecturing methods without recognition
of the time investment needed to get into applying new technologies.

*"OOI structure still expects traditional lecture formats. No
time is allocated to preparation of materials, dealing with
student queries online, etc." –LS43*

Within this traditional model, some lecturers were still reluctant to develop too
many resources as they felt they would be making themselves redundant and a
lack of understanding about how their roles would be impacted by the change
caused by using the technologies:

*"Time to learn and engage with new technologies is always an
issue. Also, instability in module teaching means that there is*

> *reluctance in putting too much resources into any form of development. Plus, fear of making oneself redundant is always a factor."-LS109*

> *"Resistance by colleagues to change due to work involved in some instances"*
> *–LS71*

The resistance of some staff to technology integration or adoption is attributed to not being convinced about the value of such technology as was highlighted by 9% of the surveyed lecturers with statements such as:

> *"Too many options, many of which seem to be of little value or require massive lecturer input in addition to teaching."-LS36*

As well as being sceptical about the use of technology adding value, others believed that technology use leads to reduced lecture attendance. This could perhaps be because the emphasis of a lot of technology use has been around online learning stating that their observations on learning technologies to be:

> *"Belief that students do need to come to lectures, in particular first years"*
> *- LS15*

Other lecturers demonstrate reservations with the use of technology in learning being the right way to create a learning environment that encourages critical thought:

> *"Isn't always the best environment to generate critical thinking among students"*
> *–LS46*

As a further example of the adherence to traditional methods, one respondent focused on online teaching as an application of technology and stated that:

> *"There is no point unless lecturers get timetable reductions for doing so. Why should the lecturer prepare face-to-face lectures involving potentially 20 hours per week, and then engage in distance learning beyond this. It's impossible. The hours we put into online teaching and support should be*

> *included on our timetables. Otherwise, lecturer adoption of*
> *these technologies will be limited."*

-LS50

Summary

Time to learn and practice continues to be highlighted as a barrier to using technology to enhance learning and teaching. However, this is clarified not just to be about having time to attend sessions and practice what is learned. It is more about the time invested in such activity being recognised and accounted for within existing OOI expectations of the lecturer's time expenditure during the term, instead of the current approach of being focused on the timetabled hours for lecture delivery.

In addition to this, existing infrastructure provided in the OOI support traditional lecturing approaches and with this technology availability including the provision of licenses for software was not often sufficient and internet connectivity was often poor.

The type of change that could be realised and absence of a clear OOI recognition of the time and effort the lecturers invest in getting familiar with and using technology leaves some lecturers uncomfortable and unsure of their place. This leads to reluctance to engage further, but instead makes them focus on the status quo. There are also some lecturers who are not convinced about the value of using technology in learning.

With the perception of the services and support provided by the LTSC established and the barriers to the use of technologies for enhancing learning and teaching identified at an institutional level by the wide engagement with a broad representation of the teaching staff, the next question focuses on mobile learning.

Barriers to using Mobile Technologies for enhancing learning and teaching

In this section, lecturers were asked to consider the definition of Mobile Learning, they were asked to identify what prevented them using mobile learning. The following are the issues they highlighted:

Perception of Mobile Technology as an information access mechanism

In considering what would stop them from using mobile technologies in learning and teaching, 21% of the staff surveyed appeared to have focused on a perception of mobile technology as providing access to information and having students at a distance from the lecturers:

> *"It probably reflects my advancing years but I believe that mobile technology (though wonderful in its proper place) can get in the way of deeper learning (with students confusing true education with access to instant information)!"- LS3*

> *"I'm not against it but feel the students can easily find existing resources for the topics I cover."-LS29*

This remote access to information in any media form is also seen as threatening to lecture attendance:

> *"I was recently told that lecturers' actual class contact time is now being closely monitored and that it is not necessarily in my favour to teach remotely."-LS63*

> *"It could further disengage the student and lead to poor attendance. This is already a problem since the use of the VLE was introduced" –LS77*

> *"The use of mobile learning technologies would reduce the necessity for class contact with lecturers."-LS84*

These representative quotes suggest that there is a gap in the understanding for some lecturers of what using mobile technology can offer when purposefully designed to actively enhance the learning experience, rather than providing remote access to material or information through a mobile interface.

Knowledge and Skills Gap

The lack of knowledge about how mobile technologies can be used in learning and teaching contexts is confirmed by 29% of the lecturers, some of whom as in the responses to previous questions, also specify the lack of time to learn and practice as reasons for the knowledge and skills gap:

"Only my own lack of knowledge."- LS41

"The knowledge of how to use them to enhance teaching and learning. I would like to be able to use them to do so however."- LS44

"Lack of confidence/personal comfort in using mobile devises. Lack of appreciation of how they can be used for true teaching/learning" –LS101

As well as a general lack of skills and knowledge about mobile technologies and designing mobile learning experiences, lecturers recognised the limitations of mobile devices such as the screen size and the variety of platforms as indicated by this response:

"Small screen size of smart phone" –LS37

However, they did not indicate any understanding of the affordances of the mobile devices that would make it suitable for various learning contexts (Section 2.3.3). In the quote below, the lecturer saw the potential of mobile learning but due to the multiplicity of devices, felt that as an organisation, the OOI had to cater to the lowest common denominator:

"The variety of platforms available means that it is almost impossible to ensure that all content is fully accessible to all users and if a lowest common denominator approach must be taken then this reduces the effectiveness of the entire medium. However, this is, I think, the route that we must all eventually go" –LS109

This type of comment raises the issue of equity which is also highlighted as a concern.

Lack of Assurance of Equity

Within the academic staff body, 14% of the responses received indicate concern about how the use of personally owned devices would introduce inequities into the classroom and learning experience either due to students not owning the

required device or since the OOI infrastructure was not reliable, the cost of using their data to students.

> *"The cost of OOI providing devices or the need for students to have suitable devices is likely to be a key issue that requires to be addressed." -LS42*

> *"Not all students have access to smartphones and the lack of owning the technology can have a stigmatising effect if a lecturer uses this technology" -LS61*

> *"I would only formally introduce student owned devices into a module if all students agreed and had access to mobile learning devices. The possibility that this may not be as ubiquitous as is assumed would prevent me from formal use of mobile learning."- LS71*

It is suggested that the OOI may pay for all student's devices and ensure wireless access as a way to ensure equity:

> *"I think it is unfair to expect students to have to have such technologies. Many of our students cannot afford the basics and asking them to have advanced expensive technologies to participate in a class is to my mind exclusionary and should not be entertained unless OOI were to make such technologies free to all students and pay for wireless use wherever the student is." –LS48*

Lack of Interest

As well as indicating not having the knowledge and skills to use mobile technologies and apply them in a learning context, 5% of the lecturers indicated a lack of interest in pursuing this. They also indicated having a preference for traditional methods due to an assumption that using mobile technology meant removing face to face interactions:

> *"Time taken to get up to speed whilst trying to manage all the other tasks in the job. General lack of interest on my part too." –LS27*

> *"Prefer face to face interaction with students." –LS51*

Reservations about Value

9% of the respondents explained in their answers that they had reservations about the use of mobile technologies and needed to be convinced of its value in learning and teaching:

> *"I have yet to be convinced it is better than traditional methods." –LS57*

> *"Students as a group tend to want to use any excuse/reason not to attend in person. I'm not convinced that using mobile technologies without a sound educational reason underpinning them confers any real advantage." –LS86*

In some instances, even when they saw the use of mobile technologies in other areas, they mostly saw it as a means to access information and were concerned about how such instant access to information could impede the student experience:

> *"We promote reflective learning and it is difficult to see how mobile technology would promote this type of deep learning." –LS40*

OOI Infrastructure

Furthermore, 15% of the respondents said they were wary of using the technologies as their experience of using the infrastructure in the OOI showed that the technology was not reliable enough. They felt that until this was addressed, they could not use mobile technologies to any scale. Their responses around the OOI infrastructure also referred to the use of personal devices and highlighted the need to clarify the financial implications of using personally owned devices especially when it was due to the lack of suitable connectivity on campus:

> *"Cost and lack of good wifi on campus. It is next to impossible to use a iPad"* –LS106

> *"I have a smart phone but am a pay as you go user. It would be too expensive for me to go bill pay. There should be some financial support if staff are expected to use these technologies for student engagement."* -LS107

> *"The technology required (iphone/tablet) should be provided by OOI. And supported by OOI not the existing arrangement of keep fixing it yourself. Hate to negative but the resources are just not there to support any form of smart technologies within OOI."* –LS49

Even lecturers who wanted to use mobile learning felt they were let down by the wireless infrastructure:

> *"Nothing whatsoever! Pity the wifi is so poor, I generally have to use a personal hotspot on my phone to use my tablet"* -LS110

OOI Culture and Lack of Strategy and Policy

The OOI culture which was defined in Section 5.1.2 as how members of an organisation relate to each other and their work, is based on a strategy that has been shared as the means by which the goals of the OOI are achieved. Alongside the strategy, there are policies to guide the delivery of the curriculum. For 18% of the lecturers, the lack of any strategy around the use of mobile technologies at an institutional level made it difficult to navigate the mobile learning space. Within existing OOI culture lecturers perceive an emphasis on classroom lecturing time which is interpreted to mean traditional lectures. It is hard for them to see how using mobile technologies fit into this vision especially, as technology in their minds tended to be associated with reducing class time. For example, one lecturer stated that:

> *"Institutional ambiguity in strategy - what does engagement mean? Coming to class or facilitating remote learning? No way have current structure, workload and training really supported meaningful transition in this way. And do we really*

want it? Fine to have add on supports to traditional structure,

very different to ask us to enable mobile learning." –LS56

This quote suggests that as long as technology enhancements support the existing traditional structure and do not threaten that status quo then such use is acceptable, however, mobile technology use for learning is seen as outside of that scope. Even when lecturers are aware of successful mobile learning implementations elsewhere, they do not see this as applicable in the OOI except for communication and outside the classroom:

"I would tend to see mobile phones an efficient means of

communication rather education. I realize that M learning

projects have been very successful elsewhere but within the

context of the OOI they could be used to support activities

outside the classroom and to communicate efficiently with

students." –LS72

The consensus appears to be that teaching in the OOI is based on a traditional model of education and within this traditional model of teaching, introducing mobile technology use could introduce an additional workload on top of existing commitments. This ambiguity threatens the work-life balance of lecturers and is captured in the following quotes:

"I am concerned that it will create a culture of lecturers being

available to communicate with students 24 hours a day, 7 days

a week. As it stands, I spend a considerable amount of my own

personal time outside of work hours dealing with student

emails. I believe this would increase with further use of mobile

learning." –LS35

"The possible breach of personal time - expectation of

students for you to be accessible anytime."

-LS101

6.2.1.2 Summarising Staff perspective of barriers to mobile technology use applying framework

Conducting the survey of the lecturers provided an opportunity to capture their perspective of the obstacles to using mobile technologies in learning and

teaching contexts. By first eliciting information about their awareness of the LTSC services and identifying what their challenges were with technology use in general, a backdrop was provided against which to position the use of mobile technologies and identify where an institutional responses and leadership is required.

In Table 6.1 the barriers so far identified are itemised and the existence of the capability of the OOI to respond to the barrier is indicated and mapped to the description of the institutional response in place. The barriers indicated Y(Yes) have an institutional response in place to deal with them. However, for those marked N(No), there is no institutional response in place and further input is required from the leadership of the OOI and IT.

Table 6.1: Mapping of Barrier to Mobile technology use to current institutional response capability

Barrier to Technology	Y/N	Capability of Institutional Response (via LTSC resources or other unit)
Time to attend training and individually reflect and practice	N	This is outside of the remit of the LTSC and is a function of the expectations of academic staff during the term.
Existing Workload	N	The existing workload of academic staff is determined under existing contracts and expectations set by the leadership.
Personalisation to suit disciplinary context	Y	LTSC have staff with a range of expertise and skills to support lecturers in personalising to suit their context.
Infrastructural Suitability and reliability	N	IT and Leadership input required
Cultural Expectations and Adherence	N	Leadership input required
Perception of Mobile Technology as an information access mechanism	Y	Even though the LTSC have inherent skillsets to support mobile technology application, there has not been sufficient work done to build a library of evidence for reference.
Knowledge and Skills Gap	Y	The LTSC provides a variety of training and support such as workshops, training in tool usage, seminars, one to one consultancies.
Lack of Assurance of Equity	N	Leadership input required
Lack of Interest, Individual Preferences	N	Leadership input required

Reservations about Value	Y	To demonstrate value for the activity, the LTSC need to gather evidence from practice.
Lack of Strategy and Policy	N	Leadership input required

From the staff perspective time was a recurring trend in the barriers to using technology in general and mobile technologies in particular. Upon analysis, when users referred to not having time to learn and practice with mobile technologies, it was often that there was no imperative in the OOI strategy that placed a value on such activity so they did not prioritise such work.

The concerns about ownership of devices, equity, privacy expectations and provision of support can be addressed by the specification of how user-owned devices are integrated on to the OOI infrastructure, and by creating policies and guidelines to help lecturers. The reputation of technology use in the OOI was such that lecturers viewed it as introducing a distance rather than enhancing the classroom experience. This led to a culture of resistance which manifests as not prioritising the use of such technology.

Also, with no evidence of leadership support for the use of mobile technologies, it did not seem that such activity was of value compared to time spent lecturing. The next phase of this Cycle three engages with the OOI stakeholders in management and leadership positions to investigate how they position the use of mobile technologies within the organisation's strategic goals and objectives.

6.2.2 Senior Leadership, Management and further academic perspectives

Cycle three began with the first phase where a survey was sent to all academic staff members as described in Section 6.2.1 and culminated in the mapping of the barriers to use of mobile technology in learning and teaching as illustrated in Table 6.1.

The second phase of Cycle three outlined in this section comprises two parts: a focus group interview which was stimulated by a mobile learning workshop which was open to academic staff who were responsible for or influenced their department's programmes, academic support staff such as student support and library staff. Parallel to this workshop and interviews, there were also individual interviews with organisation's senior leadership representatives. The senior leadership representatives were interviewed separately to give them freedom to

express their views. The aim of the activities in this phase is to explore the implementation of mobile technologies for learning and teaching with the OOI leadership to explore areas highlighted in Table 6.1 and ground the emerging guidelines for strategic and organisational relevance.

Table 6.2 is the schedule of questions which was used to guide the conversations in this cycle:

<p align="center">**Table 6.2: Cycle 3 interview questions schedule**</p>

- Do you think you would explore the use of mobile technologies for learning and teaching?
- What concerns do you have around the use of mobile technologies for learning?
- Do you know of an institutional policy on the use of student-owned mobile devices for learning and teaching?
- Do you think such a policy is necessary? Why or why not?
- What would concern you about using students own phones in learning and teaching contexts?

Focus Group Discussion:

The mobile learning workshop for academic and academic support staff interested in mobile learning was planned as part of the regular workshop schedule offered by the LTSC with two choices of sessions. These workshop sessions were advertised on the LTSC site and an email with a list of upcoming workshops and seminars including these two were also sent out to the academic staff community in the OOI. Staff with programme leadership responsibilities or influence were invited to register to attend one of the two sessions to explore mobile learning and then participate in a focus group discussion on the state of mobile learning in the OOI. Out of the twenty-five staff who registered, twenty-one staff attended the workshops across the two sessions and included programme leaders or academic staff who sat on their departmental teaching committee.

To kick off the workshop, participants were invited to give possible reasons for the slow uptake of mobile learning in the OOI. To do this, they were encouraged to use their mobile devices or the computers in the room to input their responses into the digital board shown in Figure 6.2 which was displayed at the top of the

room. The reason for this was to so they could see what everyone else was saying in real time and their input also became stimulus for further discussion around the challenges preventing the use of the technologies in their own practice.

Figure 6.2: Cycle 3 Reasons for slow uptake in Mobile learning
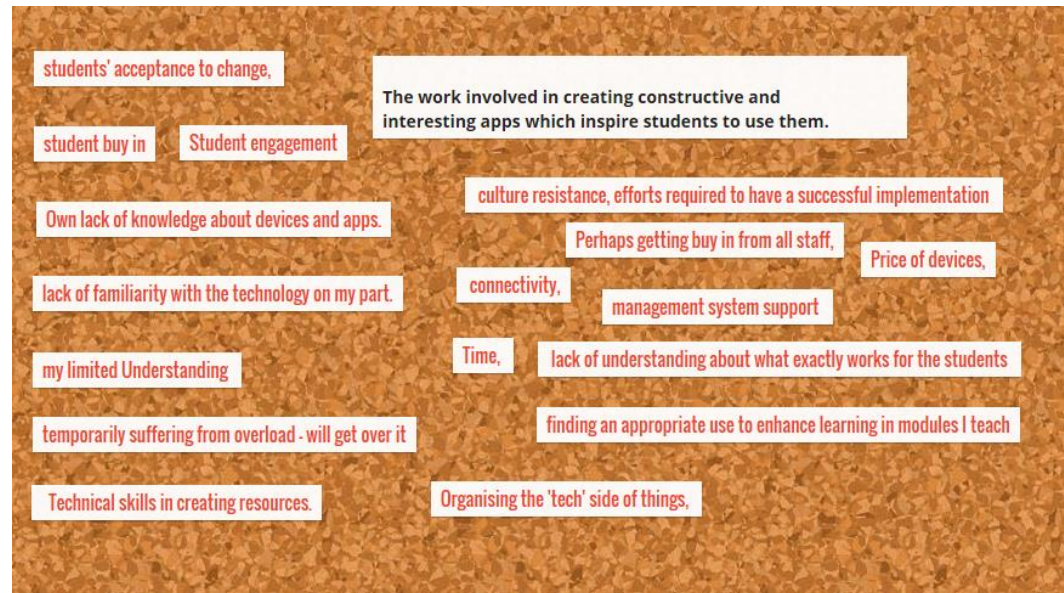
The mobile learning workshop agenda (Figure 6.3) familiarised participants with mobile learning.

Figure 6.3: Mobile Learning Workshop Agenda
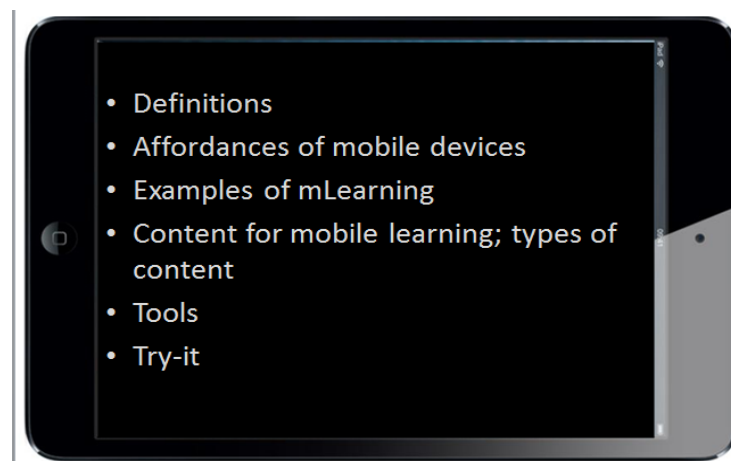
Definitions for mobile learning were presented and the affordances of mobile devices highlighted. Examples of how the affordances could be taken advantage of in learning and teaching contexts were given, including the Cycle one case study on using mobile devices to support learning while out on a field trip, and the Cycle two case studies of using messaging to support learning in the Chinese language course and the Entrepreneurship course.

To conclude the workshop, participants were invited to participate in a focus group discussion to consider whether they would consider using mobile technologies in their teaching practice and their plans for the future in their programmes and modules. Workshop participants were informed of the purpose of the focus group discussion and notified of their right to withdraw from participation. All participants agreed to continue. Participants to the workshops also filled out an open-ended questionnaire with the schedule of questions as given in Table 6.2.

As well as the focus group interview following the workshops, one to one interviews were conducted with three stakeholders representing the leadership of the OOI. These stakeholders for the interviews were identified by the leaders of the LTSC based on their roles in the OOI. These stakeholders, represented the Senior Organisational leadership, IT management and learning support leadership. For each of the interviews, participants were debriefed by reviewing the agenda from the mobile learning workshop as well as the reasons given by the lecturers for slow uptake in mobile technology use for enhancing learning and teaching.

The management staff interviewed and senior leadership acknowledged that they also understood what mobile learning was and were aware of the value that using student owned mobile devices could bring to the learning and teaching spaces. They were also conscious of the popularity of mobile devices both with the student population and on the OOI's network.

In the following section, the findings from the focus group sessions and leadership stakeholder interviews using the Schedule of questions in Table 6.2 is presented.

6.2.2.1 Understanding the stimulus for the use of Mobile Technology in learning and teaching

At the end of Cycle two, it was established that without clear evidence of leadership support and wider engagement in the OOI, learning initiatives that took advantage of mobile technologies were considered fringe activities. For the participants in this phase of Cycle three, understanding the stimulus for the use of mobile technologies within the context of the OOI was an important step towards their adoption. This understanding established that such adoption of mobile technologies for learning and teaching was aligned with existing systems

and processes in the institution as well as how gaps were identified. For example, for the senior leadership, the use of mobile technologies was particularly relevant as a medium through which to extend and enhance support learning developments in existence by using solutions that are owned by students. As an example, it was identified that using student-owned devices and chat applications provided a means to support students on a programme established and delivered to a remote island in Ireland:

> *"One of the things that I was particularly interested in was to harness the existing technology rather than looking for very high end specialised solutions. I wanted to harness the actual solutions people might have already so that ordinary people might benefit from it. So at the time of telephone lines, email, there happens to be an ISTN and video conferencing which we were able to tap into."*

> *-Senior Leadership*

At the leadership and management level, the value of adopting mobile technologies in learning and teaching context is considered in how it contributes to achieving the strategic goals of the OOI. This recognition should be evident in how the infrastructure supports mobile learning, the policies and guidelines in place to guide staff and evidence of leadership support shown in how the leaders advocate the use of mobile technologies.

Observations from the IT management team were that the use of mobile devices in particular and the need for enabling technologies were part of a bigger change happening in the context of eLearning. They had identified mobile learning from an IT point of view as a significant trend from their observation of the network traffic and support requests. It was suggested that at least 64% of the wireless connections on any day came from mobile devices such as iPads, iPhones, Androids and other mobile devices. IT were also receiving queries from owners of applications in the application suite they managed, and were observing industry trends.

> *"We see mobile learning as being complementary and somewhat supplementary to eLearning. In the context of the OOI, I see it very much as being embraced by what the LTSC*

have been trying to do particularly around the LMS and such
like, so I haven't seen it to date an being the absolute wow but
it clearly been a significant amplification of what has been
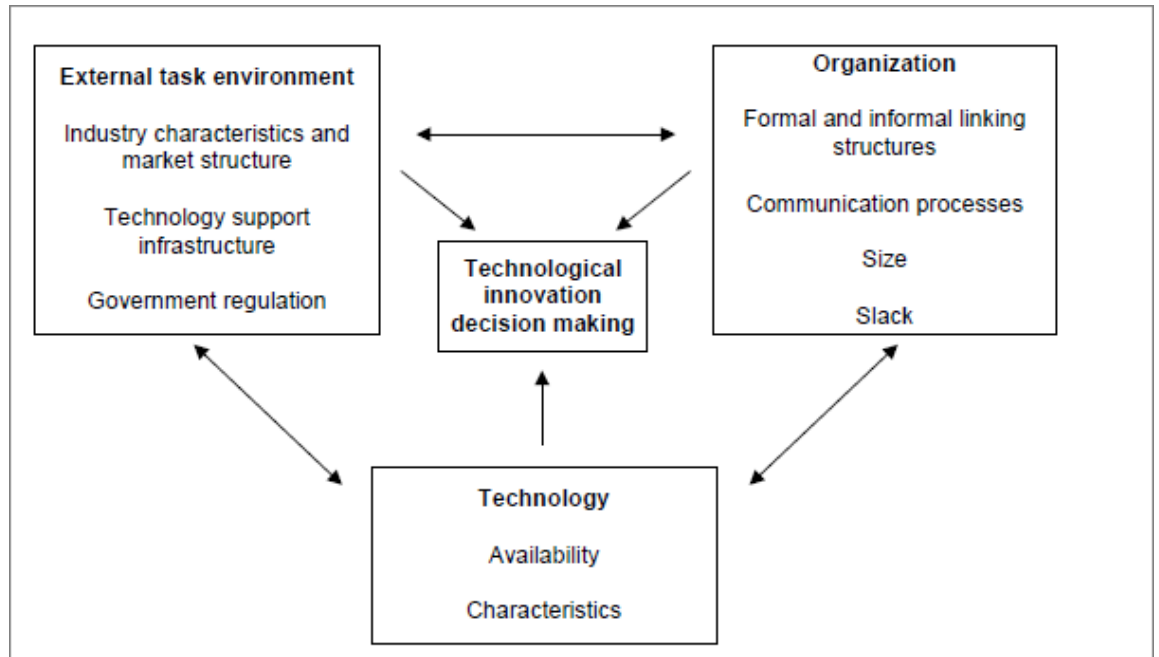*going on in the eLearning space."*
-IT Management.

External factors such as the economic climate in which the OOI operates, the competition in the higher education provision space, and higher student numbers are all factors that get considered when the OOI leadership is contemplating on the tactical plans aimed at pursuing the broader strategic goals. The focus on the strategic perspective at the leadership level in this phase of the study reveals that the DOI model on which the guidelines emerging in this thesis was based in Section 5.1, did not give room to consider the strategic factors that would lead to the consideration of new technologies to be adopted in the OOI. For this reason, the Technology, Organization and Environment (TOE) framework is considered more rounded for getting a more comprehensive view (Oliveira and Martins, 2011, p. 119).

The TOE framework provides a foundation for organisational leaders and management to take account of environmental factors when deciding if and how to adopt a technology. These environmental factors are the drivers behind the decisions the OOI makes to determine how, when and why to adopt a technology. Such external drivers for technological change are trends in technology as would be reported in publications such as the horizon report, activities of competing organisations, such as other higher education institutions, and the need to ensure that students have the necessary digital skills to function in the economy when they graduate.

The TOE framework (Figure 6.4) considers three elements which determine and influence an organisations constraints and opportunities in adopting a technology. These are: 1. the technological context, 2. The organisational context, and 3. The External Task Environment (Depietro et al., 1990, p. 153). Each of these contexts directly influences how an organisation adopts and implements technology innovations.

When the items of the guidelines proposed at the end of Cycle two are mapped to the TOE framework (Figure 6.5), the category for recognising the external task environment is identified accommodate the categorisation of the issues of how the organisation identifies and responds to external drivers in response to understanding the stimulus for use of mobile technologies and UYOD.

This external task environment is particularly important as it gives the scope to monitor and understand the trends in how mobile technologies and the wider technology ecosystem and industry are developing and the impacts on the OOI.

Figure 6.5: Guidelines mapped to TOE framework

Organisation	Technology	External Task environment
Defining social systems, Community Creation.	Determining range of use, assessing organisational systems and processes, aligning with organisational goals, creating capacity.	Identifying and understanding the drivers, external regulation such as privacy and data protection laws that influence use, mobile technology trends, evolution of devices.

Within the existing environment in the OOI, it was confirmed that while there has been good and almost complete uptake of general purpose technologies such as the VLE, explorative uptake of newer technologies such as the mobile technologies for learning has not seen similar traction and so the adoption has been much slower. Of the participants in the focus group, 90% confirmed they were interested in exploring the use of mobile technologies for learning. By engaging with the OOI leadership and a self-selected group of lecturers interested in exploring using mobile technologies in their practice, a determination can be made of what constitutes and shows how the leadership see the use of mobile technologies. The next section explores if strategic and policy guidance is needed and what this may be.

6.2.2.2 The need for Strategy and Policy definition around the use of mobile technology

When asked if they knew the institutional policy on the use of mobile devices, the staff engaged with in this phase of Cycle two stated that they did not know of such or they responded that there was no such policy. All staff involved in this agreed that there was a need for some a strategy and policy definition to guide the use of mobile technologies, and even other emerging technologies that were different from the usual in –person interactions, for example, stating that:

> *"...there's lots of profits from very good practice in different*
> *areas around the use of mobile technology, virtual worlds,*
> *around the institute but we haven't gotten to a situation where*
> *we've been able to harness that for a greater advantage. And*
> *that's really got to be our next task."*
> *-Senior Leadership*

Furthermore, the lecturers felt that because of the personal nature of the devices, there was an opportunity to clarify expectations by taking an institutional approach to the guidelines and policies:

> *"It (The strategy) would give lecturers a clear indication of*
> *what was acceptable/appropriate"*
> *-Workshop attendee.*

Moreover, it was highlighted that this guidance was specially required around using devices owned by students within the learning context and the ethics of expecting students to own mobile devices:

> *"...about the ethics of our using mlearning which in turn may be putting an extra push on students to purchase mobile units"*
>
> - *Workshop attendee.*

Lecturers also wanted to see theirs and the students' right to privacy protected:

> *"Boundary issues between students and teachers"*
>
> - *Workshop attendee.*
>
> *"Intrusion into their private space. Just because they are students does not mean they have to forego their privacy"*
>
> - *Workshop attendee.*
>
> *Even though they could see the potential of using mobile technologies and students own devices, they felt that without any policies or institutional guidelines in place, individuals would be left to determine the boundaries themselves and navigating this space could become overpowering:*
>
> *"Can become overpowering and spill into private life but I can see the benefit if both parties are open to use it"*
>
> - *Workshop attendee.*

As well as expectations of privacy being clarified, it was also identified that a clear data protection specification is needed along with considerations of safety and welfare of students, such as awareness of bullying and harassment via mobile devices if they were a part of the classroom. The welfare considerations extend to include the use of mobile devices with student with disabilities.

IT management also saw an opportunity to readdress the IT-strategy to take into consideration how the institution's application suites, support structures, and other enabling services had to be aligned to recognize that people would be having a different experience with the institutional systems with the enabling of mobile on a wider scale:

> *"we believe people will be having a different experience with*
> *that device which in time will give rise to change we need to*
> *be making regarding some of those applications particularly*
> *when some of them have got bespoke or special pieces in*
> *them."*
> *-IT Management.*

Along with the changing experience that may come as a result of increased use of mobile devices, there were opportunities to address the handling of data, considerations of privacy and what this meant for different people. It was felt that the current provisions do not necessarily address how the students view privacy and how they may be limited by the imposition of a standard for privacy that does not reflect their reality:

> *"It doesn't matter if they want to be on face book or not they*
> *take photos because their friends are going to take some and*
> *post them on face book anyway so they don't live in an*
> *environment that recognises privacy they've got to find a*
> *different way of addressing it. They have different*
> *understandings of what privacy is"*
> *-Senior Leadership*

While data protection, privacy and security of user information were protected by the legal provisions which has governed IT operations to date, there was ambiguity around how these would be handled with the changing ecosystem as a result of using individually owned mobile devices. Additionally, at the national level, there have been initiatives being undertaken with the HEAnet which are seeing more of the institution's data being stored in private clouds:

> *"I would envisage that in the period of five to ten years and of*
> *course with a ramping up to that, that more and more of our*
> *data will be sitting out there somewhere other than sitting in*
> *our data centre.*
> *-IT services*

The move to cloud storage gave institutions cause to examine their data handling policies. It is expected that this would have an effect on any policies around the use of mobile devices which will also be used as part of this emerging ecosystem

of technology. Alongside the changes in the data infrastructure, the OOI is in the process of moving to a new consolidated campus. This new campus was highlighted as an opportunity to address many of the technological challenges to using mobile and other technologies. However, it was also identified that the impact of the technologies goes beyond the physical and technical constraints and the cultural practices and supporting structures in place to deliver the curriculum will need to be reviewed:

> *"...one of the changes we have identified in the institute is that*
> *we do need to review our curriculum and our practices in*
> *preparation in moving to the new campus. We want to audit*
> *our offerings, for instance, and try to identify graduate*
> *attributes and as part of that were looking at what we need to*
> *do in terms of curriculum development and pedagogy and*
> *what principles we have to set in place. I would certainly see*
> *mobile learning as a key part of that profile"*
> *-Senior Leadership.*

Having guidance and policy definition around the use of mobile technologies demonstrates support for mobile technologies at a strategic level. This encompasses the areas that have been highlighted such as harnessing the technologies for good practice, clarifying expectations of ownership, equity, boundaries, privacy, safety and security and closely aligning to the institution's goals. At a tactical level, having clear strategic and enabling policies also make it easier to get support from other departments such as IT or the registration department, libraries and enables the use of mobile devices to move from a fringe activity to a mainstream one. Mainstream activities are usually supported by the institutional infrastructure, processes, and community especially since the OOI reviews itself in the light of wider changes such as the campus relocation and the move to a cloud-data infrastructure.

6.2.2.3 Supporting Structures

Supporting structures are the mechanisms in place to address the issues previously cited as challenges to using mobile technologies such as heavy workloads, time pressures, lack of training, and familiarity with technology (Sections 5.3 and 5.5). All of those interviewed in this phase of Cycle three indicated that there was support for exploring the use of technology and that the

existing structure of technology support was adequate for starting off this exploration. The leadership in the OOI recognise this sufficiency and are aware that while the current structures may support the initial exploration, it would not necessarily sustain it:

> "IT services reckon that the Wi-Fi network in the institute has to sustain 2 ½ units per student. Between all the students in OOI each of them has a mobile phone and either a laptop or a tablet of some sort. So we have to build in a very robust Wi-Fi network that will sustain that level of engagement from staff and students without it creaking under the burden. How that's impacting on the teaching is probably a new point, with not a lot of discussion at the moment"
>
> -Senior leadership

With regard to the challenges of proficiency with the technology or how the time to learn was seen from lecturers and the management/leadership points of view, there was a dichotomy in their perspectives. From the leadership viewpoints, there was a degree of scepticism around the citing of "lack of time" or "lack of technical expertise" as challenge, and whether these were rather, simply excuses not to do the type of work that was not of interest or value to the particular lecturer:

> "The people I see that are engaging doing interesting, exciting things in the institute whether it's in eLearning or any other area are equally busy. So people are doing this if they're interested and enthusiastic"
>
> - Senior Leadership

It was acknowledged that while the existing contract put a heavy burden on teaching during the term time, the contract also covered the holidays.

> "We have particular contract here for academic staff which has quite a heavy burden of teaching if you think of it over a week. However, if you push that burden through the holidays people have and the fact of what might be expected from them. I don't think that really holds up hugely"

- *Senior Leadership*

With respect to the technology, it was highlighted that there was a certain expectation that staff were able and willing to guide their own development by engaging with and exploring technologies in the classroom and subsequently requesting the specific support they needed as they encountered them rather than a broad and non-specific technology support request. However, among the workshop attendees, those who were not planning to explore the use of mobile technologies, similar to their colleagues engaged in earlier cycles of the research, cited lack of knowledge, aptitude and confidence around the use of mobile technologies, as well as not owning one:

> *" I will have to do a lot of groundwork first before I would incorporate it into my work. My case is that I would have benefitted from a technology literacy course first to familiarise me with basic of technology"*
>
> *- Workshop attendee.*

The guidelines proposed highlights the need to incentivise the use of mobile technology in ways that showcase the value of the use of the mobile technology to the lecturer. If their primary discipline does not necessarily include an expertise with technology, or the use of technology in ways that add value, it is important to recognise that there should still be adequate support for such staff who have no need for the use of the technology on a more regular basis. This implies that the level of "technology support" required by various members of staff should be expected to vary to reflect the diversity in the population.

It was acknowledged that the provision of an enabling infrastructure that allowed use of mobile technologies amongst others was the responsibility of the institution.

> *"There are some technical issues; a certain robust system is required in order to have any kind of mobile technology. The institute has a responsibility to have that in place both in the wider institutional context and in the classroom"*
>
> *-Senior Leadership*

The NMC Horizon Report (Johnson et al., 2014, p. 22) identified *"low digital fluency"* of faculty as a *"solvable challenge."* This is one that is understood and whose solution is known.

The institutional systems however have to be aligned with a broader intent which is usually defined in the strategy of how the institution plans to meet its objectives. In the OOI similar to other organisations, each functional unit has a strategy that is aligned with the broader institutional strategies and goals. In general, the use of technologies within the OOI are governed by various considerations.

6.2.2.4 Possible Cost Implications of Mobility and Mobile technologies used in the Curriculum

Mobile learning has to take into account the mobility of the user and the mobility of the devices. It was pointed out that there was a chance to do some non-traditional curriculum changes that took into account the use of mobile technologies and built on the premise of empowering learners:

> *"we need to develop a pedagogy that everyone ties into, and*
> *the pedagogy would have to have at its heart, an ignition of*
> *the mobility of students, mobility of staff and therefore a*
> *requirement of mobile learning therefore would support the*
> *developments of modules which would help us out of that,*
> *whereas at the moment look at the offerings OOI have are*
> *very traditional and require attendance, in some areas*
> *attendance is even marked"*
> *- Senior Leadership*

From the service perspective, mobility implies extended hours of use. Within the current umbrella of support provided, there is no allowance for 24 hours by 7 days model of support for users of the institutional systems. However, some suppliers are beginning to mobilise their applications and as they do that, there is a slowly growing support provision for that. However, there is no hurry on the part of the OOI to get this type of 24-7 support model in place until there is a clear need for it:

> *"Typically, the OOI have been typically been a bit off the pace*
> *in terms of adopting leading edge..... We have been*

reasonably conservative over the years in what we have been
doing. I don't sense a coherent demand from the community, I
think there will be a degree to which the market place would
encourage it, the student in particular may drive us and I think
there is a real reasonable possibility that we'll have to drag
some parts of the organisation to this particular suite rather
than coming about itself."

-IT management

While the need for it was not obvious at this time, it is envisaged that the method of support for mobile technology use will likely present the biggest change from the IT perspective. This is due to the mobility of users, their devices and the expectations around immediacy associated with mobile use:

"… The more that people are mobile, the less likelihood that
they are going to operate in a nine to five time frame…"

- *IT management.*

Managing the support and development for the broad range of possible use cases that may be explored as mobile devices get introduced within the OOI (Section 2.3.3) requires an equivalent diversity in the type of resources and expertise needed to aid the development. Implementation and support of apps, platforms, experiences and enabling structures which in turn demands an initial cost investment.

For all the systems used in the course of this research, the cost was borne by the LTSC as a central administrator for all learning technology activities. The LTSC however, operate a limited budget and do not cater for discipline-specific requirements. In such cases, the cost is usually borne by the requester. This is often a challenge for most departments as the business case for the use of technology needs to exist before the funding can be acquired, but the pilot studies also require funding. Senior Leadership also felt that there was a long-term cost implication for the institution for enabling the use of mobile:

"...it tends to be cheaper to use student owned devices and
allowing students choose the solutions that work for them such

as googledocs, and others for collaboration rather than being prescriptive"

-Senior Leadership.

The IT management responses giving a perspective on cost implications was slightly different from the senior leadership in how cost savings are perceived as a result of using student devices. IT management identified that there would be savings from streamlining of tools as there would be at some point need to assess the tools currently existing, as they become mobile enabled to ensure there is a more coherent portfolio of tools that is not duplicating function in silos.

"An example that I think we have not gotten to grips with yet is with regard to collaboration tools there is a chuck of tools within the Google system which we use and then this is also duplicated in the VLE so you have little clusters of tools that functions similarly in the different systems that are not integrated"

-IT Management

IT management also assessed that there would also be cost implications in part owing to the type of support model for the mobile environment. The kind of support envisaged would be providing a higher level of service at 24x7, and also from a budgetary point of view would see less money spent on infrastructure, but more dedicated to the provision of services and support. This spend of services is difficult to pinpoint because as suppliers move toward mobilising their platforms, they are also moving towards changing from a traditional perpetual license model to a Software as a Service (SaaS) model. The OOI provide computers and software applications but not mobile devices. Any cost incurred in the use of personal mobile devices is borne by the lecturer although using Institution owned application portals can contribute to reducing this cost.

Summarising

Participants in the staff workshop identified similar barriers to the use of mobile technologies in learning and teaching as was uncovered in the preceding phase of this cycle.

From the focus group discussion and interviews with representatives of the senior leadership and IT services management, it is highlighted that addressing the barriers which require leadership input provides a tangible and demonstrable evidence of leadership support for the use of mobile technologies in learning and teaching. Table 6.3 illustrates the extent of the current leadership response in this regard to each of the areas identified as barriers.

Table 6.3: Revised mapping of barriers to OOI response

Barrier to Technology	Y/N	Existing Leadership Response
Time to attend training and individually reflect and practice	**Y**	Leadership response indicates a flexibility and time management may be factors in how this currently works.
Existing Workload	**N**	Leadership expectations in this regard are shaped by external environments such as government funding, industrial agreements, and the higher education environment.
Infrastructural Suitability and reliability	**Y**	IT are aware of the changes that need to be made as are the leadership, and while there is a capacity for change this is a work in progress and expected to be for some time.
Cultural Expectations and Adherence	**N**	Leadership input required
Lack of Assurance of Equity	**N**	Leadership input required
Lack of Interest, Individual Preferences	**Y**	Incentives to encourage exploration can be coordinated by the LTSC- subject to funding and support from the OOI leadership.
Lack of Strategy and Policy	**N**	Leadership input required

The barriers tagged with "N" indicate areas where the decisive input from leadership is required but not available.

Having established the staff view on the use of mobile technologies in learning and teaching settings, it is important to get the perspective of students who are also stakeholders. The following section examines the students' perspective on using mobile technologies in learning. The issues and insights identified from engaging with students in the experiential applications of using mobile devices to support their learning experiences as outlined in Section 5.4 are explored at the wider institutional level.

6.2.3 Student Survey

Sampling Approach

The students survey aimed to get an insight into what devices students already owned, how they currently used their mobile devices and what perceptions and concerns they had about using mobile devices for enhancing their learning experiences. A questionnaire exploring these areas was administered to the 18,144 students registered in the OOI and was open for a one-week time slot before the Christmas break. The survey was sent out via an email from the central communications office. Since students were also active in the VLE at this time, a link to the survey was also circulated via the VLE as a pop up when they logged in. Deploying the survey through both these methods gave as many students as possible a chance to be included in the resulting sample.

For this survey, 623 responses were received giving a 3% response rate. This low response rate is attributed to the time of year this survey was administered being so close to the end of the term. However, this period running up to the end of the term was the only available time slot, as the communications office also send institutional and national surveys which take priority over any others. It is acknowledged that there is a possibility that due to the low response rate, there may be errors due to under-coverage and non-response from some student groups.

The survey respondents making up the random sample represented each of the colleges, across a range of age groups and a balance of male and female students.

Method

There were twenty questions on the student questionnaire and it took about 7minutes to complete. The questions probed their current use of their mobile devices and the OOI infrastructure and their comfort using their mobile devices in learning.

Table 6.4: Cycle 3 Student Questionnaire

1) Consent: I understand that the data I enter in this survey is anonymous and will be used for improving support for learning and teaching and for research.

I consent to its being used in publications and reports. YES/NO

I also confirm that I am aged 18 or over.

- Yes
- No

2)   Your Gender

- Male
- Female

3)   In what age group are you?

- 18 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 35 - 40
- 40+

4)   What are you studying? and in what year are you?

5)   Which of these do you own and use? (Select all that apply)

- Smartphone (iphones, androids,etc)
- Tablet (including ipad)
- Non-smart phone (Feature phone)
- Laptop
- ebook reader (e.g kindle,kobo,etc)
- Other

6)   If you use a smart phone, please choose the type from this list:

- iphone
- android
- blackberry
- windows phone
- Other

7) What type of network or phone contract do you have?

- Prepay with data
- Prepay without data
- Contract with data
- Contract without data
- Not sure
- Other

8) Which of the following is true about your 3G/data plan? (select one)

- I have a 3G/data plan that gives me unlimited access (e.g all you can eat data)

- I have a limited 3G/data plan but it is sufficient for my needs
- My 3G/data plan is not sufficient for my needs
- I don't have a 3G/data plan
- I don't know my data plan

9) What make and model is your tablet if you have one?
   ----

10) How often during the day do you use your mobile device for school related work?

- Sometimes in class
- Very often
- Rarely
- Not at all
- Other

11) What do you use your smart phone/tablet for? (Select all that apply)

- Texting
- Voice calls
- Sending and receiving emails
- Browsing the internet
- Native apps (from the apple app store, google-play, etc)
- Games
- Taking photographs
- Watching videos
- Listening to Music
- Social Networking (Facebook, Twitter,etc)
- Recording video
- Recording audio
- Taking notes
- Maps (Google maps, applemaps)

- Looking up course related information/researching
- Instant messaging (whatspp, bbchat,etc)
- VOIP(skype, viber, etc)
- Recording lectures(audio or video)
- Accessing the VLE through my mobile browser
- I have downloaded and use the blackboard/the VLE app
- Reading course notes
- Reading books(kindle app or other)
- Other   ------------------------------

12)   Have you published images from your phone on the web?

(e.g Instagram, facebook, flickr,etc)

- Yes
- No

13)   Have you published video from your phone on the web?

(Youtube,Facebook, Vimeo,etc)

- Yes
- No
-

14)   How do you currently use your mobile phone or/and tablet to support your learning?
----

15)   Which of the following do you use while on DIT premises?   (Select   all that apply)

- 3G
- DIT –WIFI
- DIT-LAN
- EDUROAM
- Other

16)   Which of the following would you like to be able to do from your mobile phone or tablet?   (Select all that apply)

- Check PC availability in computer labs
- Check library account
- Receive alerts(course, IT, library, general)
- View timetables
- Surveys
- Campus map(lecture room/lab locations)

- Course information
- Answer questions in class/lectures
- Course resources (notes, assignments)
- Receive Grades by text
- Printer credit top up
- Other

17)   Do you use the computer labs in DIT?

- If yes, what for? -----------------------------
- If no, why not? -----------------------------

18)   Has any of your lecturers engaged you through your mobile devices?

(e.g: texts, made special content available for mobile devices, asked your to use as a classroom aid, etc)

- Yes
- No

19)   Do you have any specific suggestion as to how using your mobile device in any of your courses/modules might improve the learning outcome and experience for you?   --

20)   Do you have any concerns or general comments about using mobile devices as part of your learning experiences in DIT? ---

6.2.3.1 Students Perspective

Demographics

The student population in the OOI at the time of this survey, was predominantly male at 11,495 male students to 6649 female students. This ratio is not reflected in the respondents as while both viewpoints are represented, the ratio of female to male respondents is 51: 49 (%). The age distribution closely reflected the main population where the higher number of students in the OOI are undergraduates in the 18 to 25 year age group (Figure 6.6).

Figure 6.6: Student Age Distribution in sample
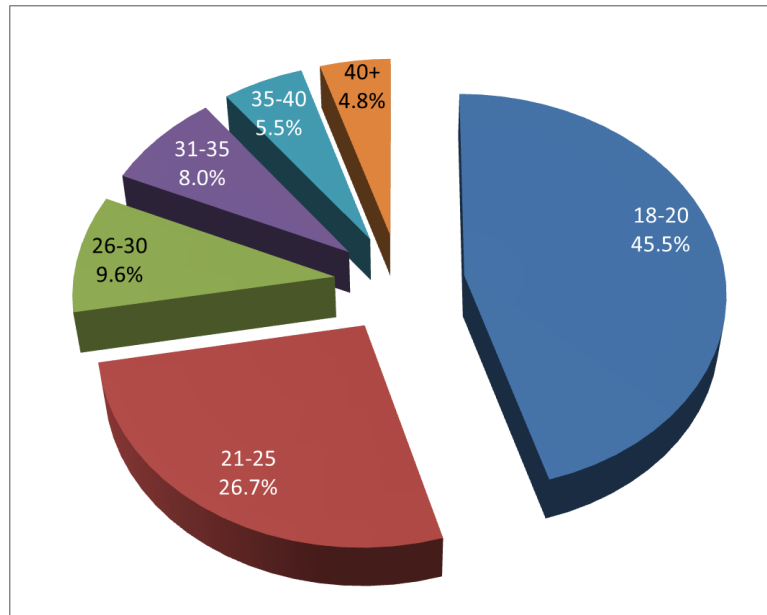
All colleges in the OOI were represented in the survey with the highest combined number coming from Arts & Tourism and Business & Management. Figure 6.7 shows the mapping of the survey respondents from each college to the actual percentage in the population according to the figures for 2013.

Figure 6.7: Representation of colleges in survey

Figure 6.7: Representation of colleges in survey
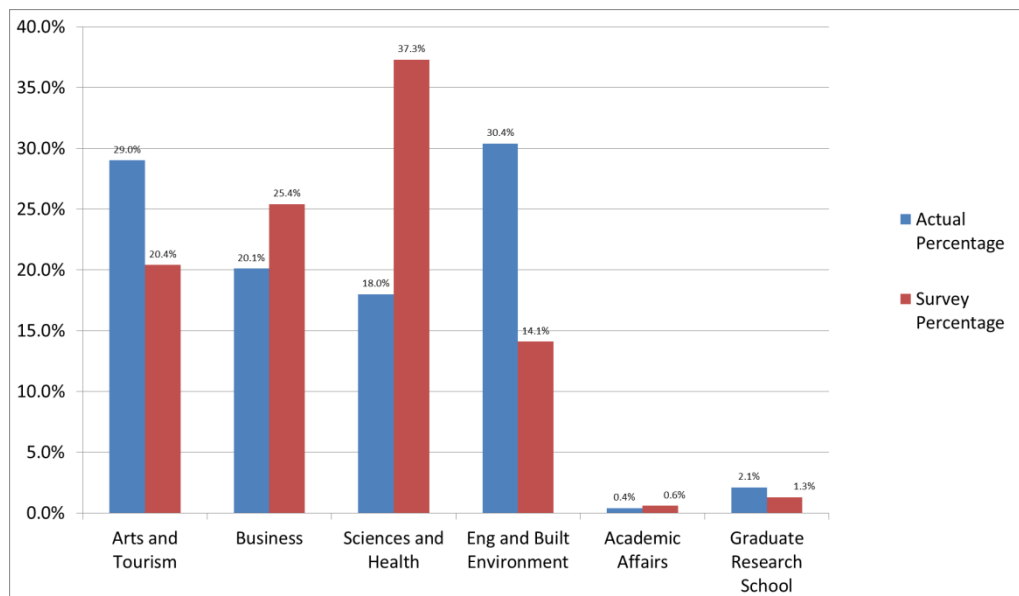
While every college was represented in the survey, there were 0.8% of the respondents, whose college could not be determined from their response.

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Device Ownership

Majority of the students surveyed owned at least one mobile device as shown in the figure 6.8 below.

Figure 6.8: Device ownership
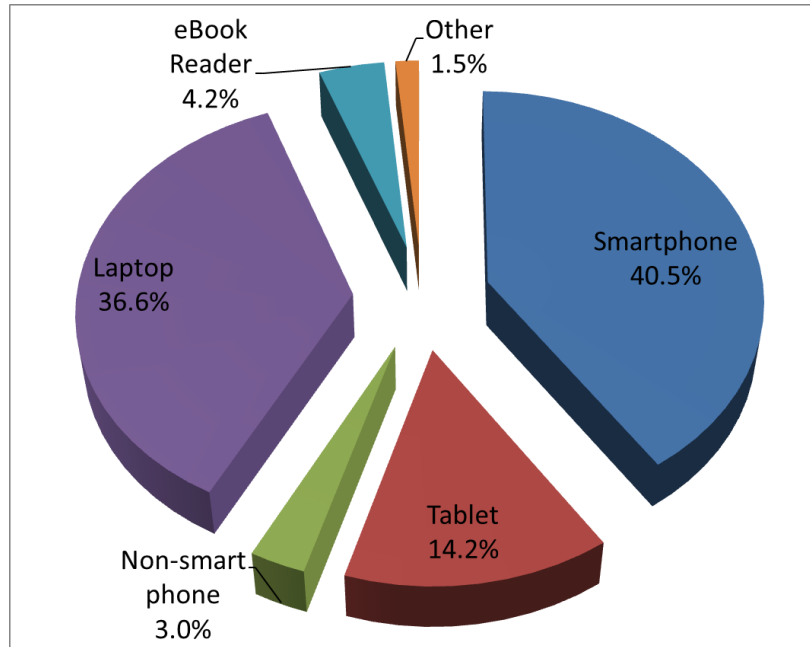
Only approximately 11% of students owned just a phone (smartphone or feature phone). Most students owned combinations of devices with the majority (45.4%) owning and using both a phone (smartphone/feature phone) as well as a laptop computer. Combinations of devices owned are given below in distribution shown in table 6.9:

Figure 6.9: Distribution of types of devices owned.

A=Smart Phone; B= Tablet; C= Non-smart phone; D= Laptop; E= eBook reader; F= desktop or other
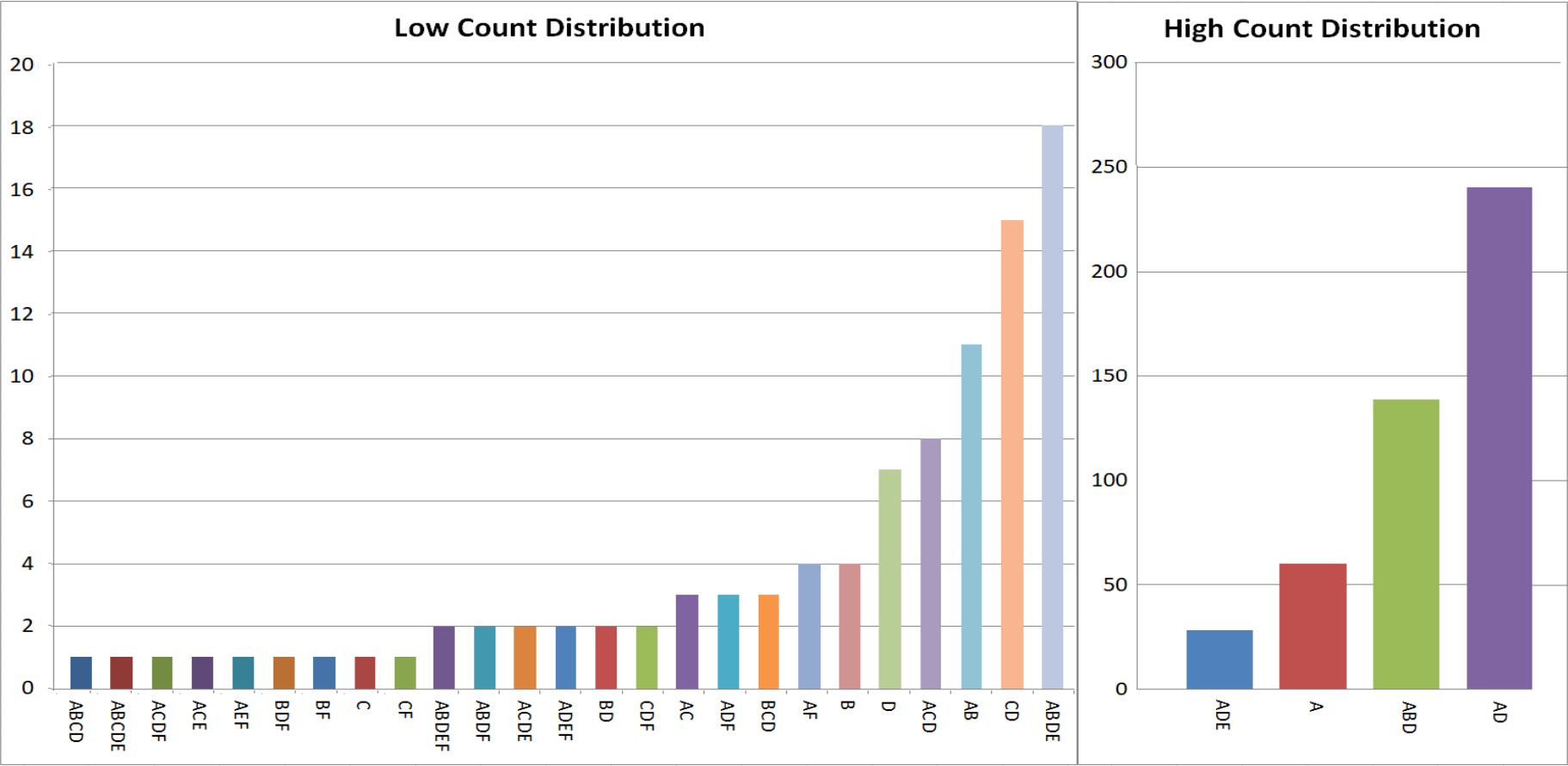
And for the 98% of the student respondents who own smartphones, the android was the most popular with the iPhone not far behind.

Figure 6.10: Type of phones owned by students
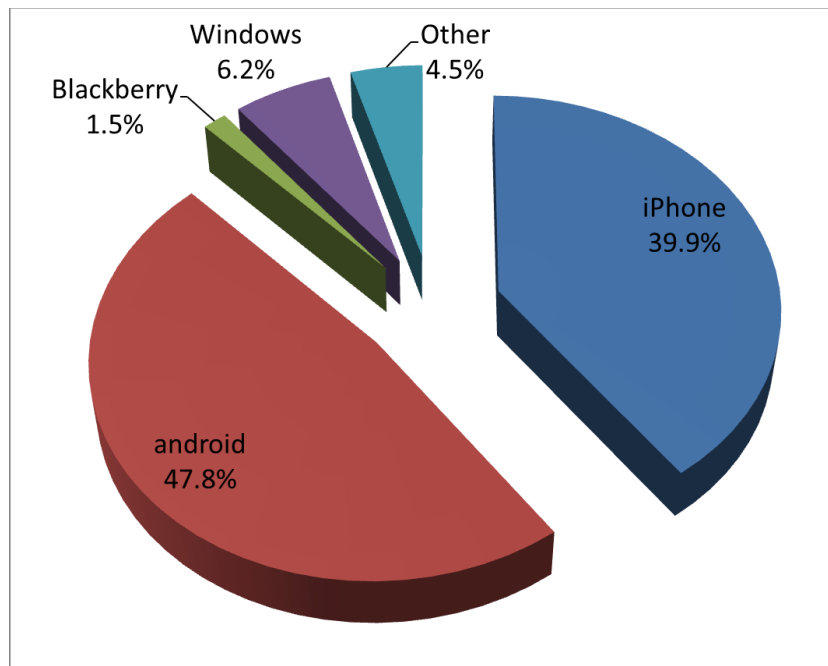
Other included-Symbian, Unknown models.

There was no correlation in the ownership of devices. All devices were spread evenly across all colleges and age groups. Students generally had provision for some form of data connection with most having pre-pay (pay as you go) with data or contract (bill-pay) with data.

Figure 6.11: Student payment plans
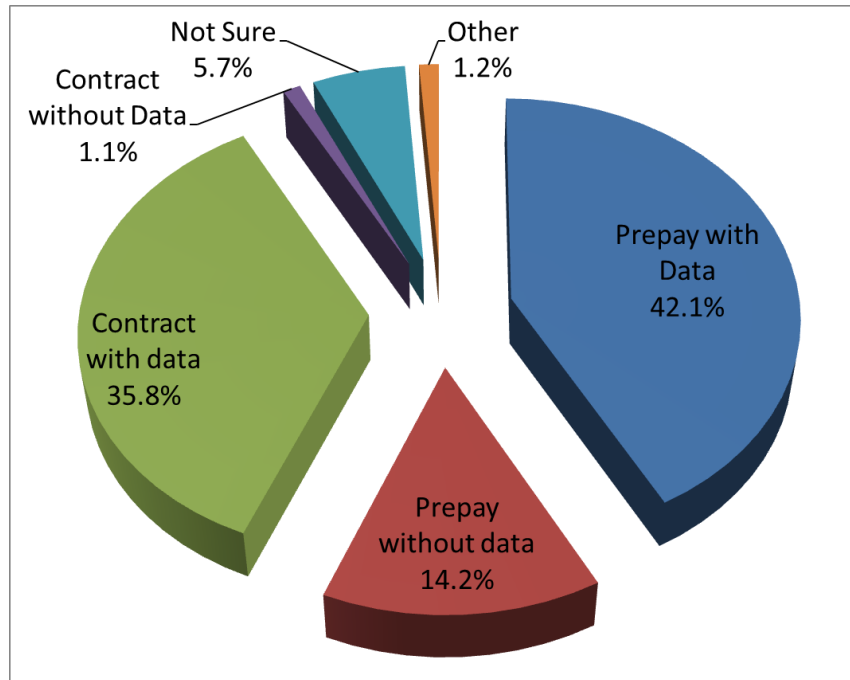
Most students tended to use data plans that satisfied their needs or got unlimited data with only approximately 10% claiming that their data plan was not sufficient for their needs, and 16% not having any data plan.

Figure 6.12: Student data plans
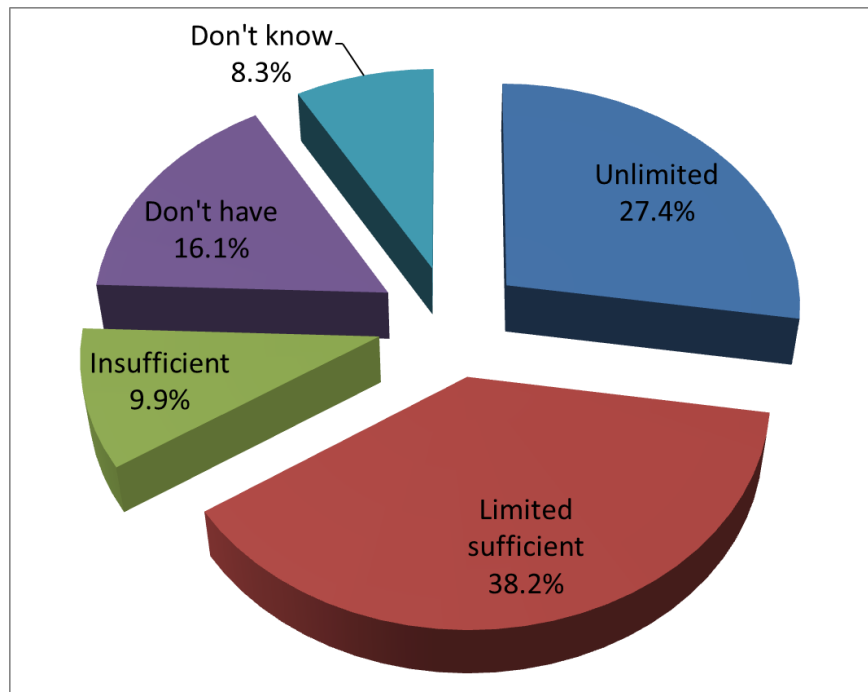
Among the students who have tablets, the iPad and android tablets are the most popular. When asked about how frequently they use their mobile device to

support school-related work, most responded "very often", "sometimes" or "rarely"

Figure 6.13: Frequency of device use
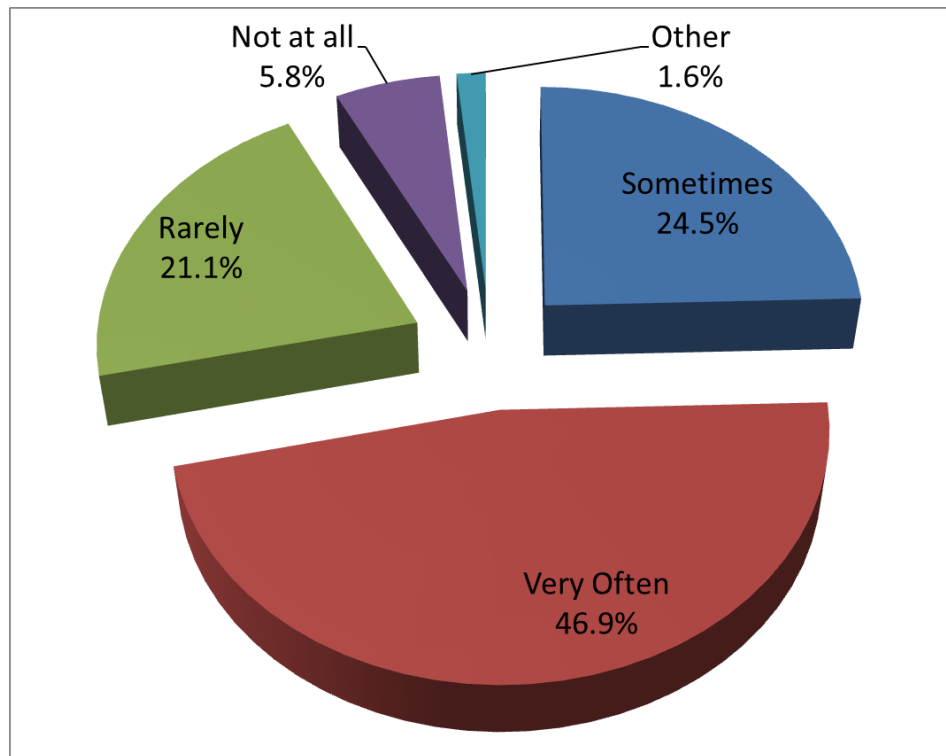
Student Usage of Devices

The highest usage for the mobile devices was texting, voice calls, browsing the internet and staying in touch via Facebook and other social media. Less than 10% of students reported recording lecture audio or video, although about 40% used their mobile devices for notes. Other uses for mobile devices included: work related task management - bespoke software, Timetables for OOI and general to-do lists, Camscanner app for scanning pages/chapters from library books and notes and converting to .pdf, Dropbox for sharing notes/PDFs etc. and storing completed assignments for easy reference. Students also used their devices for searching the library catalogue and reserving books etc. Table 6.14 below shows the distribution of these.

Figure 6.14: Distribution of how students use the devices
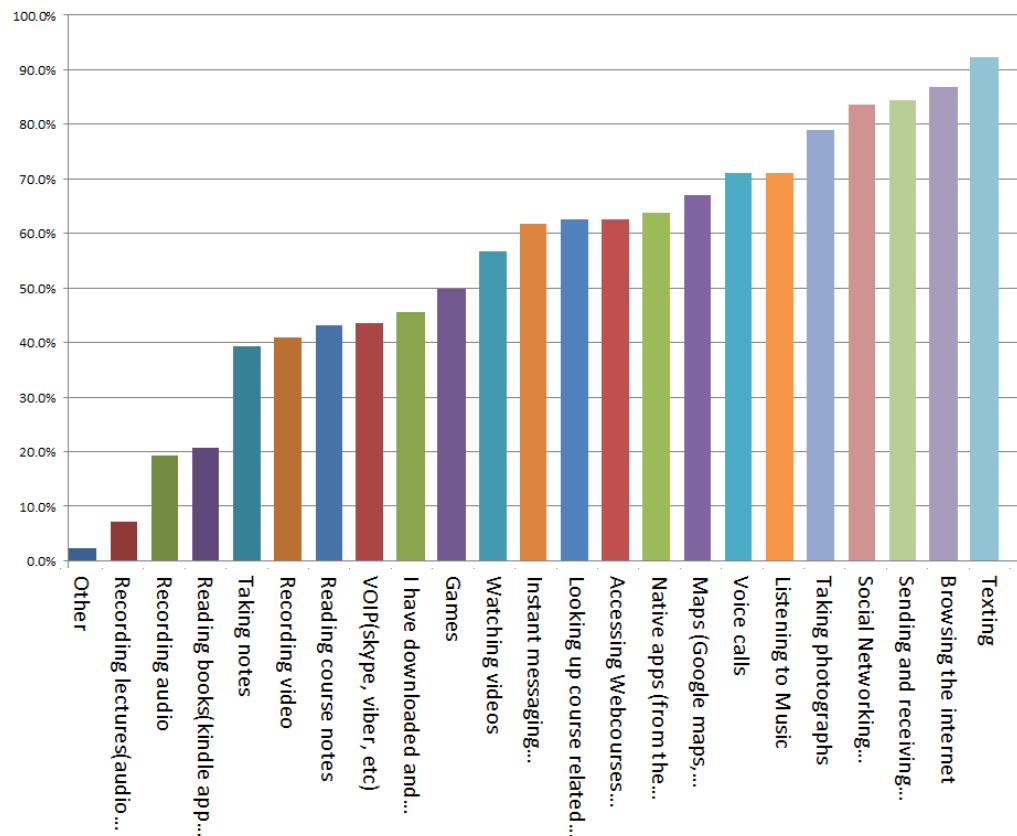
Most students (75.9%) have had no engagement with their lecturers via mobile devices. Only 24.1% have any sort of engagement with their lecturers via mobile devices. The engagement included the use of texts, making content mobile friendly, or using mobile devices as a tool in class. Despite the low engagement with lecturers via mobile devices, students demonstrated that they individually supported their own learning using their mobile devices and technologies.

While on campus, most students used the OOI WIFI or EDUROAM network. Some students predominantly used their mobile devices for most tasks such as email, taking, sharing and reading notes, research and only went to their laptops to do more creative work such as assignments. In some disciplines, there was a higher use of specialised apps for example in chemistry. Students tended to print less as they mostly kept their notes digital.

They also cited using their mobile devices to support group work communication. Students used their mobile devices and related technologies to support their learning in a "blended" fashion as they alternated between the formal and informal spaces. This reflects the concept of the existence of up to five conceptual spaces of the mlearning ecosystem identified as 1. Temporal, 2.

Physical, 3. Transactional (interpersonal, personal, intrapersonal), 4. Technological and 5. Pedagogical.(Palalas, 2013, p. 88) shown in Table 6.6:

Table 6.5: MLearning spaces (Palalas, 2013, p.88)

M-learning space	Space dimensions/definition	Examples
Temporal space	Time and length of learning: idle time or an event/activity during which learning takes place; both brief ad-hoc learnable moments and more substantial stretches of learning (When? How long? Within what time limits?	Between classes, during a bus ride, while walking a dog, during a lecture
Physical space	Place, position, location* of learning including geographical coordinates, layout, pertinent circumstances, physical context (containing context-embedded information) and limitations of the location (Where? What layout? Within what physical limits?)	In the classroom, on the bus, in a line-up, at home, at a museum
Transactional space • Intrapersonal • Personal • Interpersonal (social & public)	Intrapersonal space: the activities taking place within the individual self and internal learning processes occurring within the individual mind; the intimate zone of "my own private space within "Personal space: an intersection of intra- and interpersonal regions; zone where interactions with external actions, artefacts, information, tools occur; the intermediate zone of "my own external private space"; individuals still do not enter into a transaction with others but they interact with the learning environment and its elements Intrapersonal and personal are both private spaces, Interpersonal (shared) space: the social and public regions within which learning takes place, with public	Intrapersonal: thoughts, ideas, reflections, communications, processes internal to an individual Personal: email, individual/single-player mobile edu-game, reading a book, watching TV by oneself, listening to a podcast, writing, taking pictures, interpersonal: city, classroom, Facebook, MOOC, train, café, mobile game

	space being the broader zone (interaction and association with larger audiences) and social space being reserved for sharing, exchange and communication within an established or ad-hoc community (Who? With whom? For whom? From whom?)	
Technological space	Mobile learning technological enablers including mobile tools, connectivity and network/web, computational power, software capabilities. Technological space includes virtual space where digital information is stored in the network or personal devices, and where interaction between that content, technology and its users occur (How? Using what tools?)	Mobile apps, Internet, telephony, built-in camera, Wi-Fi, cloud computing, augmented reality
Pedagogical space	Learning theories and approaches including strategies, activities, and procedures, as well as content and materials, scaffolds and supports (How? Why? What? Who? What mlearning design? What materials?	Situated learning, activity theory, ecological constructivism, context-aware activities, assessment tasks

The categorisation of spaces where mlearning can occur is useful to understand the opportunities offered by using mobile technologies and therefore help educators design learning experiences and interactions that support and enhance learning. In this research, this categorisation maps into defining the range of use to be enabled at an institutional level as described when considering organisational systems and processes in the guidelines.

Students perspective of mobile technology usage in learning and teaching contexts

The last two questions in the survey invited students to give specific suggestions as to how using their mobile device in any of their courses/modules might improve the learning outcome and experience for them. These generated qualitative responses which were tagged with descriptive codes then categorised into the themes outlined here. 44% of the students surveyed indicated not having

any suggestions, concerns or general comments on use of mobile technologies at the time of the survey. The suggestions collected in the survey from the remaining 56% who gave suggestions and comments can be divided into six categories. Percentages in the categories are given responses excluding those with no comments.

Individual Perception of using Mobile devices in learning

Of those who held any opinion about the use of mobile technologies including mobile devices to support learning, their opinions did not fall neatly into for or against categories, but were more nuanced in how the students viewed current usage or the lack of it. While there were those who felt that mobile technologies should not necessarily be part of the formal classroom context:

> *"The class shouldn't depend on mobile devices. If it works as*
> *a personal support, it's fine."- SS46*

> *"Yes, I will say that it would be very convenient but it*
> *shouldn't be entirely depended on." -SS71*

There were also students who felt that existing applications such as the institutions website and the online timetable needed to be better designed first to gain trust with the community stating that:

> *"Implementation might be too slow; apps might be badly*
> *designed (e.g. like the OOI website and web timetables-*
> *abomination)" – SS125*

Across the student responses, the infrastructure was a strong theme in terms of barriers in the way of being able to use mobile technologies.

Infrastructure viewed as a barrier

A proportion of 26 % of the students who commented on the mobile technology ecosystem identified poor WIFI as a barrier to using mobile devices and technologies in support of learning and highlighted the need to address this for the benefit of the OOI community. The following illustrative statements are representative of the sentiment with regards to the current capability of the infrastructure:

> *".... the wife is very bad in the college. It would need to improve greatly for everyone to benefit" -SS 474*

> *"Don't believe college is equipped to have wifi where you need it, and so here lies the issue!!" -SS 479*

This inadequacy is not restricted to the OOI own network but also the EDUROAM network as it is available on campus:

> *"It's a sorry state of affairs when I get better speeds off my phone than the OOI wifi or eduroam network. Currently I hotspot the internet off my phone to my laptop and tablet. This has its own complications as it takes a toll on the battery life of my phone. Improve your wifi network to cope with the demand placed on it by the users." –SS285*

As well as the lack of adequate WIFI, it is also identified that heavy usage of the mobile devices through the day requires access to ports for charging which are not readily available:

> *"There's probably nothing that can be done about it but there is a shocking lack of wall outlets for charging tablets" - SS19*

To address the shortage of power ports, the Student Union had started a scheme to charge phone at a cost of €2 for half an hour as most people did not bother bringing in their chargers.

> *"It will waste your phones battery - especially if you have to connect to the internet. And it's €2 for half an hour charging in the S.U. most people won't want to bring in there chargers for their phones because it's extra hassle and it's too risky in case you lose your charger - because in my case i only have one charger!" –SS406*

Convenient and easier Access to Content and Information

Of these students who gave their insight into their perspective of mobile technology use in learning, 27% gave various reasons for considering mobile devices to be a convenient and easy way to access content and information. They stated that having access to content such as notes, class recordings is useful to

kill idle time in long commutes, between classes and to ensure they have the most up to date information.

> *"It makes access to material easier, it's always on your person and easy to download"-SS360*

> *"Podcast of lectures or additional material on a subject. For part time students, this would be especially helpful as they could be listened to while travelling in/from class or work."-SS41*

It was also stated that while in class it removed the need to be reliant on laptops which were heavy and took up more space:

> *"Being up to date in an instant instead of having to find time to start up your pc and wait to load."-SS355*

In terms of access to content and information, students also felt that enabling the use of mobile devices would open the door to multiple forms of the same content. For example, 3% of students wanted to be able to record audio or video of their lecturers or have the OOI make such recorded lectures available for use through their mobile devices to support their classroom attendance-not replace it:

> *"Maybe the OOI could look into video recording the lectures so that students could download to their phone/laptop and watch during exam revision or train journeys etc" –SS37*

For some of the students, it was helpful to go over the lecture again at their own pace:

> *"A video of the lectures would be great, because you're always guaranteed to miss something." –SS317*

More reliable and timely Communication

As well as having access to content and information on the go, 14% of the students who gave their opinion also wanted to be able to communicate with their lecturers through texts and also get communications such as classroom

changes, exam results, and other useful communication sent to their phones directly.

> *"Text is superior to email for contacting lecturers. Having to communicate through email is incredibly tedious." -SS122*

> *"Texts notifying if lecture is cancelled or lectures notes and supplements have been uploaded to VLE would save a lot of time"-SS123*

Administration to support learning

For 7% of the students in the group of those who expressed their insights, they saw an opportunity to enhance the administration that supported their learning, especially around the administration of the timetable:

> *"Issuing timetables, the most important part able to find faculty room no so that we no need to search for them whole building" –SS49*

And being able to monitor space in the computer labs, book rooms, receive grades and top up their printer credit:

> *"Check PC availability in computer labs, receive grades, books rooms via mobile device"- SS337*

> *"Printer credit top would be very handy." – SS510*

Being able to complete such administrative tasks that support learning through the mobile device are timesavers for the students:

> *"Personally, using mobile devices is an essential part of my learning experience and would be much less enjoyable and workable without it- SS43*

While some students may be making the adjustment to using mobile devices and technologies to support their learning individually, their impressions of the organisational culture to using mobile technologies indicated a need for some adjustments.

Need for Cultural adjustment

In Section 2.3.3 the culture of an organisation was described as the way things were normally done in an organisation. In the OOI, mobile devices are just beginning to be present in the classroom so both students and staff are still trying to find the place for this technology as has been highlighted in Chapter Two. In proposing suggestions for using mobile devices and making comments on using mobile technology, 7% of the students gave responses which confirm that the pervading culture did not have a place defined for the use of mobile devices in the classroom. They felt that lecturers frowned on their use with examples statements such as:

> *"Some lectures HATE when you have your phone on the table and I ve been in trouble lots of time for texting when i have been taken down notes." -SS18*

> *"Certain lecturers get insecure when mobiles are out as they think everyone is misusing them therefore banning their use"-SS440*

This perception from the culture is particularly frustrating when students feel that the use of the mobile device would significantly enhance the learning experience for them:

> *"It would be helpful if academic staff realised that smart devices are sometimes used as a learning aid instead of assuming that their use in class is automatically associated with personal activities like Social Media Updating…"-SS385*

> *"I'm dyslexic and so find it easier to read notes and then listen back to lectures. Some of my lectures don't allow me to use my iPad in class as they think I'm not paying attention. I feel this is effecting my grades." –SS423*

This need for staff to recognise the value of mobile devices in the classroom was further questioned by one student who recognised the need for an OOI strategic outline for guidance on using mobile devices and technologies:

> *"Some lecturers forbid the use of mobiles, tablets, and even laptops. When we asked about the rules regarding this, we were told that there were none. If mobile technology is to be utilised by OOI, rules should be put in place allowing all students the free use of their devices to aid in their learning."-SS148*

One of the reasons often given by lecturers for banning mobile devices from the classroom is the possibility of distraction.

Possibility of Distraction

In the group of students who gave their opinions, 6% recognised the potential for distraction if mobile devices were a part of their learning in class:

> *"No concerns apart from sometimes it interrupts a lecture or there is lack of attention in the lecture." –SS487*

With some students stating that this was more likely when students found the class boring:

> *"Very distracting at times when most lectures a boring." -SS565*

In considering the possibility of the distraction, it was highlighted that as adults, students held the sole responsibility for their learning in a higher educational institution:

> *"I think first all lecturer should allow/accept the use of mobile devices during lectures. Even if the student are not studying on their mobile device. It's their problem, isn't it? They are old enough..."-SS512*

Security of devices, data and accessories

Concerns about security of the devices in terms of their usage were raised by 4% of the students. Their concerns pertained to the security of their data and information shared on the OOI network.

> *"It is questionable to log into my personal email through a open network." -SS611*

For some students they needed assurances around using the open network, as they felt their personal devices alone were not secure enough:

> *"Yes, most definitely, security is a really big one, when i input my log in details i am always afraid some hacker over the internet will copy my details and do awful things like to my account. I am always afraid because android systems are not as secure as computers." -SS355*

And one student suggested that they would like to see their information encrypted as it was transmitted:

> *"I would like my information to be encrypted before being passed on" -SS387*

For all of the students who had reservations around the current provisions for security, there was a sense of inevitability about use of mobile devices becoming more persistent in the learning. Their main concern was that the OOI provided the mechanisms to ensure that user data was protected and safe:

> *"It's the way to go, as long as OOI has specific technology to protect the services from outside fraud or interference then it's what should happen ASAP!"-SS601*

Consideration of Equity

For 6% of the responding students, the mobile technologies could be used to address issues of equity in the classroom to ensure that the content to be revised or taught were relevant to most students:

> *"In class surveys may resolve issues on what content should be revised in class or tutorials at least." -SS126*

But mostly, the concerns of equity were those around the ownership of the devices and who would be disadvantaged by either not owning one or not having a suitable one:

> *"i would be concerned if it was a requirement to have a smart phone in order to do your best, i.e putting those without them*

> *(or those with them whose phones don't function properly) at a*
> *disadvantage" –SS140*

Also:

> *"...they're very useful, but people without smartphones can be*
> *at a disadvantage in some classes when everyone around them*
> *is using smartphones to find info."-SS142*

And the cost implications to ensure that one was able to be part of any initiative integrating mobile:

> *"If you do not have data as part of your mobile plan you might*
> *not get alerts as the OOI Wi-Fi in Kevin St, anyway is not very*
> *reliable." -SS424*

> *"Extra investment for everyone if it starts becoming*
> *commonplace" – SS592*

Privacy

The main concern highlighted by the 3% with concerns around privacy was particularly around the abuse of the integration of mobile devices. They did not want to get bombarded with messages from the OOI or "spammy" messages:

> *"That I will be overused by OOI and end up being worse than*
> *spam. I would delete or block any info from OOI if this*
> *happened."-SS252*

Apart from the possibility of being spammed, the respondents also indicated concerns around intrusion of their personal space by others using their mobile devices for example:

> *"People taking photos without permission" –SS373*

> *"Students shouldn't be allowed to take pictures of others,*
> *without the person having an idea of who is taking the picture*
> *and why the picture was taken."-SS147*

And they also recognised this intrusion of personal space and boundaries within the context of recording lectures:

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> *"Recording lectures audio/video. Some lecturers might not be comfortable though"- SS271*

Other issues raised with regard to privacy considerations were the extent of information that could be gathered about students and their location

> *"That I can be located using the device without my consent"- SS327*

There were also concerns about how the OOI would be providing any control of devices on its network and within its ecosystem given around the lack of guidance in the OOI to implement the cyberbullying policy that had been proposed by the Union of Students in Ireland (USI, 2013).

Self-directed usage

For 9% of the respondents, enabling an environment for using mobile devices would allow for independent direction of their learning:

> *"Going mobile is one of the most effective ways in teaching, learning, and campus life for everyone, wherever they are. You can put more power and more opportunities in the hands of your students and faculty. Everyone will have everything they need right on the mobile devices they already rely on."- SS102*

In considering how mobile devices gave more autonomy to learners,

> *"I would like if there were video tutorials/ lectures available along with notes. I would like if lecturers recorded their lectures and made them available online and mobile usable. I often don't understand something the first time but being able to stop and pause and understand something would improve my overall learning experience."- SS226*

Along the same lines of having autonomy in learning so that they could access what they needed easily to support their learning experience, a non-English speaker noted that:

> *I, as not a native English speaker, sometimes need to look up*
> *meaning of words and phrases that I have never heard before*
> *or if I want to have a better understanding.* *–SS313*

User Experience

11% of the students wanted to see existing platforms and services made user-friendly before exploration of new initiatives, for example stating that:

> *My main concern is that if OOI were to develop any learning*
> *app the design/interface etc would be substandard and*
> *frustrating to use. Nobody would use it and it would be a*
> *waste of money that could be better spent on better, more*
> *consistent and PERMANENT lecturers, better administration*
> *etc.-SS374*

They also wanted to see a uniform and consistent approach for deployment across all the types of devices in the ecosystem:

> *"I would like to see the OOI app for Windows Phone" –SS301*

Since many students already saved their notes in ways they could use them on mobile devices, they wanted to see lecturers make notes in mobile friendly formats to reduce the need to convert them:

> *"it's not very common in my course and I wasn't engaged to*
> *do so, which means that basically I don't know if I can take*
> *typed notes during classes, which would save a lot of time*
> *later on when writing the essays, because I could use the typed*
> *notes without wasting time to type them in after I hand wrote*
> *them."- SS47*

6.2.3.2 Summary of Student Perspective

The survey sample represented both male and female students from all the colleges and age groups in the OOI.

Most students owned a mobile phone as well as other devices such as a tablet or laptop and had made provision for some data connection- mostly pre-pay with data.

The student device usage was determined by the task they were involved in. Most students reported that they had no engagement with the lecturers or the within the formal learning contexts via mobile devices. However, in their individual practice and self-directed learning, the students used mobile devices as a support to enhance their learning by participating in group communication, accessing and storing notes. The concept of the existence of five conceptual spaces proposed by Palalas (2013) was reinforced. In conclusion it is proposed that to enable the use of mobile technologies within learning contexts, the OOI leadership and decision makers as well as academic staff must be able to understand how students use their devices, while also understanding the affordances of the mobile devices. The Organisation leadership needs to have mechanisms that allow its technology decision makers monitor trends in the broader technology space outside the OOI to ensure that suitable provisions can be made with regard to addressing issues identified from the academic perspective in Section 6.2.1.1, and the senior leadership and management insights (Section 6.2.2).

From the student perspective, there is a need to consider how the use of mobile devices and technologies are perceived as personal technologies, address the issues identified with the technology infrastructure particularly around WIFI connectivity and power outlets. Students are more interested in remaining in control of how they use their devices rather than having them integrated as part of the formal learning experience. In providing easier access to content and information, students want a variation in the formats of lecture notes such that they can use them on their devices. They also want to be kept informed and be able to communicate via texts on the mobile devices. Administration tasks which can be completed using mobile devices such as topping up printer credit, accessing timetables, monitoring rooms and computer labs and making bookings, are considered time-savers. The need for cultural adjustment in the OOI is highlighted with particular regard to redefining what students do with mobile devices in the classroom while recognising them as adults within a charter defining their responsibility to own their learning and define etiquette to reduce or prevent distractive use in the classroom.

The student perspective also highlights the need for a robust institutional security policy which specifies the extent of the protection to be expected for

devices, data and accessories while within the physical and virtual OOI ecosystem. The students also identify the need to consider equity from a learning perspective as well as ownership of devices and associated cost in terms of the devices and data plans.

The privacy concerns raised account for both staff and students in terms of respect for personal space and boundaries but also the possibility of being spammed by too much information from the OOI. This highlights the need for a cohesive and overarching approach to using the system for messaging. The other aspects of privacy identified include sharing personal information such as location tracking information and the OOI policy of handling cyberbullying. Lastly, ensuring that the user experience is optimised for mobile devices is seen as the key to getting it right with a need for all devices to be considered.

6.3 Revisiting Proposed Guidelines

Chapter Six has described the methods used in Cycle three of the iterative research to gain the insights of the leadership and the wider institution. The issues identified in earlier cycles (Section 5.6) which are addressed by the proposed guidelines for creating mobile learning capacity have been explored with a wider audience sample than previous cycles. The wider audience in Cycle three comprises representatives of academic staff, institutional leaders, students and support staff.

The academic staff are the stakeholders with the authority over programmes and modules who would create and implement mobile technology in the learning and teaching contexts. In order to support this group, the barriers they have identified and now summarised in Figure 6.15 will need to be addressed within the guidelines.

Figure 6.15: Summary of Academic Staff perceived barriers
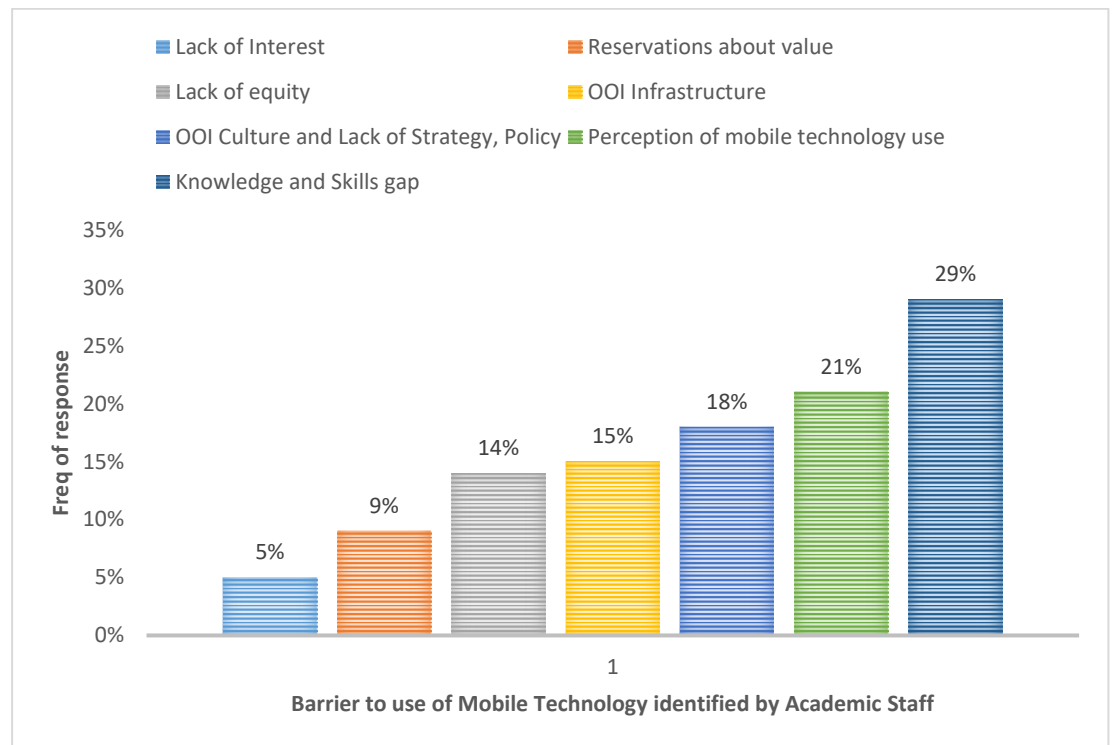
The academic staff are at the point of direct contact with the end users (the students). It was therefore important to reflect the student perspective in the guidelines being produced through this research. The student perspective showed that most indicated not having any mobile interaction with their lecturers directly or within formal learning contexts. However, both in the classroom and while studying independently or on the move, students individually supported their learning in ways that took advantage of the portability of their mobile devices as well as taking advantage of the phone features.

The use of mobile devices by students tended to fall into categorisations of mlearning that inhabited one or multiple spaces given as temporal, physical, transactional, technological and pedagogical. It was also uncovered that student held perceptions of using mobile devices in learning in ways that were not starkly defined but rather influenced by their experiences of using technology within the OOI and their own personal use of mobile devices which were constantly evolving along with the technology. In addition, they expressed a preference for using their mobile devices as a personal support tool rather than as part of a formalised learning context. Their views of infrastructure as a barrier

reflect the evidence from academic staff, as do their views of mobile technology use in learning and teaching being primarily convenient and facilitating easy access to content and information along with more reliable communication. Other factors that are identified across all groups in this research are: mobile devices have a potential for distraction in class, the need for cultural adjustment, and considerations of security, privacy and equity while ensuring a user experience.

The guidelines presented in the previous cycle proposed activities aimed at creating mobile capacity in the OOI. Through the investigations in Cycle three, a need for leadership input proposed in Table 6.1 and revised in Table 6.3 was identified. The elements of the guidelines proposed were aligned against the TOE framework to illustrate that there was a gap for understanding the external drivers behind the OOI's interests in mobile learning and adopting UYOD.

The areas for leadership guidance are identified as demonstrating the value of the time spent on innovative experimentation within the existing workload, addressing cultural expectations, lack of assurances around equity associated with device ownership lack of strategy and policies to address areas such as data protection. There is also a need to tackle the existing infrastructure in how fit for purpose it is for supporting UYOD.

To respond to these issues raised in this cycle, it is proposed that the guidelines earlier presented at the end of the previous cycle be expanded. The expansion adds on a circle of activities which are a backdrop that are enable the OOI leadership to demonstrate ownership of the mobile agenda, and the change management programme to address the cultural and organisational shift associated with adopting UYOD and mobile learning. This is a continuous stream that runs simultaneously with the workstreams previously proposed. This leadership activity provides a foundation for the programme, accountability and ongoing change management and visible leadership support. The leadership can define how such an environment is relevant to the institution, specify the programme objectives in relation to the organisation's key goals and identify the external influences that are driving mobile technology use. This demonstrates their commitment to the wider organisation and address the perceptions held about the use of mobile and UYOD being fringe activities or the sentiment that:

"OOI structure still expects traditional lecture formats. No time is allocated to preparation of materials, dealing with student queries online, etc." –LS43

The change management effort in this phase will also define measures to ensure that the programme for creating mobile capacity is absorbed into the institution's normal operation procedures processes and functional units to ensure future continuity and sustainability while continuously assessing current practices and evolving technology.

The first visible show of leadership is the initiation of a programme to enable mobile capacity by the leadership. This is when the leadership of the institution decide in response to external stimuli such as the technology trends, or increased competition for students to employ UYOD to advance the mobile learning agenda of their institution. In the OOI, the organisational leadership and the LTSC have a two way relationship in that the LTSC advice on policies pertaining to learning technologies and this provides the opportunity where the leadership can instigate the programme through the LTSC who then conduct the tactical process of creating capacity to incorporate UYOD for mobile learning.

Figure 6.16: Guidelines for creating a mobile learning environment by enabling UYOD

Programme initiation by leadership

Change management: Showcase value in adopting UYOD

Demonstration of Leadership support

Identify change agent(s), aides. (Gatekeepers)

Define the social systems
Define user categories which include innovators, early adopters, early majority, late majority, and laggards . Define communication plan and identify appropriate channels to reach the different categories of users

Establish community of users
Deploy communication plan and establish a community of end users from all categories in formal and peer networks.
Ensure community includes student representation

Ongoing Mobile/Personal Device Management: Monitor knowledge gaps as technology evolves and be responsive to privacy, data needs

Change management : Address issues of equity and ownership

Align with OOI strategic goals.
Relate the use cases to the organisational goals to define value to all stakeholder

Assessing Organisation systems and processes
Identify the challenges and roadblocks to the use cases identified.
Consider external forces such as evolving technology and determine how to account for this in any proposed changes
Situate the value of a UYOD environment within the terms of the organisation's strategic goals and objectives
Address student concerns with using their personal mobile devices

Determine UYOD range of use
Engage with community to generate possibilities for deploying UYOD in practice (use cases)
Explore how students current use their devices

Creating Capacity
Specification of how to incorporate user owned devices, enabling policies and guidelines Establishing support and learning pathways.

Programme integration

Change management: Tackle Infrastructure, Culture, Policies

Continued change management and demonstration of leadership support

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As the programme progresses through the workstreams, the leadership remain engaged and visible as part of change management activities which are ongoing to ensure that all stakeholders- staff and students are prepared, supported and motivated to make the cultural and practical adjustments associated with UYOD. As capacity for using UYOD to implement mobile learning in the organisation increases, this gets integrated into the programme as "business as usual." A lasting part of this programme is the provision of a legacy of ongoing management of mobile or personal devices. This is important to ensure that the systems and processes remain fit for purpose as the technologies evolve, particularly around the knowledge gaps that come up and the assurances around issues pertaining to personal data management, privacy.

6.4 Conclusion of Cycle three and chapter six

This chapter has described the three phases of interrogation explored in cycle three to reveal the issues issues to be addressed to enable sustainable mobile learning in the OOI from the perpectives of the wider body of academic staff and students as well as the leadership of the OOI. These issues have been revealed to be:

- Ensuring there is value for both staff and student in using mobile technologies
- Addressing issues of equity and ownership
- Reviewing the Institution's infrastructure
- Reviewing the culture, strategy and policies around the use of technologies to reflect a consideration of the tactical issues, particular in relation to mobile technologies.
- Addressing the perceptions of mobile technology use held by staff and students by cultivating activities to demonstrate value
- Determining how to close knowledge and skills gaps

The response to these issues has formed a workstream focused on change mamagement activities which is added as a foundation and backdrop to the tactical work described in the previous presentation of the guidelines at the end of the previous cycle. This is now presented as the UYOD guidelines for enabling sustainable mobile learning in the OOI- a higher education institution.

7. Conclusions and Future Plans

Introduction

This last chapter is a summary of the research conducted and reported in this thesis. The research followed a Design-Science (DSR) or Design-Based Research (DBR) approach to produce a set of guidelines which is in the form of a defined meta-level programme of activity involving stakeholders in a higher education institution (the OOI). In this chapter, the significant contributions made to the mobile learning research area and management of technology for learning in higher education institutions are outlined. In concluding the chapter, the strengths and limitations of the thesis and future work areas including recommendations and directions for future research are identified.

After examining the state of mobile learning by reviewing current literature earlier in Chapter two, it was determined that various factors put together provide the opportunity for mobile learning to transform learning where transformation is described in the context of the SAMR model to be when existing tasks are modified or redefined (Table 2.1). The factors are the widespread ownership of relatively cheap computing power in the form of mobile devices in the student population, the improving network capabilities and the evolution of mobile devices and developments such as virtual reality, augmented reality, big data resulting from increased activities using devices and artificial intelligence. By adopting UYOD in a learning and teaching context, educators can take advantage of the affordances of the mobile device as outlined in Figure 2.1 noting that the classifications are subject to revision as new affordances are developed and mobile devices evolve. However, in order to be in a position where educators can do such transformation work, the institution needs to have the environment within which such implementations of mobile learning can be deployed and are sustainable. To provide guidance on how to enable such an environment, this research has gone through three cycles of DBR described in chapters four, five and six based on the methodology outlined in chapter three, to propose guidance in response to the issues encountered. This final chapter outlines the findings from the thesis as a whole and discusses the guidelines as the culmination of the iterative activities of the DBR cycles described in Chapters Four, Five and Six. The guidelines are presented as an

instrument with which higher education leadership and management and policy advisers can guide the creation of capacity to leverage the use of UYOD to create a mobile enabled environment in a higher education institution.

7.1 Design-Based Research (DBR) Cycles

The primary goal of this research was to derive guidance for higher education institutions such as the OOI or similar organisations[2] to create capacity for sustainable mobile learning deployments that leverage student owned devices. To address this goal, three research questions were explored in DBR cycles. These three research questions were specified in Section 2.5 as:

> *Question 1: What are the obstacles around UYOD in learning and teaching?*
>
> *Question 2: How can policy and practice in an institutional context for UYOD respond to these obstacles?*
>
> *Question 3: What leadership requirements would be adequate to implement helpful policy and practice to enable UYOD for mobile learning?*

Exploring these questions through the three cycles described in the previous chapters led to gaining an understanding of the obstacles that prevent the institution wide adoption of mobile learning using UYOD. As a response to the issues raised, this study has proposed guidelines which provide direction to put in place suitable strategies and services to ensure that an organisation can support and sustain mobile learning initiatives that leverage UYOD. By using the guidelines proposed, the organisation can also ensure that its environment and infrastructure remains fit for purpose as these technologies evolve.

The guidelines are based on the findings from the activities in cycles one, two and three of this research. Each of these cycles has been described in the preceding chapters to this and culminated in the guidelines presented at the end of cycle 3 in Chapter Six. Each cycle addresses a research question and is revisited in the following subsections.

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[2] Organisations who have adopted the higher education model for deploying ongoing education, developmental programmes. Examples are Ingersoll Rand University, Veolia Campus, Eni Corporate University.

7.1.1 Cycle 1 The obstacles around UYOD in learning and teaching

Following the literature review, in Cycle One, the objective was to understand how students and staff were using mobile technologies to support their learning and teaching and enable the researcher to determine if there was an appetite for mobile technologies in the institution and what the obstacles were for implementing mobile learning using a UYOD approach. It was determined that while there was an interest in exploring mobile learning, lecturers were reliant on the goodwill of supporting staff due to shortcomings of the existing support structures and infrastructure. These explorative mobile learning activities were seen by support staff as experimental and not considered to be prioritised as part of the strategically aligned work to be done to drive the organisational goals.

The areas of obstacles around UYOD were with the systems and processes which did not interoperate with the solution being deployed. Management of a mobile learning initiative was also difficult due to a lack of policy guidance to address student concerns of equality, equity, privacy and security of systems and data protection.

The themes from Cycle One were aligned into three categories to be investigated for their capacity to enable and support mobile learning using UYOD in Cycle Two. These categories were environment and infrastructure, processes, and people.

7.1.2 Cycle 2 Institutional policy and practice response needs to enable UYOD for mobile learning

Having established the appetite, it was determined that the next phase of the research would focus on determining evaluating the institutional capacity to identify the difficulties in the current system.This is with particular focus on when students use their own devices in formal learning contexts (Section 5.4). The staff experience of incorporating student-owned devices and mobile learning within a formal learning context such as using the institution's messaging system is also examined through the implementation of Cycle 2 discussed in Section 5.5. It was established that there were three areas to be addressed when considering implementing the mobile technology strategy:

- The concerns of people who would be impacted as stakeholders in the use of the mobile technology,

- The processes these stakeholders were engaged in as part of participating in or supporting learning and teaching
- The environment within which they operated, including the physical environment and IT systems or the infrastructure within which the mobile technology would need to operate.

Two instances of messaging based mobile learning were deployed to test the institutional capacity to support mobile learning leveraging UYOD and identify where guidance was required. These comprised of the deployment of a messaging system to send messages to students:

- To prompt them to act by completing a task related to their programme in the VLE
- Which they needed to respond to in message format.

These implementations of messaging as mobile learning enabled examining activities in the categories of the Environment and Infrastructure, Processes, and people as shown in Figure 5 and revealed the shortcomings in the capacity of the OOI to enable and support mobile learning with UYOD. These shortcomings stem from a lack of recognition of the personal nature of individual mobile devices and provision of suitable guidelines around incorporating of such. Due to the lack of the guidance around managing personal devices such as the mobile devices, there was no reassurance to ensure privacy of information, and set expectations around possible usage. Additionally, there was lack of capacity around expertise in mobile instructional design, and lack of awareness of the scope of benefits, and risks associated with mobile learning.

To address these areas workstreams of activities aimed at addressing the issues and creating capacity to leverage UYOD for enabling mobile learning were proposed as guidelines. The activities within the workstreams are locally customisable to be sensitive to the underlying cultural dynamics that influence the operational activities in the institution.

- Working through change agents as practice leaders and influencers to create a diverse community of practice and support where mobile learning is explored through discussions and experiments. And use cases are generated. This diverse community group will include users from disciplines and social systems across the institutions. To encourage

participation, incentives for staff are useful tools to demonstrate the value of the programme to the wider institution at this stage and to sustain innovation. Exposure to the possibilities of UYOD in this way stimulates cultural adjustment from excluding mobile device use, as highlighted in Section 6.2.3.1, where students pointed out that lecturers tended to ban the use of mobile devices even when their use enhanced the learning experience for the student.

- By exploring the use cases identified, it is possible to specify organisational systems and processes likely to be affected and put it place measures to address these which also serve to reassure both students and staff that mobile learning administration is based on informed organisational guidance. In working through use cases and aligning them with learning outcomes, assessment strategies can be defined to ensure that the use of mobile learning adds value to the experience for students.

- Determining a programme for capacity creation by defining policies and guidelines to govern how devices are incorporated and clarify expectations of support and how to scale knowledge and expertise. An important aspect of determining the programme for capacity is the consideration of what the programme will cost.

Visible artefacts resulting from the experimentation in this phase serve to influence the culture around mobile technology use in the institution. Such artefacts also serve to promote experimentation that align with the objectives of the institution. These artefacts can include a published and accessible catalogue of use cases for mobile learning, a policy for enabling staff use of their own devices, or provision of devices for staff use and a transparent process of how staff can try out innovations in their practice. These deliberations around ensuring the provision of devices for staff include consultation with Legal and Human Resources (HR) to deal with the complexities around staff use of mobile technologies, like those highlighted in section 6.2.1.1, such as balancing workloads, extending office hours, and ensuring that staff's personal time is protected.

Recognising that the scale of change associated with this type of organisational shift in using technologies requires leadership support, the next cycle focuses on specifying what the leadership requirements are.

7.1.3 Cycle 3 Leadership Requirements for UYOD and mobile learning

This last cycle of the research focused on eliciting where the leadership direction was required to drive the agenda of using UYOD to enable mobile learning in the OOI. It also engaged with the wider population to establish that the feedback got from student and staff in cycles one and two was a valid reflection of the population.

A recurring factor was balancing the exploration of new technologies such as mobile devices for learning with the existing workload. The leadership staff felt that without determining a priority for such exploration and specific demonstration of the value of such activity to indicate support, it was not feasible to expect traction on mobile learning. However, the executive leadership on the other hand felt that academic staff were expected to constantly improve their practice of teaching acknowledging that while term time might be too busy for this but highlighting that existing contracts including holiday periods when there were no teaching duties.

It was however acknowledged that institutional systems need to be aligned with more defined strategic intent that demonstrates support for innovative approaches such as mobile learning using UYOD in learning and teaching practice. Such demonstration of support is evidenced by the provision of funding to support the activities indicated in the guidelines, mandating continuous change management reporting and cultural adjustment initiatives that continue even after the integration of the programme of mobile capacity creating is absorbed into the regular operation of the organisation.

7.2 Research Contributions

This thesis has produced a set of guidelines to support a higher education institution to put in place an environment that allows the use of UYOD for sustainable mobile learning practices and enable transformational learning experiences. Previously in Section 2.3, it was acknowledged that while there is a growing literature on mobile learning and mobile technologies, most of the literature has tended to focus on mLearning implementations in learning and teaching, specific mobile applications and less so on broader strategic implementation at an organisational level and the incorporation of UYOD. The

models aimed in the literature for guiding mobile learning adoption or implementation have been targeted at systems designers, and educators rather than at decision makers responsible for determining the technology or digital strategy at the organisational level, IT management and Learning Technology strategists.

In the literature review at the start of this thesis, it was indicated that some of the mobile learning models and frameworks have tended to be evaluative rather than directive leaving a gap for guidelines to support a higher education institution to build an environment to support mobile learning.

The findings from the three cycles of this research have demonstrated that the process of creating mobile learning capacity by adopting a UYOD approach needs to be led from cultural, technical and pedagogic perspectives, and be flexible in order to take future trends into account as the possibilities of the interactions which can be enabled by mobile technology use within the boundaries of institutional learning cannot be definitely forecasted. From the researcher's perspective as a third space professional as defined in Section 1.5 and in the context of the OOI as a case study of a higher education institution, this thesis makes the following contributions:

7.2.1 Contribution to Literature

The research has demonstrated the value of Design-Based Research (DBR) as a method for integrating multiple viewpoints from a variety of stakeholder groups in an organisation to generate a solution to a relevant problem. The iterative approach of DBR was applied to examine different viewpoints and develop the guidelines proposed as a result of the findings from each cycle of interrogation. This iterative process contributes to establishing DBR as a viable research method for managing complex research contexts that encompass integration of technology, management of resources and consideration of cultural impact (Bannan et al., 2016).

This research also describes the issues of infrastructure and processes around implementing mobile learning with UYOD giving insights into how the interoperation of the organisational strategy, culture, infrastructure and perceptions of the stakeholder community can influence building capacity for

incorporating user owned devices in learning and teaching and driving the agenda of mobile learning. These insights as summarieded

It is important to note that the guidelines proposed here are not an alternative to existing mobile learning frameworks such as those described in Section 2.3.4 for designing, developing or evaluating mobile learning initiatives. By focusing on the organisational perspective of enabling UYOD for mobile learning, this thesis provides a foundation within which these other frameworks and models can be applied to individual projects. The guidelines also provide a context within which a higher education institition can address issues pertaining to its assessment and quality criteria for audit considerations.

7.2.2 Contribution to Practice

In practice these guidelines will be of use to institution leaders, policy makers, academic quality management leaders and academic support practitioners such as learning technologists, and IT management staff who need to support educators to design and deploy sustainable mobile learning initiatives.

The activities in the workstreams of the guidelines are aligned with issues that have been highlighted in the interaction across the three cycles of the research. While being grounded in research findings that reflect the viewpoints from multiple stakeholders who have engaged with using mobile technologies (Cycle 1 and 2) and who are intended users (Cycle 3), the guidelines produced are strategic and focused on the actions to accomplish the goal of being capable of supporting UYOD for mobile learning. By doing so an organisation such as the OOI can determine its own tactical plan and identify the roles and resources lacking in its current structure to carry out the activities in the workstreams defined.

The guidelines provide a pathway through which which innovation and change resulting from UYOD being incorporated for mobile learning can be proactively driven in line with broader strategic directions in response to technological developments and other environmental factors rather than simply managed as a fringe activity. From the feedback from students and staff, this thesis has revealed not being convinced of the value to organisational goals and valued work as well as reservations around privacy, personal boundaries and equity are strong reasons for the lack of traction with mobile learning.

By specifying the actions to be undertaken, the guidelines provide a blueprint that can be used to determine the readiness of the higher education institution's environment for the use of mobile technologies in learning and teaching contexts. It also defines a recommended action to build an environment for sustainable mobile learning initiatives, strategy, policy development and enabling innovation in learning using mobile technologies. Being purposefully derived for higher education environments the guidelines provide the channels by means of recommending a communities of practice model to ensure that concepts important in higher education such as intellectual development and scholarly community are incorporated.

7.3 Research Limitations

Reflecting on the research done to acknowledge the limitations is a way to establish the quality of the findings. These are discussed in the following sections.

7.3.1 Research Design Approach and Methods

The research was undertaken from the particular perspective of a multidisciplinary professional and employed a DBR approach in an iterative approach to addressing the research questions identified. This was particularly suited to the type of exploratory research described in this thesis. A researcher more focused on one particular aspect of the guidelines and using a different approach may discover additional findings that enhance the guidelines in that particular aspect. It is not expected that any such findings will invalidate the results from this research as each cycle of the research has iteratively contributed to the guidelines.

7.3.2 Research Data Set

In the DBR Cycle 2, there were two mobile learning implementations observed as part of this study due to the availability of academic staff participants and available resources for the research. The use of a messaging platform in the two ways described (Section 5.2.2: using messaging to support learning in entrepreneurship programme and 5.2.3: using messaging to support learning in Mandarin language module) highlighted the potential areas where the current systems need to be adjusted to enable a UYOD approach. This use of messaging

in learning limits the study to one use case. However, it is acknowledged that observing more use-cases based on other affordances of mobile devices would validate the guidelines proposed.

Furthermore, since the samples of students and staff engaged in Cycles 1 and 2 of the study was a convenience sample rather than a probability sample, there is a potential for sampling bias. This limitation is addressed by engaging with a wider audience of both staff and students in Cycle 3 which make the study generalisable to other similar organisations.

7.3.3 Generalisability of Findings

In section 1.2, the OOI was characterised as a higher education institution. In Section 3.2 the OOI was further identified for study as the bounded case of a higher education institution in so far as the characteristics of the case are recognised. While it is acknowledged that the findings derived in the cycles of the research may be unique to the OOI given its inherent characteristics during the period of the research, the insider accounts from various stakeholders derived through the cycles and the engagement with the larger random sample of students and staff in cycle three produce the insights prompting the response captured in the proposed meta level guidelines which are generalisable to other similar organisations. A study in Australia which looked at the instructional, curricular and organisational factors that impact the adoption of mobile learning in higher education instititions identified similar issues to be addressed to ensure successful adoption as shown in figure 7.2 (Handal et al., 2013, p. 365):

Figure 7.1: Issues in mobile learning implementation (Handal et al., 2013)

Themes	Instructional	Curricular	Organizational	
			Technical	Corporate
Issues	Educational benefits	Training delivery style	Access to technology	Policy
	Distractedness	Type of training	Cross-platform compatibility	Workload
	Student-staff communication	Disciplinary learning	Quality of wireless connection	Equity of access
	Superficial learning	Specific training	Operational limitations	
			IT support	

A more recent study also found that academics perception of mobile technology and weak institutional support along with ethical and privacy concerns hinder effective integration (Shraim and Crompton, 2015). These validate the findings from the research conducted from this study as being relevant to other similar institutions.

Given the similarity of the issues to those uncovered in this thesis, the guidelines developed in this study are applicable to other institutions and provide a systematic and planned approach to creating capacity for mobile learning in an institution by addressing the issues to be tackled to adopt UYOD for mobile learning.

7.3.4 Post Research Validation of Proposed Guidelines

The research was limited to one organisation and while this is not unusual for a case study and when using a DBR approach, the output can be strengthened by deploying validation tests of the guidelines. Conducting such post-research validation in the OOI, or at a different institution or organisation, would increase the generalisability of the guidelines proposed.

7.3.5 Researcher Bias

As the research is conducted by a researcher who is also a practitioner, it is important to acknowledge that the findings reported may have been subject to interpretation bias and be inclined to be action oriented. Data reported and analysed included both positive and negative aspects expressed by the participants using quantitative measures to validate the data strengthens the conclusions reported.

7.4 Future Work

The opportunities to build on the findings of the research include areas of interest for the researcher as well as other interested parties. It is envisioned that the guidelines proposed in this thesis are a first step towards a goal of transforming higher education using user owned devices. The next step is validating the guidelines in a higher education institution. This validation can focus on an aspect of the guidelines or on the entire presentation of it. Such post-research validation may be conducted by practitioners or researchers with a specific interest in pursuing the agenda of enabling UYOD for mobile learning. Other areas of future work that are pertinent to the research from this thesis are:

7.4.1 Publication of Research Output

It is intended that having completed the thesis the following areas will be written up as outputs from this research:

- Exploring the Design-Based Research (DBR) approach used for creating the guidelines

- Presenting the proposed guidelines and making recommendations for its use.

As well as submitting to academic publications to share the output from the study, it is intended to make the findings and guidelines accessible to practitioners by creating an eBook and website.

7.4.2 Validating the guidelines for private sector organisations

Many private sector organisations such as multinational organisations and larger companies with staff learning needs also face challenges with creating a mobile learning enabled environment and deploying mobile learning initiatives to their staff despite in some cases, having provided mobile devices to their staff. These organisations tend to focus on technology solutions such as enterprise mobility systems and mobile learning platforms to deliver their learning content.

7.4.3 Further study of individual aspects of the guidelines

There are opportunities to continue further research on individual sections of the guidelines as this study has focused on the strategic institutional approach to enabling mobile learning.

7.4.3.1 What are the privacy and data handling implications of increased use of UYOD in learning and teaching contexts.

Given that most higher education institutions will have mature systems and architecture as in the case of the OOI, there is an opportunity to focus research on how to incorporate the particular systems that enable mobile learning, with due consideration of the terms and conditions that accompany use of mobile devices. These are: privacy, handling of data, access to personal information held on the devices and ability to track users. With the growth in big data, and legislative changes being proposed, there is continued need to ensure that a balancing of the ethical and regulatory aspects of using individually owned mobile devices against the user experience to be pursued.

While the guidelines include directions to the organisation on specification of the policy and strategy for enabling staff use and exploration of mobile technologies, more research is required into the impact of this type of activity

and the implications, particularly around the types of activities enabled and how these can be tracked for purposes of learning assessment. More so, given that IT management have acknowledged in section 6.2.2.2 that most of the data in the OOI is being moved from the current data centres to cloud-based services.

It is expected that the library of possible use cases for mobile technologies will continue to grow as the technology evolves. Aspects of the guidelines that consider the implications from the data management, storage provide an opportunity to contribute to the research around the privacy, security and ethical perspectives of mobile technology use. The design of the architecture of systems to be deployed in higher education institutions is also an area for further research as the amounts of data being generated and advances in machine learning increase the level of the granularity of personalisation possible in using learning analytics.

7.4.3.2 Will transformational learning experiences require a rethink of practice and purpose of higher education?

Lastly, with the emphasis in this thesis on the organisational approach to creating an environment for sustainable mobile learning, such an environment has the potential to transform education in ways not experienced previously as demonstrated in Section 2.1.2 where the SAMR model definitions were applied. It is also suggested that there are implications of such a transformation that will impact on the practice and philosophy of higher education regarding inclusion, participation and access (Traxler, 2016b, p. 13). It is expected that such transformation will require further research into teaching and assessment methods, how the curriculum is affected, as well as any impacts on the roles of teaching and support staff.

7.5 Last note: Revisiting the research questions

The aim of this research was to derive guidance for how the capacity for mobile learning which leverage individually owned devices (in a UYOD approach) could be created within an organisation such as a higher education institution. After reviewing frameworks from the literature and current research, it was established that the existing frameworks and models addressed the design of mobile learning systems, interventions and evaluation of these. However, there was a gap for practical guidance for a higher education institution to create the

capacity to take advantage of individually owned mobile devices which have become ubiquitous to enable sustainable mobile learning. To do this, the research addressed the questions re-presented in the introduction to Chapter 7.

To present and communicate the creation of a mobile learning enabled environment, the guidelines provide a useful illustration of the specification of steps required. They have been designed for practical application at a strategic level to determine the activities and considerations involved in creating a mobile learning enabled environment. The guidelines are based on the learning from the activities in Cycles one, two and three of this research. The work has built on previous research and contributed to existing gaps in the literature.

As a final note, from the time this research commenced till date, mobile technologies and devices have become more than simply handheld computers to include personal devices such as watches, wearable devices and a part of the ecosystem frequently referred to as the Internet of Things (IOT). These guidelines provide a useful starting point for the consideration of user owned devices (Gibson, 2016) within the higher education institution's environment and infrastructure. This is particularly relevant as higher education continues to explore incorporation of mobile and personal technologies to enhance learning starting with information access as the most common point of entry.

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Appendices

Appendix 1: Research Ethics Applications

1a School of Education Fulfilment

SCHOOL OF EDUCATION – PGR STATEMENT OF RESEARCH ETHICS

The University of Nottingham

Name (Student): CLAUDIA IGBRUDE   Supervisor: MIKE SHARPLES; CHARLES CROOK

Research Topic: STRATEGIC IMPLEMENTATION OF MOBILE LEARNING (working title)

	Tick where appropriate
1. I have read and discussed with my supervisor(s) the British Educational Research Association's *Revised Ethical Guidelines for Educational Research* (BERA, 2004).	✓
2. I have read and discussed with my supervisor(s) the *Research Code of Conduct* of the University of Nottingham: http://www.nottingham.ac.uk/csc/academic-integrity/PhD/nottingham-research-code-of-conduct.php .	✓
3. I am aware of and have discussed with my supervisor(s) the relevant sections of the *Data Protection Act* (1998): http://www.hmso.gov.uk/acts/acts1998/19980029.htm.	✓
4. Data gathering activities involving schools and other organizations will be carried out only with the agreement of the head of school/organization, or an authorized representative, and after adequate notice has been given.	✓
5. The purpose and procedures of the research, and the potential benefits and costs of participating (e.g. the amount of their time involved), will be fully explained to prospective research participants at the outset.	✓
6. My full identity will be revealed to potential participants.	✓
7. Prospective participants will be informed that data collected will be treated in the strictest confidence and will only be reported in anonymised form, but that I will be forced to consider disclosure of certain information where there are strong grounds for believing that not doing so will result in harm to research participants or others, or (the continuation of) illegal activity.	✓
8. All potential participants will be asked to give their explicit, normally written consent to participating in the research, and, where consent is given, separate copies of this will be retained by both researcher and participant.	✓
9. In addition to the consent of the individuals concerned, the signed consent of a parent, guardian or 'responsible other' will be required to sanction the participation of minors (i.e. persons under 16 years of age) or those whose 'intellectual capability or other vulnerable circumstance may limit the extent to which they can be expected to understand or agree voluntarily to undertake their role'.	NA
10. Undue pressure will not be placed on individuals or institutions to participate in research activities.	✓
11. The treatment of potential research participants will in no way be prejudiced if they choose not to participate in the project.	✓
12. I will provide participants with my contact details (and those of my supervisor), in order that they are able to make contact in relation to any aspect of the research, should they wish to do so.	✓
13. Participants will be made aware that they may freely withdraw from the project at any time without risk or prejudice.	✓
14. Research will be carried out with regard for mutually convenient times and negotiated in a way that seeks to minimise disruption to schedules and burdens on participants. (see BERA, 2004)	✓
15. I have considered carefully to what extent, if any, my research might expose me to any kind of risk to my personal safety. I have also discussed this with my supervisor and have taken appropriate steps to respond to any risks identified. Where such a strategy has been agreed a record of it is attached to this submission.	NA

16. At all times during the conduct of the research I will behave in an appropriate, professional matter and take steps to ensure that neither myself nor research participants are placed at risk.	✓
17. The dignity and interests of research participants will be respected at all times, and steps will be taken to ensure that no harm will result from participating in the research.	✓
18. The views of all participants in the research will be respected.	✓
19. Special efforts will be made to be sensitive to differences relating to age, culture, disability, race, sex, religion and sexual orientation, amongst research participants, when planning, conducting and reporting on the research.	✓
20. Data generated by the research (e.g. transcripts of research interviews) will be kept in a safe and secure location and will be used purely for the purposes of the research project (including dissemination of findings). No-one other than research colleagues, supervisors or examiners will have access to any of the data collected.	✓
21. Research participants will have the right of access to any data kept on them.	✓
22. All necessary steps will be taken to protect the privacy and ensure the anonymity and non-traceability of participants – e.g. by the use of pseudonyms, for both individual and institutional participants, in any written reports of the research and other forms of dissemination.	✓
23. Where possible, research participants will be provided with a summary of research findings and an opportunity for debriefing after taking part in the research.	✓

24. Does your research involve (please tick **ALL** that apply):

Schools? [ ]   Vulnerable Adults? [ ]   Children? [ ]   **None** of these groups [✓]

25. a) Will your research be conducted in (please tick **ONE BOX** only):

UK only? [ ]   Outside the UK only? [✓]   UK & outside the UK? [ ]

b) If outside the UK, please name the country(ies) involved:
IRELAND

26. FOR ALL STUDENTS UNDERTAKING RESEARCH INVOLVING SCHOOLS, CHILDREN (UNDER 18) AND/OR VULNERABLE ADULTS I have received Enhanced Criminal Records Bureau (CRB) disclosure *through the University of Nottingham* and the School of Education Research Office has the reference number· *This applies even when data are collected outside of the UK.* **NB:** All students <u>must</u> remember to apply for their **University of Nottingham** CRB disclosure when they are visiting the UK.	NA
27. FOR ALL NON UK STUDENTS I have received a Certificate of Good Conduct (or equivalent)* and the School of Education CRB Coordinators have a copy of this**	NA

* Countries that produce a Certificate of Good Conduct are: Australia, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Irish Republic, Italy, Jamaica, Latvia, Malaysia, Malta, Netherlands, New Zealand, Philippines, Poland, South Africa, Spain, Sweden & Turkey.
** UK students who have lived in one of the above countries for 6 months or more may also need to apply for one of these.

Please provide further information below in relation to any of the above statements which you have not been able to tick, explaining in each case why the suggested course of action is not appropriate (continue on a separate sheet if necessary):

9) Participants are non vulnerable adults- higher education staff and some students.
15) No foreseeable exposure to risks to personal safety. Meetings will mostly be held in semi public spaces or via electronic means.
26) Not applicable- Research is with Higher education academic, administrative staff and students.
27) Not applicable

Please outline any areas of research ethics related risk, which have not been referred to above, associated with your research, and how you intend to deal with these (continue on a separate sheet if necessary):

Not Applicable

1a Attachments (as appendices to application)

PARTICIPANT INFORMATION SHEET

You are being invited to participate in a research project on Mobile Learning.
This document contains information that explains what the research is about, what it will involve, and what will be expected of you. If you have any questions at any stage, please contact me for clarification before deciding whether to take part or not (claudia.igbrude@OOI.ie)
If you would like to receive a summary of the findings from this study, please indicate this by including your email address in the space provided.

Research Aim

The aim of this research is to develop guidelines that can guide the implementation of mobile learning across a wider context across institutions or organisations than single instances or pilots.
You have been selected as a participant because you are a stakeholder in the process of designing and implementing technological enhancements to learning and teaching in your organization. This study is intended to take all stakeholders views into consideration.

What is expected of you?

All Participants

If you decide to take part, you will be required to sign the consent form attached to this information sheet and a copy of this will be given to you for your own record. You are however; free to withdraw at any point up until after data has been collected. I will need you to watch a brief presentation or read a brief document on what Mobile Learning is, and then, I will interview you either one to one, or in a focus group. These interviews might be face to face or by electronic means (telephone, video conference, Skype, etc) There might be two or three interviews of such interviews. The interviews will last for about 30mins to 1hour.

For students, participation in this research will not affect your coursework or relationship with your lecturer.

Pilot Participants

If you are involved in the pilot implementation process, I will need to interview you again, and will make observation as the pilot is implemented as well as after. I will also require you to keep a log to document any reflections.

All Participants
What happens to the Data?

To be able to analyse the data, I will need to record conversations we have whether they are face to face, over telephone or Skype, instant messenger or email exchanges. However, all individual contributions will be anonymised. Data is stored in a password protected file that is only accessible by the researcher. Any information acquired from your mobile phones or devices via any sort of tracking mechanism will be used solely for the purpose of this research.

All original data is considered confidential and will be destroyed as soon as the research study is completed.

What happens to the research results?

The results of this research will be presented to the University of Nottingham as my PhD thesis. There will also be papers and articles based on this research disseminated via journals, conferences or books.

Thank you for reading this and I look forward to hearing from you.

Best Regards,

Claudia Igbrude

PARTICIPANT CONSENT FORM

Working Project title ……Strategic Implementation of Mobile Learning…

Researcher's name …CLAUDIA IGBRUDE………

Supervisor's name …….MIKE SHARPLES, CHARLES CROOK……

1.   I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.

2.   I understand the purpose of the research project and my involvement in it.

3.   I understand that I may withdraw from the research project at any stage up until data collection is completed and that this will not affect my status now or in the future.

4.	I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential.

5.	I understand that I will be audio taped / videotaped during the interview, phone calls or Skype conversations.

6.	I understand that data (Audio, video, transcripts, etc)will be stored electronically on a password protected hard-drive designated solely for use in this project and kept securely in a physical location accessible only by the researcher, and upon request, the project supervisors or examiners. Any hardcopies of notes (handwritten or typed will also be kept in said location.

7.	I understand that I may contact the researcher or supervisor if I require further information about the research, and that I may contact the Research Ethics Coordinator of the School of Education, University of Nottingham, if I wish to make a complaint relating to my involvement in the research.

Signed …………………………………………………………………………
	(Research participant)

Email address..If you would like to be part of a smaller focus group as part of this research, please tick this box
(Optional for receiving summary of results)

Print name ………………………………………………………………… **Date** …………………………………

Contact details

Researcher: *Claudia Igbrude:* ttxci3@nottingham.ac.uk
Supervisors: *Mike Sharples:* mike.sharples@nottingham.ac.uk
	Charles Crook: charles.crook@nottingham.ac.uk

School of Education Research Ethics Coordinator:
educationresearchethics@nottingham.ac.uk

Initial Interview questions

Academic/Teaching

The Questions here are meant to highlight what teaching staff see as mobile learning, and their attitudes towards mobile learning, any perceived barriers as well as their expectations.

-Have you read the primer and do you understand what mobile learning is?

-Have you applied any sort of mobile Learning in your teaching or lecturing?

-If yes, what were they and describe what worked and what didn't?
-If no, why not?

-How do you envisage mobile learning might be useful to you? (Ignoring constraints)

-What difficulties do you envisage?

How do you think students use mobile devices (phones, ipods, ipads, etc) for learning outside of school work?
(E.g. games, social networking, etc)

-How do you support your own learning using mobile devices?

-What would concern you about using student's own mobile phones for school related work?

- Do you think using mobile learning impacts on your teaching? How?

Admin/Non-Academic (IT, Student affairs...finance
The interviewees here include staff from a variety of support functions that work together to ensure the smooth interactions between processes/procedures and systems. The questions will vary depending on their department function.

-Have you read the primer and do you understand what mobile learning is?

-How would you envisage that your department can support lecturers can get to use mobile learning?

-What structures or adaptations of your systems and processes can you put in place to support this?

-How would such as incorporation or adaptation affect your current practices and use of the systems?

-Are there any particular concerns you might have around the use of mobile learning?

Students
I will be interviewing Students to get insights into their own expectations, fears and hopes for using mobile learning

-Have you read the primer and do you understand what mobile learning is?

-How do you use mobile devices (phones, ipods, ipads, etc) for learning outside of school work?
(E.g. games, social networking, etc)

-How do you support your school work using mobile devices?

-What opportunities do you see within your courses to apply mobile learning?

-What would concern you about using your own mobile phones for school related work (formal learning)?

- What effect do you envisage there might be from using your mobile device within your formal learning contexts and settings?

1b School of Computer Science Fulfilment

School of Computer Science

The University of Nottingham

Research Ethics Review Checklist

To be completed by the researcher or student undertaking the study

3. This checklist should be completed for every research project that involves human participants, use of personal data and/or biological material …

4. … *before* potential participants are approached to take part in any research.

o The principal investigator, or the supervisor if the applicant is a student, is responsible for exercising appropriate professional judgement in this review.

o Email the completed and signed form, together with attachments, to cs-ethicsadmin@cs.nott.ac.uk   The signature page may be scanned separately if

required and/or email approval given.

SECTION I: Applicant Details

1. Name	CLAUDIA IGBRUDE
2. Status	**Postgraduate Student**
3. Email address	Email address removed
4. Date of application	29th March 2012
5. Is this a resubmission?	**No**

SECTION II: For UG & Postgraduate Students Only

1. Module name and number, or MA/MSc/MPhil/PhD course and department	PhD Computer Science
2. Supervisor's name	Peter Blanchfield, Charles Crook
3. Student ID	4152042

Before completing this form, applicants should read the guidelines at

www.cs.nott.ac.uk/ethics **and ensure that they understand**

- **what is defined as** *personal data;*
- **what is required for** *valid consent;*
- **the key requirements of the Data Protection Act**
- **the University of Nottingham Research Code of Conduct**

The signature at the end of this form confirms that this has been done.

SECTION III: Project Details

1. Project Title	Trojan Horse method for Strategic Implementation of Mobile learning *(Working Title)*
2. Proposed Start Date and Period of Study	**April 2012 through to July 2014**
3. Description of Project, including aims and objectives [Please include any information which may affect the consideration of the ethics involved, eg location of study, unusual circumstances, age range of participants.]	This purpose of this research is to explore the design, development and implementation of mobile learning as part of the overall learning and teaching or learning and development strategy within an organization, in this case a higher education institution. This involves the assessment of its current systems and processes with a view to how the adoption of mobile learning can be facilitated. It will analyze the process of mobile learning technology implementation with balancing perspectives from the administrative, academic and student standpoints. In the context of this research, Mobile Learning refers to the following types of activities: -Activities that are carried out using student owned mobile devices while the student is outside the physical classroom, and directed at addressing a specified learning objective. - Activities that are carried out using student owned mobile devices while the student is (1) inside the

	physical classroom and (2) as part of other activities, directed at addressing a specified learning objective.
4. Will personal data or biological materials be collected, recorded and/or analysed? If Yes, please give details of the data or materials and the methods to be used. Please describe how safe storage will be maintained according to the Data Protection Act.	**Yes** Personal Data such as user identification within the systems being investigated and implemented might be harvested initially but will discarded or anonymised before subsequent analysis. Interviews, focus groups, online meetings with participants will also be recorded as well as observations of the researcher. No identifying data will be included in transcription. Particular considerations will be made around the use and storage of any data acquired in the course of the research as the study focuses on the implementation of mobile learning with student owned devices. All data will be destroyed at the conclusion of the study and review by University of Nottingham review authorities. Participants will maintain their right to withdraw at any point up till after data gathering for the relevant stage. All data will be stored securely in encrypted files.

SECTION IV: Research Checklist (Part 1) – for completion by the applicant

	Please answer each question by ticking the appropriate box:	**Yes**	**No**
1.	Does the study involve participants who are particularly vulnerable or unable to give informed consent (ie children, people with learning disabilities, prisoners, your own students)?		✓

2.	Will the study require the co-operation of a gatekeeper for the initial access to the groups of individuals to be recruited (ie students at school, members of a self-help group, residents of a nursing home)?		✓
3.	Will it be necessary for participants to take part in the study without their knowledge and consent at the time (ie covert observation of people in non-public places)?		✓
4.	Will the study involve the discussion of sensitive topics (ie sexual activity, drug use)?		✓
5.	Will participants be asked to discuss anything or partake in any activity that they may find embarrassing or traumatic?		✓
6.	Is it likely that the study will cause offence to participants for reasons of ethnicity, religion, gender, sexual orientation or culture?		✓
7.	Are drugs, placebos or other substances (ie food substances, vitamins) to be administered to the study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?		✓
8.	Will body fluids or biological material samples be obtained from participants? (eg blood, tissue etc)		✓
9.	Is pain or more than mild discomfort likely to result from the study?		✓
10.	Could the study induce psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?		✓
11.	Will the study involve prolonged or repetitive testing for each participant?		✓

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12.	Will financial inducement (other than reasonable expenses and compensation for time) be offered to participants?		✓
13.	Will the study involve the recruitment of patients, staff, tissue sample, records or other data through the NHS or involve NHS sites and other property? If yes, NHS REC and R&D approvals from the relevant Trusts must be sought prior to the research being undertaken.		✓

Research Checklist (Part 2) – for completion by the applicant **Please answer each question by ticking the appropriate box:**	**Yes**	**No**	**Not Applicable**
14. For research conducted in public, non-governmental and private organisations and institutions (such as schools, charities, companies and offices), will approval be gained in advance from the appropriate authorities?	✓		
15. If the research uses human participants, personal data or the use of biological material, will written consent be gained?	✓		
16. Will participants be informed of their right to withdraw from the study at any time, without giving explanation?	✓		
17. If data is being collected, will this data be anonymised?	✓		

18.	Will participants be assured of the confidentiality of any data?	✓		
19.	Will all data be stored in accordance with the Data Protection Act 1998	✓		
20.	Will participants be informed about who will have access to the data?	✓		
21.	If quotations from participants will be used, will participants be asked for consent?	✓		
22.	If audio-visual media (voice recording, video, photographs etc) will be used, will participants be asked for consent?	✓		
23.	If digital media (eg computer records, http traffic, location logs etc) will be used, will participants be asked for consent?	✓		
24.	If the research involves contact with children, will the researchers have appropriate CRB checks?			✓

If you have answered 'no' to all questio in Part 1 and 'yes' to all relevant questi in Part 2	This project is deemed to have minimal ethical risks - go to signature page.
If you have answered 'yes' to any of the questions in Part 1 or 'no' to any of the questions in Part 2	Please describe in Section V why this is necessary and how you plan to deal with the ethical issues raised.

Please note that it is the applicant's responsibility to follow the University of Nottingham's Code of Practice on Ethical Standards and any relevant academic or professional guidelines

in the conduct of the study. **This includes providing appropriate information sheets and consent forms, and ensuring confidentiality in the storage and use of data.**

Any significant change in the questions, design or conduct over the course of the research should be notified to cs-ethicsadmin@cs.nott.ac.uk and may require a new application for ethics approval.

SECTION V: Further Information as required for paragraph 2 above

[to be completed by the applicant]

NA

RESEARCH ETHICS REVIEW CHECKLIST – SIGNATURE PAGE

SECTION VI: Applicant Declaration

Please tick to confirm each of the following statements before signing the form:	
I confirm that I have read the University's Code of Practice	✓
I confirm that I have read the guidance documents listed on page 1	✓
I confirm that the information provided in this application is correct	✓
Signature of applicant: … *Claudia Igbrude* … Date: …29/Mar/2012….	
Name of applicant: CLAUDIA IGBRUDE……..	

SECTION VII: Supervisor Declaration for UG and PG Applications

Name of Supervisor	
Please tick to confirm each of the following has been approved before signing the form:	

The participant information sheet or leaflet is appropriate for this research project	
The procedures for recruiting and obtaining informed consent are appropriate	
The data collection and storage methods, where applicable, are in accordance with the Data Protection Act.	

Have you received training in research ethics?	**Yes /No** [delete as applicable]	
For UG and PG Taught only: [Initial the statement which is applicable]	This project involves minimal ethical risk and **DOES NOT REQUIRE** consideration by the Research Ethics Committee.	
	This project involves more than minimal risk and **DOES REQUIRE** consideration by the Research Ethics Committee	
Signature		
Date		

SECTION VII: For completion by a School Research Ethics Committee Member

This approval is only required prior to the research when:

- The checklist reveals more than minimal risk for participants and/or personal data; and/or
- The research is being carried out by a member of staff or a PhD student.

Name of SREC member			
Comments or suggestions			
Decision	**Approve**	**Revise**	**Reject**

(circle as appropriate)	
Signature	
Date	

On completion, an email confirming the decision should be sent to the applicant and the supervisor/principal investigator. The completed form will be kept by the School Office.

1b Attachments (as appendices to application)

Appendix 2 PARTICIPANT INFORMATION SHEET

You are being invited to participate in a research project on the implementation of mobile technologies for learning and teaching.

This document contains information that explains what the research is about, what it will involve, and what will be expected of you. If you have any questions at any stage, please contact me for clarification before deciding whether to take part or not.

If you would like to receive a summary of the findings from this study, please indicate this by including your email address in the space provided.

Research Aim

The aim of this research is to explore the design, development and implementation of mobile learning as part of the overall learning and teaching or learning and development strategy within an organization, in this case a higher education institution. This involves ongoing assessment of its current systems and processes with a view to how the adoption of mobile learning can be facilitated, the tracking of the implementation of texting systems and other subsequent systems that enable mobile learning. It will analyze the process of mobile learning technology implementation with balancing perspectives from the administrative, academic and student standpoints.

You have been selected as a participant because you are a stakeholder in the process of designing and implementing technological enhancements (mobile technologies) to learning and teaching in the organization. This study is intended to take all stakeholders views into consideration.

What is expected of you?

If you decide to take part, you will be required to sign the consent form attached to this information sheet and a copy of this will be given to you for your own record. You are however; free to withdraw at any point, and to withdraw you can simply send an email to me at Claudia.igbrude@OOI.ie.

At some point, I will interview you either one to one, or in a focus group. These

interviews might be face to face or by electronic means (telephone, video conference, Skype, etc) There might be two or three interviews of such interviews. The interviews will last for about 30mins to 1hour.

In your use of the system, I may harvest and analyse data or/and traffic logs pertaining to mobile usage and activities (your personal data will be excluded as much as is possible)
Participation in this research will not affect your job, access to support, or if you are a students, your coursework or relationship with your lecturer.

What happens to the Data?
To be able to analyse the data, I will need to record conversations we have whether they are face to face, over telephone or Skype, instant messenger or email exchanges. However, all individual contributions will be anonymised. Data is stored in an encrypted file that is only accessible by the researcher. Any information acquired from your mobile phones or devices via any sort of tracking mechanism will be used solely for the purpose of this research and will again be anonymised. All original data is considered confidential and will be destroyed as soon as the research study is completed.

What happens to the research results?

The results of this research will be presented to the University of Nottingham as my PhD thesis. There will also be papers and articles based on this research disseminated via journals, conferences or books. No identifying data will be used in publications.

Thank you for reading this and I look forward to hearing from you.

Best Regards,

Claudia Igbrude

PARTICIPANT CONSENT FORM

Working Project title ……Strategic Implementation of Mobile Learning…

Researcher's name …CLAUDIA IGBRUDE………

Supervisor's name ……PETER BLANCHFIELD, CHARLES CROOK……

8.   I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.

9.   I understand the purpose of the research project and my involvement in it.

10.   I understand that I may withdraw from the research project at any stage up until data collection is completed and that this will not affect my status now or in the future.

11.   I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential.

12.   I understand that I will be audio taped / videotaped during the interview, phone calls or Skype conversations.

13.   I understand that data (Audio, video, transcripts, etc)will be stored electronically on a encrypted file accessible only by the researcher, and upon request, the project supervisors or examiners.

14.   I understand that I may contact the researcher or supervisor if I require further information about the research.

15.   I confirm that I am over 16years old

Signed …………………………………………………………………
          (Research participant)

Email address..
(Optional for receiving summary of results)

Print name …………………………………………………………… **Date** …………………………………

Contact details

Researcher: *Claudia Igbrude:* ttxci3@nottingham.ac.uk
Supervisors: *Peter Blanchfield:* pszpxb@exmail.nottingham.ac.uk
          Charles Crook: charles.crook@nottingham.ac.uk

1c OOI Research Ethics Fulfilment

DECLARATION OF RESEARCH ETHICS AND/OR ASSESSMENT OF RISK

All research and scholarship proposals, whether funded or not by internal or external funds, must submit a RESEARCH ETHICS/ASSESSMENT OF RISK FORM to the OOI Research Ethics Committee.

This is a self-declaration process. The researcher is asked to formally identify any possible ethical issues or risks that might arise in the course of the work, and to sign the documentation.

Please refer to the Guiding Principles and Procedures indicated on the OOI Research Ethics website prior to completing this form:

- Link to OOI Form

PLEASE NOTE

- You are requested to attach a copy of your research application to this form.
- The RESEARCH ETHICS /ASSESSMENT OF RISK FORM must be signed by the applicant(s)
- Ethical Approval must be granted prior to start of any research/scholarly activity or prior to funding being released for the project, as appropriate.
- No postgraduate research student will normally be registered until the proposal is cleared by the OOI Research Ethics Committee.

Completed forms should be returned to: Research Ethics Committee, c/o Office of Graduate Studies, OOI. Address removed.

Title of the proposed project:		
Strategic Implementation of Mobile Learning		
Applicant Details (Use Block Capitals):		
Surname: IGBRUDE	Forename: CLAUDIA	Title: MS
Present appointment: Elearning Development Officer		
School/Department/Centre: removed Faculty:------- Work Tel: removed Fax: E-mail: work email address removed		

Other departments/organisations/individuals involved: a)**Learning Teaching Technology Centre** b) **Information Services and other non-academic/support staff** c) **Students** d)**Academic Staff**
Source of Funding: **SELF and OOI**
Has the current research project already received approval from another research ethics committee? **No** If so, please enclose relevant information and documentation
Generic Projects: Researchers may receive approval for a cluster of similar research activity by approval of a *generic protocol* to cover repetitive methodologies or activities. A *generic protocol* should comprise a covering letter setting out the circumstances and rationale for generic approval, outlining the procedures to be followed in all such projects, in addition to completion of the appropriate appendices. If this project is part of a cluster of research with similar methodology, please tick here and submit a generic protocol to cover all such projects. ❑

Insurance

Normally, OOI insurance covers standard research activity, including fieldtrips. Are you aware of any unusual or exceptional risks or insurance issues to which OOI's insurance company should be alerted? If so, please list the issues:

NA

Please note that no contract should be entered into for clinical/medical (including drug testing) or surgical trials/tests on any human subject until written confirmation has been received from the OOI's insurers that the relevant insurance cover is in place.

Are you or any members of the research team a member of any organisation that provides professional indemnity insurance?   **NO**

Name of the organisation: **NA**

Please provide written confirmation of the terms of insurance cover. **NA**

Professional Code of Conduct

Please reference, if appropriate, the Code of Ethical Conduct produced by your relevant professional organization(s), which also informs your research.

Please note that: Where those requirements conflict with OOI requirements, the latter will normally be followed. In all such circumstances, please contact the Office of Research Ethics for clarification.

All researchers must confirm with the Data Protection Act 1988. Please consult the OOI Data Protection Officer for advice.

IDENTIFICATION OF ETHICAL ISSUES AND/OR RISK

Do any of the following ethical issues or risks apply in your research? If so, tick all box(es) which apply and complete the relevant Appendix, which can be downloaded from **LINK REMOVED**

Yes	No	Does your research involve…
	✓	Impact on human subject(s) and/or the researcher(s) [Appendix 1]
✓		Consent and advice form given to subjects prior to their participation in the research [Appendix 2]
	✓	Consent form for research involving 'less powerful' subjects or those under 18 years [Appendix 3]

✓	Conflict of interest [Appendix 4]
✓	Drugs and Medical Devices [Appendix 5]
✓	Ionising Radiation [Appendix 6]
✓	Neonatal Material [Appendix 7]
✓	Animal Welfare [Appendix 8]
✓	General Risk Assessment [Appendix 9]
✓	Hazardous Chemical Risk Assessment [Appendix 10]
✓	Biological Agents Risk Assessment [Appendix 11]
✓	Work involving Genetically Modified Organisms Risk Assessment [Appendix 12]
✓	Field Work Risk Assessment [Appendix 13]

If other risk and/or ethical issues are identified please provide a written submission which outlines the issues and the manner in which they are being addressed.

Please tick the appropriate box below

☐ **No, there are no** ethical issues and/or risks involved in your research project, **please tick here, and sign the declaration on page 5.**

✓**Yes, there are ethical** issues and/or risks involved in your research, **please tick here and complete the appropriate forms identified above.**

In accordance with the Principles of the Declaration of Helsinki and OOI Principles and Procedures, I declare that the information provided in this form is true to the best of my knowledge and judgement.

I will advise the OOI Research Ethics Committee of any adverse or unforeseen circumstances or changes in the research which might concern or affect any ethical issues or risks, including if the project fails to start or is abandoned.

Signature of applicant 1: _____

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(An electronic signature is permissible)

Checklist

Please ensure the following, if appropriate, are attached:

Documents to be attached	Tick if attached	Tick if not appropriate
Research Proposal	✓	
Letters (to subjects, parents/guardians, GPs, etc)	✓	
Questionnaire(s)	✓	
Advertisement/Poster		✓
Ethical clearance from other ethical research committees	✓	
Copy of signed agreement of professional indemnity		✓
Generic Protocol		✓
Other (please specify)		✓

Request for Ethical Approval

Ethical approval for activities in this research is being sought from the Research Ethics Committee for mobile technology study which is to commence in January 2013. This application outlines how the proposed research will adhere to the three ethical principles:

> i. Beneficence- maximizing good outcomes while avoiding unnecessary risk, harm or wrong,
> ii. Respect- Protecting the autonomy of people with courtesy to people as individuals,
> and,
> iii. Justice- Ensuring reasonable, non-exploitative and carefully considered procedures and their fair administration, distribution of costs, and benefits

amongst persons and groups
(Sieber J. 1992,18)

The ethical consideration outlined here are to ensure that in this research, the relationships between the researcher and the participants remains both mutually respectful and beneficial with useful information being sought, candid responses offered and valid results obtained (Sieber J,2009; 106) . There will be a continuous review of the ethical needs and considerations throughout the lifetime of the research, as well as further reading of literature around Ethics of research in the areas of concern in this study such as mobile learning.

1c Attachments (as appendices to application)

Appendix 1 PROPOSAL

Research Aims:

The aim of this study is to develop guidelines that can guide the implementation of mobile learning across a wider context across institutions or organisations than single instances or pilots.

To that end, these are the research questions to be addressed:

1. What kind of mobile learning can lecturers or instructors in each of the establishments implement in their teaching practice beyond content delivery?

2. What effect would implementation of these kinds of mobile learning identified in (1) have on have on other non-learning and teaching functions?
3. What standards should be implemented such that learner owned mobile devices can be accommodated as part of the system infrastructure and interfaces? (IT, student records, etc)

4. What are the issues that concern learners in using their own devices in formal learning?

5. What are the pedagogic outcomes of introducing Mobile Learning?

Research Participants

The research participants in the groups targeted for this study are OOI students and staff. They are all non-vulnerable adults and so voluntary informed consent will be sought to elicit their participation and use their data.

They will be apprised of the nature of this research and its future dissemination using the participant information sheet which is attached to this request. Having read the

information, if they are willing to participate they will indicated their agreement by signing the participant consent form which is attached below.

While the research aims to target representative samples of the population being studied, it is possible that the sample group used in the study will be convenient samples of the target groups accessed while performing my role as an elearning developer.

As the researcher in this study, there will be occasions in which I will also be a participant as well as an observer. These include when I will be interviewing or when I might be using my own observations while in my work role. In either role, I will maintain respect for any social, cultural, professional, or personal boundaries as well as privacy of individuals.

Recruitment of Participants

As the aim of this research is to bring about the implementation of mobile learning in a strategic manner, staff participants will be volunteers, or participants in the programmes and workshops offered by the OOI learning teaching technology centre (LTTC). The student participants will also volunteers -they will be those students whose lecturers intend to introduce the use of mobile devices into their teaching approaches, so their use of mobile devices is part of an ongoing process with their lecturers and not determined or dictated by this research. Students will be made aware that their participation or not in this research will not affect their coursework and relationship with their lecturer.

Remuneration

There will be no rewards or participation offered for participating in this research. As a learning technologist, I am required by my job specification to support the lecturers in their jobs, and co-operate with non-academic staff in the performance of my job, their participation or not will have no effect or impact on the existing relationships. Participants will be informed that their participation is valued as it will contribute to the success of future implementations of technology such as mobile technologies.

Privacy and Data Security Considerations

The privacy of any individuals or groups involved in this research will be respected and although the names of the institutions where the studies have been carried out will be available, names of individuals and affiliations will be anonymised by the use of pseudonyms and reference numbers. The mapping between such anonymisation and real identities will be held in a secured password protected file physically accessible

by only the researcher and upon request the research supervisors and examiners. These measures provide protection against any potentially harmful situations and possible confidentiality breaches.

As a participant researcher, there is the possibility that I may be privy to conversations around the research topic outside of interviews and official data-collection periods, in such cases, such conversation will not be included in the research data as it would constitute a breach of trust.(Campbell 2002 in Mercer, 2007,p13)

Particular considerations will be made around the use and storage of any data acquired in the course of the research as the study focuses on the implementation of mobile learning with student owned devices. All data will be destroyed at the conclusion of the study and review by University of Nottingham review authorities. Participants will maintain their right to withdraw at any point up till after data gathering for the relevant stage.

Method

The study will be conducted by interviews, focus groups. Some meetings might be face to face or by telephone, or Skype, to suit the interviewee. In instances where a person really wants to participate but can't do an interview, the same questions will be administered as a written questionnaire.

Interview questions

The questions below are indicative of the types of questions that will be asked rather than specific. It is expected that during the interviews other questions might come up from the answers given by participants.

Academic/Teaching

The Questions here are meant to highlight what teaching staff see as mobile learning, and their attitudes towards mobile learning, any perceived barriers as well as their expectations.

-Have you applied any sort of mobile Learning in your teaching or lecturing?

-If yes, what were they and describe what worked and what didn't?
-If no, why not?

-How do you envisage mobile learning might be useful to you? (Ignoring constraints)

-What difficulties do you envisage?

How do you think students use mobile devices (phones, ipods, ipads, etc) for learning outside of school work?

(E.g. games, social networking, etc)

-How do you support your own learning using mobile devices?

-What would concern you about using student's own mobile phones for school related work?

- Do you think using mobile learning impacts on your teaching? How?

Admin/Non-Academic (IT, Student affairs

The interviewees here include staff from a variety of support functions that work together to ensure the smooth interactions between processes/procedures and systems. The questions will vary depending on their department function but

-How would you envisage that your department can support lecturers can get to use mobile learning?

-What structures or adaptations of your systems and processes can you put in place to support this?

-How would such as incorporation or adaptation affect your current practices and use of the systems?

-Are there any particular concerns you might have around the use of mobile learning?

Students

I will be interviewing Students to get insights into their own expectations, fears and hopes for using mobile learning

-How do you use mobile devices (phones, ipods, ipads, etc) for learning outside of school work?

(E.g. games, social networking, etc)

-How do you support your school work using mobile devices?

-What opportunities do you see within your courses to apply mobile learning?

-What would concern you about using your own mobile phones for school related work (formal learning)?

- What effect do you envisage there might be from using your mobile device within your formal learning contexts and settings?

References:

Sieber J (2009) in The SAGE handbook of applied social research methods / edited by Leonard Bickman and Debra J. Rog. 2nd edition, London.

Sieber J (1992) Planning Ethically Responsible Research, A Guide for Students and Internal Review Boards. Applied Social Research Methods Series. Volume 31. pg18.

Mercer J (2007) The Challenges of the insider researcher in educational institutions wielding a double edged sword and resolving delicate dilemmas. Oxford review of Education.33 (1) 1-17

Appendix 2

CONSENT FORM

Researcher's Name: CLAUDIA IGBRUDE	Title: MS
Faculty/School/Department: LEARNING TEACHING TECHNOLOGY CENTRE	
Title of Study: STARTEGIC IMPLEMENTATION OF MOBILE LEARNING TECHNOLOGIES	
To be completed by the: subject/volunteer/informant/interviewee/	

3.1 Have you been fully informed/read the information sheet about this study?
YES/NO
 	
3.2 Have you had an opportunity to ask questions and discuss this study?
YES/NO
 	
3.3. Have you received satisfactory answers to all your questions?
YES/NO
 	
3.4 Do you understand that you are free to withdraw from this study?
• at any time
• without giving a reason for withdrawing
• without affecting your future relationship with the Institute
   YES/NO
 	
3.5 Do you agree to take part in this study the results of which are likely to be published?
 	
YES/NO
3.6 Have you been informed that this consent form shall be kept in the confidence
    of the researcher?
YES/NO	

```
┌─────────────────────────────────────────────────────────────────────┐
│                                                                       │
│  Signed_____            Date             │
│  _____                                                    │
│                                                                       │
│                                                                       │
│  Name in Block Letters                                                │
│                                                                       │
│  _____         │
│                                                                       │
│  Signature of Researcher  _____  Date  │
│                                                                       │
│  _____                                                    │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
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Appendix 3 PARTICIPANT INFORMATION SHEET

You are being invited to participate in a study on Mobile Learning.

This document contains information that explains what the research is about, what it will involve, and what will be expected of you. If you have any questions at any stage, please contact me for clarification before deciding whether to take part or not.

If you would like to receive a summary of the findings from this study, please indicate this by including your email address in the space provided.

Research Aim

The aim of this research is to develop guidelines that can guide the implementation of mobile learning across a wider context across institutions or organisations than single instances or pilots.

You have been selected as a participant because you are a stakeholder in the process of designing and implementing technological enhancements to learning and teaching in OOI. This study is intended to take all stakeholders views into consideration.

What is expected of you?

All Participants

If you decide to take part, you will be required to sign the consent form attached to this information sheet and a copy of this will be given to you for your own record. You are however; free to withdraw at any point up until after data has been collected.

All Participants

What happens to the Data?

To be able to analyse the data, I will need to record conversations we have whether they are face to face, over telephone or Skype, instant messenger or email exchanges. However, all individual contributions will be anonymised. Data is stored in a password protected file that is only accessible by the researcher. Any information acquired from your mobile phones or devices via any sort of tracking mechanism will

be used solely for the purpose of this research.

All original data is considered confidential and will be destroyed as soon as the research study is completed.
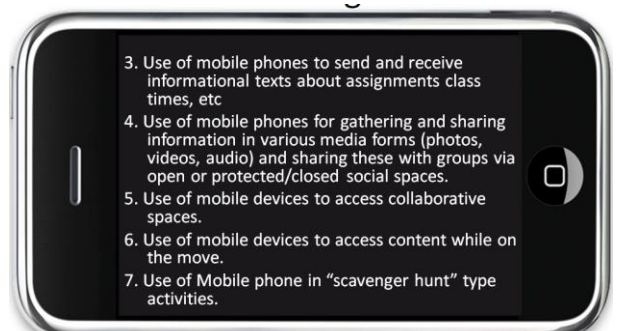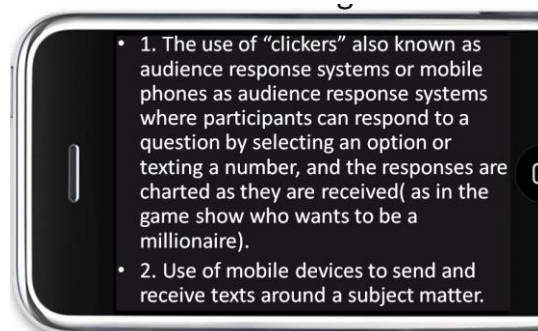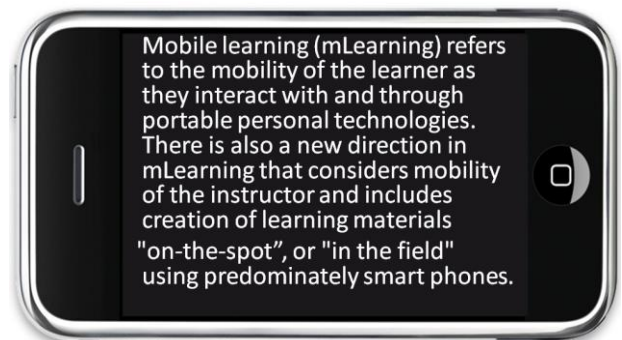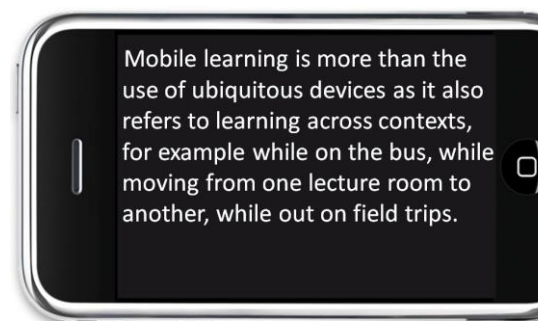
What happens to the research results?

The results of this research will be analysed and used to inform practice in the DIT. It is likely that this will also contribute to my own research and there will also be papers and articles based on this research disseminated via journals, conferences or books. Thank you for reading this and I look forward to hearing from you.

Best Regards, Claudia Igbrude

Appendix 2: Explanation of "Mobile learning" (Primer)

The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning"
(molenet.org.uk)

Mobile devices include devices such as mobile phones, tablets (e.g. ipads); media players such as iPods, and other mp3 players.

Mobile learning is more than the use of ubiquitous devices as it also refers to learning across contexts, for example while on the bus, while moving from one lecture room to another, while out on field trips.

Mobile learning (mLearning) refers to the mobility of the learner as they interact with and through portable personal technologies. There is also a new direction in mLearning that considers mobility of the instructor and includes creation of learning materials "on-the-spot", or "in the field" using predominately smart phones.

- 1. The use of "clickers" also known as audience response systems or mobile phones as audience response systems where participants can respond to a question by selecting an option or texting a number, and the responses are charted as they are received(as in the game show who wants to be a millionaire).
- 2. Use of mobile devices to send and receive texts around a subject matter.

3. Use of mobile phones to send and receive informational texts about assignments class times, etc
4. Use of mobile phones for gathering and sharing information in various media forms (photos, videos, audio) and sharing these with groups via open or protected/closed social spaces.
5. Use of mobile devices to access collaborative spaces.
6. Use of mobile devices to access content while on the move.
7. Use of Mobile phone in "scavenger hunt" type activities.

Now, Please answer the following questions on the sheets you have been given.

Appendix 3: Open ended Student Questionnaire

1. What technology have you used in your learning?
2. Do you now understand what mobile learning is and can you describe what it means to you personally?
3. Please describe how you use your mobile device.
   (Mobile devices include devices such as mobile phones, tablets (e.g. ipads); media players such as ipods, other mp3 players;)
4. How do you use mobile technologies to support your learning?
5. Where do you see an opportunity to use your mobile devices in formal and informal learning?.
6. What concerns would you have around using your own mobile device for mobile learning?
7. What effects do you think there might be from using your own mobile device within your formal learning contexts and settings?

Appendix 4 Web interface of texting system

Plan for Written Chinese, Year 4.

Number of students: 9

Total learning hour:200

Independent study: 128, interactive class hours: 72

In this module, students are to further progress their command of Chinese with emphasis on the written language. The module is taught entirely in Chinese.

Module aim:

- Reinforce the student's knowledge of the structures of Chinese with a particular focus on written characters.
- Ensure that students have an active knowledge of approximately 1200 characters and a passive knowledge of approximately 2000 though the use of press articles, contemporary stories, and television broadcasts.
- Further develop student's knowledge of Chinese grammar.
- Acquire the skills of formal letter-writing (Chinese and Taiwanese style).

The above aims will help students achieve the following outcomes of being able to:

- read, understand and summarise press articles and short stories or average difficulties and answer questions regarding their content.

- Write short, formal written requests and letters.

Strategy:

The above aims and outcomes are pursued in a classroom setting where the lecturer delivers the class speaking only in Chinese and the students are invited to interact by responding to questions, or carrying out tasks such as writing. However, full class participation is not always achieved and exercises required electronic input is usually left till outside class time as this module is no allocated lab space. Learning and teaching methods include:

Writing practice in class, identification of sentence elements and comprehension of written texts, reading practice of press articles and short stories,, and comprehension exercises involving multiple choice questions as well as short written and oral answers in Chinese.

Change:

Modern communication of the kind that is required is often carried out via mobile phones. People tend to send texts from holidays, and if they have missed an appointment. Currently the students are taught to write informally for applications in cards, postcards, casual letters, describing appearances or summarising, putting up notices, leaving notes. And then having mastered the informal writing, they progress to more formal communication such as essays, job applications, cover letters.

For this research, I will be examining the use of mobile technology (devices) as being used as being a technology all the students have and more reflective of their daily informal communication.

From the use of mobile device, students will move to using blogs (possibly from mobile devices but not restricted to that) and also manual writing.

Mobile technologies to be used include technologies that closely emulate real life situations but offer additional value in the context of learning and teaching.

The implementation of mobile technologies in this context will be examined from the perspectives of learning and teaching, system/ technology integration and process integration. Continuous dialogue with lecturer and students though out the terms by means of focus groups and one on one interviews as well as questionnaires.

Assessment (Same as before)

Aural: 20% 1 audio visual to be commented in writing

Written tests: 40% 2 tests at 20% each

Written exam: 40%

Re-assessment: written exam at 100%.

3/08/2012 Week by Week breakdown

The module runs over 12weeks and the mobile learning activities have been integrated into the first 5weeks.At this point, students are expected to write coherent short messages in different contexts using a variety of characters.

Using mobile learning here allows for quicker assessment as well as being more true to life. It will

1. Informal letters/card texts: This covers informal communication. Students will respond to texts from lecturer. For each of these use 20 or 30 different characters :
   a) Lecturer's text: "It's Mary/John's birthday tomorrow, remember to send them a birthday message expressing your wishes for them."

   b) Lecturer's text: "Send a new year greeting"

   c) Lecturer's text: " Your friends are getting married on Saturday, send an appropriate text wishing them well"

   d) Lecturer's text: "Mary's Grandmother just died, send her a text expressing your condolences"

2. Short Notes: Students learn to leave short messages or notes. Messages should be clear and concise. 30 to 40 different characters.
   a) Scenario: You have just called to your friend's house and they are not there, send them a message letting them know you called, why you called, and when you will be back if you will be or when you will see them again.
   b) Send a text to your friend inviting them to a party. Should include date, time, venue and other relevant information.

3. Short notice ctd: Continuing with short notices-(30-40 characters)
   a) Put up a general announcement about an event (e.g Chinese calligraphy) being hosted by your department and with a guest who is well known in their field.
   b) Leave a messaging apologising to your lecturer or someone else with whom you had a prescheduled appointment explaining why you cannot make it, and offering an alternative.
4. Personal letters- letters to friends, family
5. Announcements:
   a) Lost: Construct a short message about something you lost.

   Remember to say where you lost it, and other relevant information such as reward if appropriate, how you can be reached, etc.

   b) Found: Construct a short message about something you found.

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Remember to say where you found it, and other relevant information such as how you can be reached, by what date,etc.

c) Write the text for an announcement selling an item for the small ads section in a magazine or noticeboard,

6. Revision week
7. Formal Letter- Job application, enquiring about job positions, letters requesting information
8. Business letter: Introducing yourself and business.

Appendix 5: Communication with text messaging system provider:

Hi XXXXXX

Without being certain that the other aggregator can handle non-GSM characters on an ROI SIM card, it is a lot to base on speculation.

We are trying to get more Lecturers using the system and this would essentially bring us into September which would be a bad time to have the system down. While we might get more sustained use resulting from being able to use the Chinese characters, we would not be able to service existing users.

I appreciate your help in this but with the uncertainty and timeframe, I think we'd be better to find an alternative.

Best Regards,

XXXXXX

From: Xxxxxx
Sent: 18 July 2012 13:33
To: XXXXXX
Cc: Txttools Support; xxx@; Xxx
Subject: RE: Chinese characters in incoming messages

Hi XXXXXX,

The way I understand it is that the 1 month notice period is for the aggregator currently hosting the SIM card.

So should we ask them to release the SIM and send it to us so that we can pass it on to the other aggregator, they will host it for 1 final month, then release it, and the whole process of getting it back and passing it on to the other aggregator would probably take between 1 to 2 weeks before it is live again and ready to use.

So it all depends whether we actually go ahead and send the notice via email (bear in mind the other aggregator are not 100% sure they can handle non-GSM character on an ROI SIM card as per email below)

I hope this makes sense.

Kind regards,

xxxx

Xxxxxx

Client Care Director

From: XXXXXX [mailto:XXXXXX.@]
Sent: Wednesday, July 18, 2012 8:46 AM
To: Xxxxxx
Cc: Txttools Support; xxx@; Xxx
Subject: RE: Chinese characters in incoming messages

Hi XXXXXX

Thanks for all that.

Need to discuss with my colleagues but can you tell me:

So in total we are talking about a 1 month downtime period to get this sorted?

And when would this downtime period fall into?

Best Regards,

XXXXXX

On 17/07/12, **Xxxxxx** > wrote:

Hi XXXXXX,

It may be possible to get the SIM card hosted by the other aggregator, however:

-The other aggregator tell me that:

"As far as we are aware the networks in Ireland support Unicode. We have not performed tests for Unicode on MO's so we would only be able to be 100% sure once we perform tests which we can't do at the moment as we are not currently hosting an IE Sim for that country."

Which I read as "we are not sure we can handle inbound messages written in Chinese sent to an Irish number until we try"

The aggregator currently hosting the SIM card that you are using have confirmed to me this morning that it is possible to get the SIM card back from them, with a notice period of 1 month.

This would also obviously include downtime for the period the SIM card will spend being "de-hosted" then "re-hosted"

What are your thoughts? I will press the aggregator that could potentially host the number to see if they can get me a definitive answer about being able to handle non-GSM characters MO messages, and will let you know.

With kind regards,

xxxxxx

Xxxxxx

Client Care Director

Hi XXXXXX,

Some elements of answers from the aggregator that can handle non-GSM for mobile originated messages:

• The specific operator that a Sim Card is sourced on must be one of the following:

Country   Prefix Network   MCC MNC

"Ireland, Republic Of",353,Hutchison 3G Ireland,272 05

"Ireland, Republic Of",353,Meteor,272 03

"Ireland, Republic Of",353,O2 Communications (Ireland),272 02

  "Ireland, Republic Of",353,vodafone,272

• Sims must be post pay and have the ability to remain active even though they are not activated on a phone.

• Sim cards must be activated on the home network before they are sent to us. This involves putting the Sim in a phone and going through the set up process.

• You must ensure that you will not be charged to receive messages while the Sim is roaming.

I am now trying to find out from the aggregator currently hosting the SIM what would need doing in order to get the SIM card ported over to them,

again I would like to thank you for the patience that you have been showing so far with this query.

With kind regards,

xxxxxxx

Xxxxx

From: Xxxxxx
Sent: Monday, July 16, 2012 10:48 AM
To: XXXXXX.@
Cc: Txttools Support; xxx@
Subject: RE: Chinese characters in incoming messages

Hi XXXXXX,

I am hoping to get a yes or no definitive answer for you today.

Thank you for your patience while I try to get the info for you.

With kind regards,

Xxxxxx

From: XXXXXX.@ [mailto:XXXXXX.@]
Sent: Friday, July 13, 2012 4:37 PM
To: Xxxxxx
Subject: RE: Chinese characters in incoming messages Connecttxt

Hi XXXXXX

Just wondering if you got anywhere with this today?

Regards,

XXXXXX

Hi XXXXXX Would appreciate that.

Thanks for your help.

Best Regards,

XXXXXX

Hi XXXXXX,

The reason we cannot change aggregators for handling inbound traffic is because they are the ones out of the various aggregators we use who offer SIM hosting services that are reliable and stable.

The SIM cards being physically hosted at the aggregator's, switching suppliers would amongst other things mean interruption to the service whilst it is being transferred to another aggregator, who may not offer a guarantee that the SIM would work once switched on again at their location, so it is a risk I would advise against taking for the time being.

A potential alternative would be for me to check whether the aggregator that can handle non-gsm characters could host new SIM with a different ROI number and whether they would be able to handle non-GSM characters inbound.

I am due to speak on Friday with our account manager there about an unrelated matter but will add this a an item for our conversation and will let you know the outcome.

With kind regards,

xxxxxxx

From: xxxxxx
Sent: Wednesday, July 11, 2012 9:12 AM
To: xxxxxx
Cc: xxxxxx
Subject: RE: Chinese characters in incoming messages

Hi XXXXXX

 Thanks for investigating and getting back to me on this issue.

Can you tell me what exactly the difficulty might be with switching aggregators? Is it a technical or a contractual issue?

Is there any possibility that this might happen anytime in the near future?

Regards,

xxxxxxx

From: XXXXXXX]
Sent: 09 July 2012 10:55
To: XXXXXXXXX

Cc: XXXXXXXXX

Subject: Chinese characters in incoming messages

Hi XXXX,

Thank you for your patience whilst waiting for the answer to your query. I spoke with the aggregators we use to handle inbound and outbound traffic on your account.

Specifically we use one aggregator for your outbound traffic, and this aggregator handles non GSM characters, such as Arabic, Chines and Cyrillic which is why you are able to send messages out in Chines without problems.

We do have to use another aggregator to handle your inbound messages, as they are the ones who can host and handle incoming messages on the ROI dedicated number you are using. This particular aggregator confirmed to me that it is not technically possible for them to handle messages containing anything over than GSM characters which is why the messages that are being sent to you written in Chinese cannot get processed by them and therefore displayed in your ConnectTxt's inbox.

I have explored the possibility of moving your inbound traffic onto the aggregator that is able to handle non GSM characters, however we currently will need to still use the current aggregator that handles your inbound traffic as they host the ROI number and this is something that we are unable switch providers wise for now.
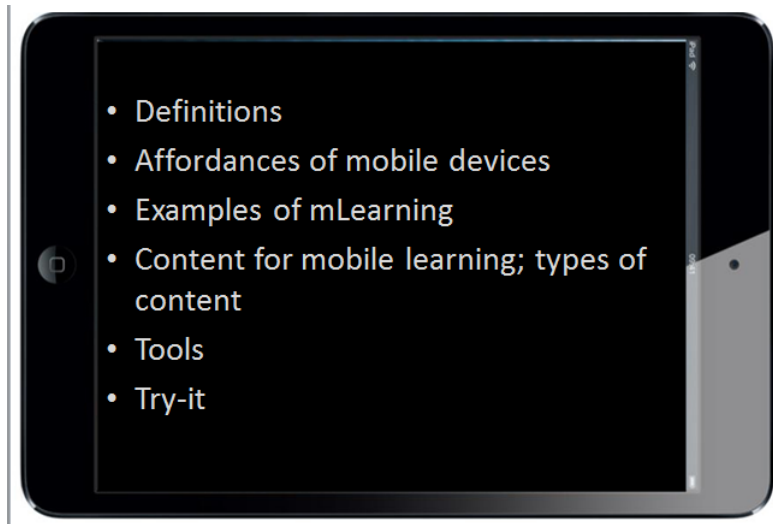
I hope this makes sense; please feel free to call me directly on 00000000 if you would like to discuss this in more detail and I will gladly assist you.

With kind regards,

Xxxxx

Appendix 6: Workshop material

Appendix 6a: Workshop Presentation Agenda

Appendix 6b: Workshop Questions.

1. Do you think you would explore the use of mobile technologies for learning and teaching?
2. What concerns do you have around the use of mobile technologies for learning?
3. Do you know the institutional policy on the use of student owned mobile devices for learning and teaching?
4. Do you think such a policy is necessary? Why or why not?
5. What would concern you about using students own phones for school related work?

Appendix 7a: Questions in LTSC Staff Survey used as initial contact point

After confirmation of consent enter responses to the following questions in the database

1. Have you used Blackboard during this academic year?
2. IF NO....Do you intend to use it in the future? (Then please proceed to Q's 8 onwards)
3. If yes, then do you think that the newest version of Blackboard is:
4. How would you describe your use of Blackboard ?
5. We'd like to know how lecturers are using Blackboard with their students and so I'm going to list the various blackboard tools. Please indicate whether you have used the tool with students or not. If you are not aware of the function please say so.
   Options: sharing files, discussion boards, private journals and blogs, messaging, surveys/polls, quizzes, SafeAssign, wiki, embedding videos (Youtube), assignment, Dropbox, BB mobile app, Webinars,

chatrooms, Slideshare, GradeCenter, email, announcement, learning

module packaging, weblinks, Wimba voice tools, campus pack,

Lockdown browser, publisher content, podcasts, calendar,

6. Is there any tool not mentioned which you have used?
7. Are there tools/functions you would like to see in webcourses which it currently does not offer?
8. Are you aware of/have you used any of the following with your students?
   Options: Social Networking: Facebook, LinkedIn, Twitter,

   Google+/hangouts,

   Other tools: Second Life, Skype, Googledocs, ePortfolios, Smartboard,

   Flickr, Clickers, Social Bookmarking, personal website,

    Resources: eBooks, , Online games, iPad/tablets, Screencasts,

   Echo360, , SCORM files, NDLR materials, Digital simulations,

   mobile apps,
9. Have you attended one or more LTSC training sessions, including 1 to 1 consultancy sessions, in the use of these technologies, including webcourses?
10. How long have you been teaching at DIT?
11. Have you undertaken any of the accredited programmes run by the LTSC?
12. Which OOI school do you belong to?

Appendix 7b: Staff Survey Questions for Cycle 3

1) I consent to my anonymous responses here being used within reports, and as part of other publications, about the usage of learning technologies. (If you do not consent to this, then please do not continue with this 3 question survey)

2) What type of support do you need, or would like, from the LTSC (in general)?

3) Any further observations or comments or issues which might prevent you from using technology in your teaching?

4) Molenet (UK) defines mobile learning as "the exploitation of ubiquitous handheld technologies such as phones, tablets (usually owned by the students), together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning"

In considering the use of technologies in learning and teaching, what would prevent you from using mobile learning in particular?

Screenshot shown below:

Mobile Learning Technology Survey

Report Abuse

Following the telephone survey completed with a member of the LTTC, You are invited to participate in a study on Mobile Learning.

If you have any questions at any stage, please contact me for clarification before deciding whether to take part or not.

If you would like to receive a summary of the findings from this study, please indicate this by including your email address in the space provided.

The aim of this study this survey is being used for is to develop guidelines that can guide the implementation of mobile learning across a wider context across institutions or organisations than single instances or pilots.

You have been selected as a participant because you are a stakeholder in the process of designing and implementing technological enhancements to learning and teaching in DIT. This study is intended to take all stakeholders views into consideration.

If you wish to take part, you are required to indicate your consent by selecting yes to the first question. You are however, free to withdraw at any point up until after data has been collected. If you select no, you will be unable to complete the survey.

The results of this research will be analyzed and used to inform practice in the DIT. It is also being used to contribute to research by members of the LTTC and there will also be papers and articles based on this research disseminated via journals, conferences or books.

Please direct any questions to claudia.igbrude@dit.ie

1* I consent to my anonymous responses here being used within reports, and as part of other publications, about the usage of learning technologies.
(If you do not consent to this, then please do not continue with this 3 question survey)
○ Yes
○ No

2* What type of support do you need, or would like, from the LTTC (in general)?

3* Any further observations or comments or issues which might prevent you from using technology in your teaching?

4* Molenet (UK) defines mobile learning as "the exploitation of ubiquitous handheld technologies such as phones, tablets (usually owned by the students), together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning"
In considering the use of technologies in learning and teaching, what would prevent you from using mobile learning in particular?

Finish Survey

Appendix 8: Student survey questions in Cycle 3

1) Consent: I understand that the data I enter in this survey is anonymous and will be used for improving support for learning and teaching and for research.

I consent to its being used in publications and reports.

I also confirm that I am aged 18 or over.

- Yes
- No

2)   Your Gender

- Male
- Female

3)   In what age group are you?

- 18 - 20
- 21 - 25
- 26 - 30
- 31 - 35
- 35 - 40
- 40+

4)   What are you studying? and in what year are you?

5)   Which of these do you own and use? (Select all that apply)

- Smartphone (iphones, androids,etc)
- Tablet (including ipad)
- Non-smart phone (Feature phone)
- Laptop
- ebook reader (e.g kindle,kobo,etc)
- Other

6)   If you use a smart phone, please choose the type from this list:

- iphone
- android
- blackberry
- windows phone
- Other

7) What type of network or phone contract do you have?

- Prepay with data
- Prepay without data
- Contract with data
- Contract without data

- Not sure
- Other

8)   Which of the following is true about your 3G/data plan?

- I have a 3G/data plan that gives me unlimited access (e.g all you can eat data)
- I have a limited 3G/data plan but it is sufficient for my needs

- My 3G/data plan is not sufficient for my needs
- I don't have a 3G/data plan
- I don't know my data plan

9)   What make and model is your tablet if you have one?

10)   How often during the day do you use your mobile device for school related work?

- Sometimes in class
- Very often
- Rarely
- Not at all
- Other

11)   What do you use your smart phone/tablet for? (Select all that apply)

- Texting
- Voice calls
- Sending and receiving emails
- Browsing the internet
- Native apps (from the apple app store, google-play, etc)
- Games
- Taking photographs
- Watching videos
- Listening to Music
- Social Networking (Facebook, Twitter,etc)
- Recording video
- Recording audio
- Taking notes
- Maps (Google maps, applemaps)
- Looking up course related information/researching
- Instant messaging (whatspp, bbchat,etc)
- VOIP(skype, viber, etc)
- Recording lectures(audio or video)
- Accessing Blackboard through my mobile browser
- I have downloaded and use the blackboard/VLE app

- Reading course notes
- Reading books(kindle app or other)
- Other

12)   Have you published images from your phone on the web?

(e.g Instagram, facebook, flickr,etc)

- Yes
- No

13)   Have you published video from your phone on the web?

(Youtube,Facebook, Vimeo,etc)

- Yes
- No

14)   How do you currently use your mobile phone or/and tablet to support your learning?

15)   Which of the following do you use while on OOI premises?

- 3G
- OOI –WIFI
- OOI-LAN
- EDUROAM
- Other

16)   Which of the following would you like to be able to do from your mobile phone or tablet?

- Check PC availability in computer labs
- Check library account
- Receive alerts(course, IT, library, general)
- View timetables
- Surveys
- Campus map(lecture room/lab locations)
- Course information
- Answer questions in class/lectures
- Course resources (notes,assignments)
- Receive Grades by text
- Printer creOOI top up
- Other

17)   Do you use the computer labs in OOI?

- If yes, what for?

- If no, why not?

18) Has any of your lecturers engaged you through your mobile devices?

(e.g: texts, made special content available for mobile devices, asked your to use as a classroom aid, etc)

- Yes
- No

19) Do you have any specific suggestion as to how using your mobile device in any of your courses/modules might improve the learning outcome and experience for you?

20) Do you have any concerns or general comments about using mobile devices as part of your learning experiences in OOI?

Appendix 9: Guideline Questions used in Workshops in Cycle 3

- Do you think you would explore the use of mobile technologies for learning and teaching?
- What concerns do you have around the use of mobile technologies for learning?
- Do you know the institutional policy on the use of student owned mobile devices for learning and teaching?
- Do you think such a policy is necessary? Why or why not?
- What would concern you about using students own phones for school related work?

Appendix 10: IT Policy

Identity Management Policies   **Effective: 02 July 2009**

1. **INTRODUCTION**

   Identity and Access Management (IDaM) is a recognisable discipline within information security that encompasses a range of enterprise tools and technologies within a distinct architecture supporting a set of interrelated processes.

   Identity and Access Management enables ████████████████ to verify that individuals are who they say they are, whether or not they are affiliated with ████████████████ and what entitlements that affiliation allows to the Institute's Information Technology resources.

   Accurate 'identification' of a individual enables 'authentication' to an IT resource. 'Identification and authentication link the electronic identity to the physical individual. 'Authorisation' is the process of determining if policy permits and intended action to proceed.

   This document sets forth the ████████████████ policy for providing access to ██ IT services and facilities for students, staff and users of the Institute's IT systems who are neither students nor staff. The policy states when access should be provided, when it should be modified and when it should be removed. This policy will further ensure individual privacy rights, reduce administrative overheads, support regulatory compliance and secure essential Institute applications and services.

2. ████████ – **STUDENT IDENTITY POLICY**

   2.1 Definition of Student

   A student for the purposes of identity management is a person who exists on the Student Administration System with a valid Student ID number and for a current term.

2.2 Reason for Policy

Students need access to ▮ IT services and facilities in order to communicate with DIT and participate in learning and teaching activities.

2.3 Granting student access to a service/facility

Upon accepting a place on a ▮ programme, a student is classified as "Eligible to Register" in the Student Administration System. Once a student is "Eligible to Register" they should be granted access to:

- ▮ wired and wireless network access
- ▮ Portal, incorporating Institute email service
- ▮ eLearning service
- ▮ network printing account

When a student completes the registration process, they are classified as "Registered" in the Student Administration System. A registered student retains the services listed above and is granted access to the following additional services:

- Student ID card
- A library account

This access is valid for the following time periods:

- ▮ eLearning service – until the end of term.
- ▮ library account – Undergraduate students until the 30th September of the year of term end.
- ▮ library account – Postgraduate students, who register before 15th September until 30th November of the year of term end. For Postgraduate students who register after 15th September for a period of 430 days after date of registration
- All other services – until the 31st October following the end of term at which time their access will be revoked or will be extended based on a student's status in the following term.

If a student who is Eligible to Register has not completed the registration process by 31st October of any given term, all services will be revoked.

A student who is classified as an "external repeat" is not entitled access to any resources, other than ▮ Portal, incorporating eMail service.

2.4 Modifying student access to a service/facility

Scenarios exist where it will be required to modify a student's access to certain services or facilities. These scenarios are listed below in addition to the recommended action which should occur at that time:

Scenario	Action
A student who is "Eligible to Register" subsequently notifies the Institute of their intention not to avail of their place on a course, prior to the commencement of the course are classified as "Person not attending".	Services revoked
A student who withdraws from a course after it has commenced is classified as "Withdrawn".	Services revoked
A student who defers their place on a programme is classified as "Deferred".	Services revoked (Temporarily)
A student who moves from one programme to another within ▮	Services amended where necessary (▮ Portal and eLearning)
A student who changes personal details.	Services amended where necessary (▮ Portal and eLearning)
A student who is deceased.	Services revoked and archived as required on a service by service basis.
A student who studies ▮ programmes from a non ▮ location (e.g. Students who are abroad) are considered as being "Registered"	Normal services

2.5 Removing student access from a service/facility

Since a student's access to resources is provided time limited, access will be revoked when that time period expires and the student access is not extended as a result of their status in the following term.

3. ███████ – STAFF IDENTITY POLICY

3.1 Definition of Staff Member

A staff member is a person who exists in the HR system with a valid staff number, and a status of live.

3.2 Reason for Policy

Staff members need access to ██ IT services and facilities in order to discharge their duties within the Institute.

3.3 Granting staff access to a service/facility

Once a staff member is appointed to a position with the Institute, they should get access to a standard number of resources, namely:

- ███ wired and wireless network account
- ███ Portal, incorporating Institute email service
- ██ Network Printing Account
- ██ eLearning Service

A member of staff will also be granted access to an appropriate set of resources commensurate with that staff member's role in ██

3.4 Modifying staff access to a service/facility

When a staff member's role changes within ██ their access to services should change to reflect their new status, this may result in removing access to some services and adding access to others.

Additional services may be requested by a member of staff. Service owners are responsible for approving access to their service.

334

3.5 Removing staff access from a service/facility

Scenarios exist where a member of staff no longer has a status of "live" within the HR system. These scenarios are listed below in addition to the recommended action which should occur at that time:

Scenario	Action
Member of staff resigns their role within the Institute.	All services revoked.
Member of staff is dismissed from their role within the Institute.	All services revoked.
Member of staff retires from their role within the Institute.	██Portal, incorporating Institute email service is retained while the account is in use, and external reader access to library resources is provided. All other services are revoked.
Member of staff is deceased.	Services revoked and archived as required on a service by service basis.
Member of staff is granted Career Break.	██Portal, incorporating Institute email and library services retained. All other services revoked (Temporarily)

3.6 Location Based Access

██Business Systems applications should only be accessed from an internal ██network. Service owners may approve remote access to their applications using a ██approved access method.

4.   ██████ – 'OTHER' IDENTITY POLICY

4.1 Definition of 'Others'

The group known as 'others' are the range of users who require access to IT services and facilities but are neither staff nor students.

4.2 Granting 'others' access to a service/facility

Where "others" require access to service they must have their access request authorised by a valid sponsor and then approved by a service owner. Service owners are responsible for approving access to their service. Access is provided on a time limited basis.

The Valid Sponsor is responsible for validating an "other's" identity, and their request.

4.3 Modifying 'others' access to a service/facility

When an "other" requires modification to an already approved resource that request must be approved first by their sponsor and then by the service owner.

4.4 Removing 'others' access from a service/facility

All access for service will be granted time based and after that period access will be revoked.

5. SPECIAL SITUATIONS / EXEMPTIONS

Special situations may arise which will require consideration on a case-by-case basis.

6. ROLES AND RESPONSIBILITIES

6.1 Academic Affairs

Creating and maintaining student records. Polices relating to access to services for students.

6.2 Student

It is the responsibility of the student to ensure that they complete the registration process. Similarly, it is the responsibility of the student to inform Academic Affairs of any change in their registration status.

6.3 Human Resources

Creating and maintaining staff records.

6.4 Valid Sponsor

The Valid Sponsor is responsible for validating an "other's" identity, and their request.
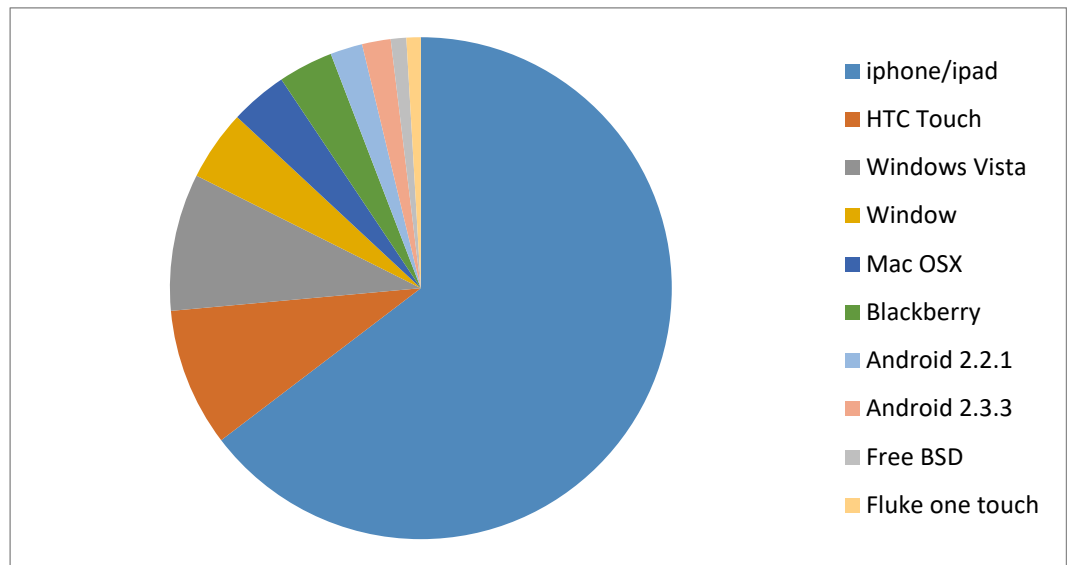
6.5 Service Owner

Service owners are responsible for approving access to their service.
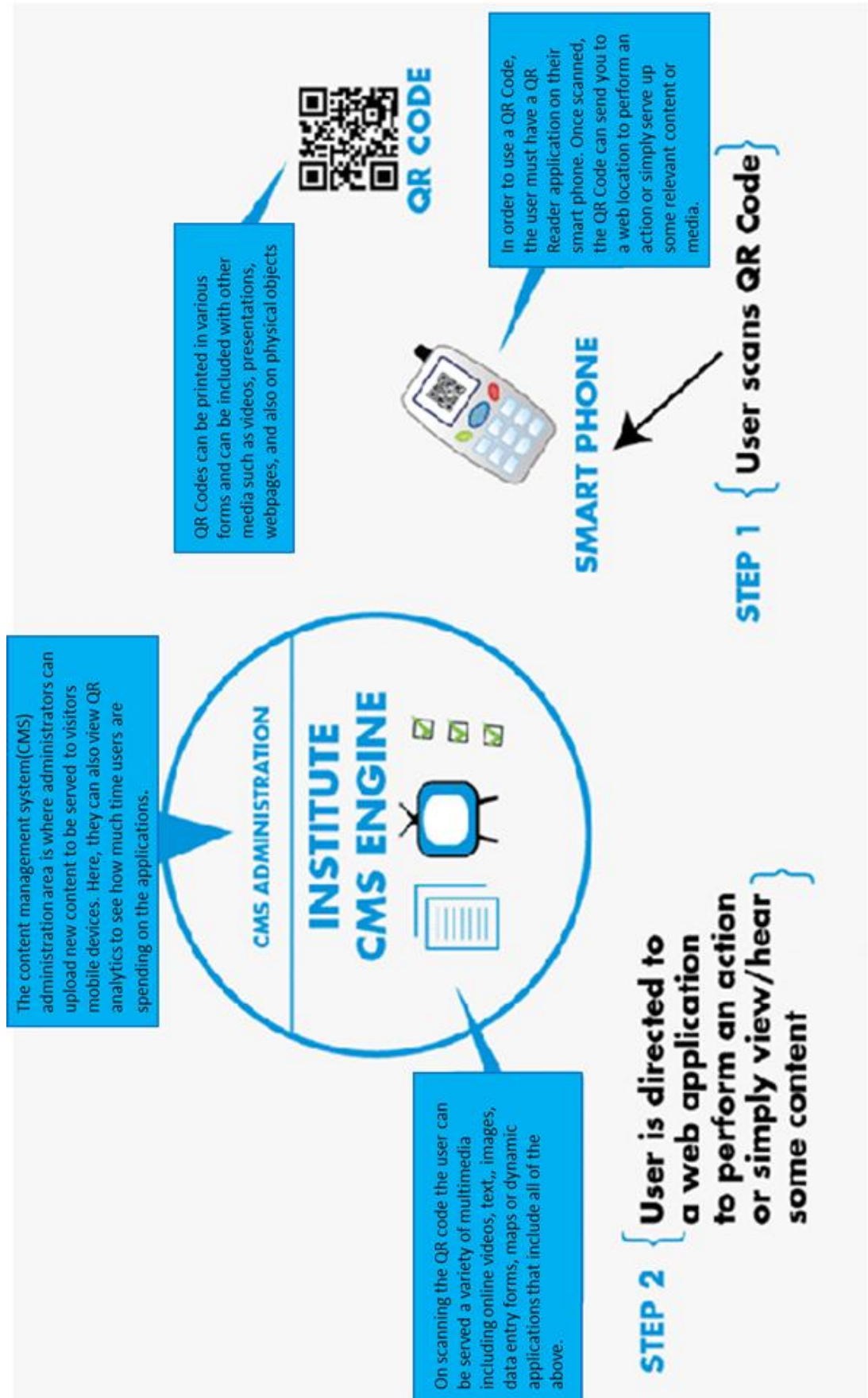
6.6 Information Services

Grant access to a service of facility, modification of access to a service or facility and removal of access from a service or facility in accordance with Identity and Access Management policies.

Appendix 11: Detailed Snapshot of network traffic

Appendix 12: Larger image of Cycle 1 QR Mobile solution

The content management system(CMS) administration area is where administrators can upload new content to be served to visitors mobile devices. Here, they can also view QR analytics to see how much time users are spending on the applications.

CMS ADMINISTRATION

INSTITUTE CMS ENGINE

QR Codes can be printed in various forms and can be included with other media such as videos, presentations, webpages, and also on physical objects

QR CODE

In order to use a QR Code, the user must have a QR Reader application on their smart phone. Once scanned, the QR Code can send you to a web location to perform an action or simply serve up some relevant content or media.

SMART PHONE

STEP 1 { User scans QR Code

On scanning the QR code the user can be served a variety of multimedia including online videos, text,, images, data entry forms, maps or dynamic applications that include all of the above.

STEP 2 { User is directed to a web application to perform an action or simply view/hear some content

Appendix 13: Plan for written Chinese, Year 4 as proposed by lecturer.

Number of students: 10;

Total learning hours: 200 (Independent study hours: 128, interactive class hours: 72)

In this module, students are to further progress their command of Chinese with emphasis on the written language. The module is taught entirely in Chinese.

Module aim:

- Reinforce the student's knowledge of the structures of Chinese with a particular focus on written characters.
- Ensure that students have an active knowledge of approximately 1200 characters and a passive knowledge of approximately 2000 through the use of press articles, contemporary stories, and television broadcasts.
- Further develop student's knowledge of Chinese grammar.
- Acquire the skills of formal letter-writing (Chinese and Taiwanese style).

The above aims will help students achieve the following outcomes of being able to:

- read, understand and summarise press articles and short stories or average difficulties and answer questions regarding their content.

- Write short, formal written requests and letters.

Strategy:

The above aims and outcomes are pursued in a classroom setting where the lecturer delivers the class speaking only in Chinese and the students are invited to interact by responding to questions, or carrying out tasks such as writing. However, full class participation is not always achieved and exercises requiring electronic input are usually left until outside class time, as this module has no allocated lab space. Learning and teaching methods include:

Writing practice in class, identification of sentence elements and comprehension of written texts, reading practice of press articles and short stories, and comprehension exercises involving multiple choice questions as well as short written and oral answers in Chinese.

Change:

Modern communication of the kind that is required is often carried out via mobile phones. People tend to send texts from holidays, and if they have missed an appointment. Currently the students are taught to write informally for applications in cards, postcards, casual letters, describing appearances or summarising, putting up notices, leaving notes. And then having mastered the informal writing, they progress to more formal communication such as essays, job applications, and cover letters.

For this research, I will be examining the use of mobile technology (devices) as being used as being a technology all the students have and more reflective of their daily informal communication.

From the use of mobile device, students will move to using blogs (possibly from mobile devices but not restricted to that) and also manual writing.

Mobile technologies to be used include technologies that closely emulate real life situations but offer additional value in the context of learning and teaching.

The implementation of mobile technologies in this context will be examined from the perspectives of learning and teaching, system/ technology integration and process integration. Continuous dialogue with lecturer and students though out the terms by means of focus groups and one on one interviews as well as questionnaires.

Assessment (Same as before)

Aural: 20% 1 audio visual to be commented in writing; Written tests: 40% 2 tests at 20% each. Written exam: 40%. Re-assessment: written exam at 100%.

3/08/2012 Week by Week breakdown

The module runs over 12weeks and the mobile learning activities have been integrated into the first 5weeks. At this point, students are expected to write coherent short messages in different contexts using a variety of characters. Using mobile learning here allows for quicker assessment as well as being more true to life.

> Informal letters/card texts: This covers informal communication. Students will respond to texts from lecturer. For each of these use 20 or 30 different characters:
> a)**Prompt/ Lecturer's text:** "It's Mary/John's birthday tomorrow,

remember to send them a birthday message expressing your wishes for them."

b) **Prompt/ Lecturer's text:** "Send a new year greeting"

c) **Prompt/ Lecturer's text:** "Your friends are getting married on Saturday, send an appropriate text wishing them well"

d) **Prompt/ Lecturer's text:** "Mary's Grandmother just died, send her a text expressing your condolences"

Short Notes: Students learn to leave short messages or notes. Messages should be clear and concise. 30 to 40 different characters.
a) **Prompt/ Lecturer's text:** You have just called to your friend's house and they are not there, send them a message letting them know you called, why you called, and when you will be back if you will be or when you will see them again.
b) **Prompt/ Lecturer's text:** Send a text to your friend inviting them to a party. Should include date, time, venue and other relevant information.

Short notice ctd: Continuing with short notices-(30-40 characters)
a) **Prompt/ Lecturer's text:** Put up a general announcement about an event (e.g Chinese calligraphy) being hosted by your department and with a guest who is well known in their field.
b) **Prompt/ Lecturer's text:** Leave a messaging apologising to your lecturer or someone else with whom you had a prescheduled appointment explaining why you cannot make it, and offering an alternative.
Personal letters- letters to friends, family
Announcements:
a) **Lost Prompt/ Lecturer's text::** Construct a short message about something you lost. Remember to say where you lost it, and other relevant information such as reward if appropriate, how you can be reached, etc.

b) **Found Prompt/ Lecturer's text::** Construct a short message about something you found. Remember to say where you found it, and other relevant information such as how you can be reached, by what date, etc.

c) **Prompt/ Lecturer's text:** Write the text for an announcement

selling an item for the small ads section in a magazine or noticeboard.

Appendix 14: Communication with Vendor

From: XXXXXXX]
Sent: 09 July 2012 10:55
To: XXXXXXXXX
Cc: XXXXXXXXX
Subject: Chinese characters in incoming messages

Hi XXXX,

Thank you for your patience whilst waiting for the answer to your query. I spoke with the aggregators we use to handle inbound and outbound traffic on your account.

Specifically we use one aggregator for your outbound traffic, and this aggregator handles no GSM characters, such as Arabic, Chines and Cyrillic which is why you are able to send messages out in Chines without problems.

We do have to use another aggregator to handle your inbound messages, as they are the one who can host and handle incoming messages on the ROI dedicated number you are using. This particular aggregator confirmed to me that it is not technically possible for them to handle messages containing anything over than GSM characters which is why the messages that are being sent to you written in Chinese cannot get processed by them and therefore displayed in your XXXXX's inbox.

I have explored the possibility of moving your inbound traffic onto the aggregator that is ab to handle non GSM characters, however we currently will need to still use the current aggregator that handles your inbound traffic as they host the ROI number and this is something that we are unable switch providers wise for now.

I hope this makes sense; please feel free to call me directly on 00000000 if you would like t discuss this in more detail and I will gladly assist you.

With kind regards,

XXXXX

Appendix 15: ITIL within OOI

ITIL within ███

Introduction

As part of our ongoing commitment to Service improvement and in order to fall in line with the industry standard for IT Service management, ███ has embarked on a process of implementing ITIL (Information Technology Infrastructure Library). The main objective of implementing ITIL within ███ is to ensure we have a framework which can be used to build and develop our Service management processes.

So what is ITIL?

The IT Infrastructure Library describes itself as:

> ➢ the most recognised framework for IT Service Management in the world;
>
> ➢ a common framework of practices that unite all areas of IT service provision to deliver value to the business;
>
> ➢ non-proprietary, non-prescriptive, good practice which can be adapted to suit different environments;
>
> ➢ a framework which helps IT become a high performing service provider and partner of its customers.

Others summarise ITIL as "Documented Common Sense".

So why should we adopt ITIL?

Having adopted better practice in relation to project management over recent years, we now need to do likewise in relation to service management, and to better link the two. ITIL

> ➢ offers good practice based on the experience of professional practitioners;
>
> ➢ can be adopted and adapted;
>
> ➢ is globally recognised.

ITIL is something for which there is a university business case (IT business alignment; service improvement; customer focus; transparency; effectiveness and efficiency; quality assurance; benchmarking; etc.) and also an IT business case.

ITIL can also be used to help us apply business process review to IT. In the course of our business application projects, many of us have reviewed existing processes in Academic Registry, HR, etc., and devised more effective and efficient ways of working. ITIL can be seen as providing IT departments with a model for the latter which we can then modify to suit our environment and our specific requirements.

ITIL is a framework rather than a standard so can be adopted and adapted to suit the higher education environment. Consequently, those challenges which may be, or seem to be, unique to higher education, are surmountable. Indeed, ITIL may well help us tease out and address some of the issues:

Appendix 16 IT Service Catalogue

Service Catalogue

IT Service Catalogue

The IS Service Catalogue is designed to help promote accurate, current and timely information about our services. The Service Catalogue comes as part of our commitment to the best practice framework called Information Technology Infrastructure Library (ITIL).

IT Service Desk	Provide advice & support in relation to all IS and IT related areas. Provision of call logging and management. Online information. Requests can be made via telephone, email, web. Drop in service available.	IT Service Desk	[Support]
Email Service	Provision of email service to all staff and students of the Institute. Email delivery. SPAM and virus blocking. Mailing list administration. Email account management. Support for mobile / external email. Configuration of email clients.	IT Service Desk	[Support]
Telephony Service	Provision, development, maintenance and support of ▮ voice network. Allocation of extension numbers. Direct Dial phone service. Operator assistance. Privilege level administration. Call logging reports. Voice mail provision and administration. On-line staff directory. Fax and modem services. Mobile phone administration.	IT Service Desk	[Support]
Network [DIT NET]	Administration of ▮ Network infrastructure. Provision of ▮ external link to Internet Provision of 100Mb connectivity to desktop Protection of ▮ systems from internal/external threats Expansion of ▮ wired network	IT Service Desk	[Support]

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	Remote access to ▮ systems		

Desktop Computing Services	Administration of ▮ PC hardware and software Installation and maintenance of desktop and laptop hardware Delivery of desktop applications Desktop authentication: ictdomain, NDS (▮) Installation and maintenance of mobile devices/PDAs Provision of network storage space Printer installation and maintenance Backup and recovery of data Business case approval for PC procurement Short introductory demonstration of desktop applications Discount pricing for personally-owned computing	IT Service Desk	[Support]
Student Records	Installation, development & ongoing maintenance of business applications in support of student records Access to student records Identification of business requirements Induction training on use of student record systems Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities	IT Service Desk	[Support]
IT Services for Finance	Installation, development & ongoing maintenance of business applications in support of financial services Access to financial data Identification of business requirements Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities	IT Service Desk	[Support]
IT Services for Timetabling	Installation, development & ongoing maintenance of business applications in support of room timetabling Technical services provided Access to timetables Identification of business requirements Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities	IT Service Desk	[Support]
IT Services for Human Resources	Installation, development & ongoing maintenance of business applications in support of human resources Access to staff records Identification of business requirements	IT Service Desk	[Support]

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Resources	Identification of business requirements Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities		
IT Services for Alumni	Installation, development & ongoing maintenance of business applications in support of alumni activities Access to funder records Identification of business requirements Induction training on use of alumni systems Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities	IT Service Desk	[Support]
IT Services for e-learning	Installation, development & ongoing maintenance of systems in support of e-learning Identification of business requirements Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities	IT Service Desk	[Support]
Web Services	Installation, development & ongoing maintenance of systems in support of content management systems and web hosting services for dit.ie and project domain names **"Content Mangement System Technical services provided"** Access to ▉ websites Identification of business requirements Provision of support documentation Backup and recovery of business data Provision of performance reports Testing and deployment of system upgrades Extended support for peak-season business activities **"Web hosting Technical services provided"** Site hosting in Linux and Windows Hosting of Dynamic Content - PHP with MySQL and ASP Provision of support documentation Backup and recovery of site data Provision of web site Search Provision of performance reports	IT Service Desk	[Support]

AV Services	Provision of data projection facilities Installation and maintenance of presentation devices (AV data projectors) AV and IT facilities for teaching, conferences Support for AV presentations	IT Service Desk	[Support]

Programme Management Office	To oversee the implementation of the IS Development Programme ensuring projects are delivered as promised on time and within budget Programme management of the IS Development Programme Assist with development of project proposals Implement project management disciplines into IS projects	IS PMO	[Project Management Office]