A framework for mobile learning in international contexts

by

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Declaration

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy. I hereby declare that, except where acknowledged, the work in this thesis has been composed by myself, and has not been submitted elsewhere for the purpose of obtaining an academic degree.

Mohammed Rehman

Signed __M Rehman_____

Date __16th June 2020_____

Abstract

This study aims to understand how undergraduate students across three cultural contexts use mobile phones as part of their learning, in order to identify differences and similarities in terms of their lived experiences of using these devices. A review of the literature identifies a range of definitions of mobile learning, as well as the predominantly positivist focus of studies to date that examine mobile learning interventions from a technological perspective. Adopting an interpretivist stance, this study uses the phenomenographic research approach to understand participants' descriptions of mobile learning, conducting interviews in Japan, the UK and China with students at three higher education institutions.

The findings are presented as three outcome spaces, one for each cultural context, highlighting how conceptions of mobile learning can be organised with increasing hierarchical complexity within each of the three contexts, moving from accessing resources at the lowest level to collaboration at the highest level. Across the three contexts there are differences in terms of formal and informal communication, attitudes towards distraction and the positioning of students as either individual learners or as part of a collective, with a variety of tools used for communication and collaboration. There is evidence of the influence of cultural context on how and where mobile phones are used, such that different aspects of the phenomenon of mobile learning are foregrounded across the three sets of participants.

The findings suggest that there needs to be an understanding of the importance of cultural context when considering how and where mobile phones are used as part of learning. Educators and educational institutions should conduct more research into how they can integrate students' culturally mediated behaviours and expectations of use with regards to mobile phones into their teaching and educational practice.

1 Introduction to the study

1.1 Rationale

The last decade has seen rapid growth and adoption of mobile devices. According to the World Bank Institute (2016) 8 out of 10 users in the developed world own a mobile phone and the lowest penetration rate, in sub-Saharan Africa, is still 73%. Globally, 95% of the world's population are covered by a mobile phone network (ITU, 2016). The smartphone in particular has evolved from being a tool for the corporate market into a device that is aimed at domestic users. Calvosa (2015) see the emergence of the smartphone as a result of cycles of convergence, drive by technological innovations such as Wi-Fi technologies and the miniaturisation of components, as well as the customer demand for single devices that can perform multiple tasks such as playing music, making calls and recording video.

In response to the rapid growth of mobile phone usage, there has also been increasing research into the potential use of mobile phones in educational settings, for example to provide rich learning environments or create online spaces where students can communicate and collaborate. As with Calvosa's (2015) description of the convergence of technologies that have driven adoption of mobile devices, Sharples et al (2007) see a convergence between mobile technologies and re-conceived conceptions of learning, framing it as a personalised and learner centred activity where mobile devices facilitate access to learning resources at a time and place to suit the learner. Gómez et al (2014) cites a number of benefits provided by mobile devices: engaging students in experiential and situated learning without restrictions in terms of pace, place and delivery; facilitating the continuation of formal learning activities into informal settings; allowing on demand access to learning resources and facilitating communication and collaboration with tutors and peers outside of the classroom.

However, a number of authors have highlighted significant challenges to overcome when adopting mobile technologies in learning and teaching, including concerns over distraction (Alfarani, 2015; Russell and Jing, 2013); management and institutional issues (Butcher, 2016) and teacher resistance (Ismail et al, 2013; Serin, 2012);

Additionally, while institutions have developed an infrastructure for distance education there is still a debate over the maturity of provision of mobile learning which has tended to be on an ad hoc, per project basis and has not necessarily been underpinned by relevant

research, with a lack of studies that adopt a more naturalistic approach to how examining how mobile devices are used across a variety of contexts (Traxler 2010, Tossell et al 2015).

There are also varying definitions of what constitutes mobile learning, which focus on either the technology, the mobility of the learner, mobile learning as a subset of e-learning. For example Traxler (2005) offers a definition of mobile learning as "any educational provision where the sole or dominant technologies are handheld or palmtop devices'. El-Hussein and Cronje (2010) define mobile learning as 'any type of learning that takes place in learning environments and spaces that take account of the mobility of technology, mobility of learners and mobility of learning'. Oyelere et al (2017) define mobile learning as 'the application of portable mobile computing devices, such as mobile phones, tablets, smartphones, and e-readers, to access learning resources, collaborate, communicate, and share learning experiences' and recognise that mobile learning is not just about devices but also encompasses activities between teachers, learners and their environment. This varying focus on technologies, student mobility and social aspects when describing mobile learning has meant that a universal definition is difficult to identify.

Chan et al (2015) report that studies into mobile learning tend to adopt a positivist approach, where the focus is on interventions and experiments that test the effectiveness of mobile learning applications and systems. Ting (2012) suggests that studies that focus on technology, leads to a foregrounding of the inherent limitations of the device and the technology itself becomes a distraction. Squire and Dikkers (2012) consider that the focus should be on *how* users exploit technology and make sense of it in their social context, identifying what features are valued within the cultural setting of the user.

This is the starting point for this study, where I am seeking to examine the extent to which the cultural context of the learner impacts on how and why students use mobile phones as part of their learning. I am seeking to compare and contrast different cultural contexts in order to identify both differences and similarities in terms of how mobile phones are described and used and will attempt to broaden the scope of the research by adopting a qualitative stance that views mobile learning from the perspective of the learner.

1.2 Motivation

On a trip to Japan in 2003 I was waiting at a bus stop trying to make sense of the timetable. I observed a young Japanese woman walk up to the bus stop and, using her mobile phone, she took a picture of the timetable. This person was utilising the technological affordances of the device to capture information that I would have recorded using pen and paper. I was left thinking that not only was this an obvious use of the technology but also wondering why I had never seen anyone use phones in this way previously. The mobile phone I was using at the time certainly had the ability to take pictures, albeit at a very low resolution compared to modern standards. However, since I had a digital camera, I did not use normally use this aspect of the phone. For me this was an early example of culturally mediated technology use, where my perceptions of the technology i.e. how it could be used and my attitudes towards the technology differed from the person that I had observed.

As an academic at a UK university since 2001 I have used technology in a variety of ways to work with students, including Virtual Learning Environments, video, online quizzes and forums, social media and a range of hardware such as voice recorders, video cameras and interactive clickers. The institutions I have worked at engage with international students across a variety of programmes and I was seeing differences in how these students engaged in formal sessions and the online spaces provided for them to communicate and collaborate in. I was also seeing students using their phones in differing ways, e.g. taking a picture of the board at the end of the session or capturing audio of the session, as well as contacting me outside of the formal session using their mobile devices.

I was interested to examine how and where students were using mobile phones for learning and, given the diverse student population I was working with in terms of international and domestic students, I was interested in whether these uses were culturally mediated such that the cultural environment of the student prior to their study at a UK institution had shaped their behaviours and given rise to certain expectations about mobile phone use.

Sharples, Taylor and Vavoula (2005) suggest that in order to understand mobile learning you must examine the context in which it occurs, where context is a dynamic entity that mediates interactions between learners and their environment. Based on my experience in Japan, I wanted to examine how these devices were being used by students *within* their

particular cultural context, in order to identify similarities and differences in their lived experiences of using mobile phones that could potentially impact on their educational experiences in other contexts, such as undertaking study abroad. Tarhini et al (2015), in a study of British and Lebanese students attitudes towards technology use, state the problem quite explicitly when they state 'it is futile to facilitate a technology which is implemented in a western country or for specific group of users and then apply it in non-western countries that have substantial cultural differences without taking into consideration the social, organisational, individual and cultural factors'. However, Gikas and Grant (2013) report that there are 'few descriptions of how mobile computing devices and social media are used by university students'. As such, this study will attempt to understand how mobile learning is conceptualised in different cultural contexts in order to understand those cultural factors that may impact on the use and effectiveness of mobile learning interventions.

The rest of this chapter will present my main aim and research questions. A brief outline of the methodological approach for this study will be outlined, as well as the research setting. The remaining chapters of this study will then be outlined.

1.3 Overall aim and research questions

This study aims to understand the lived experiences of learners using mobile phones across different cultural contexts. As such the main research question is 'how do learners from different cultural contexts understand and experience mobile learning'? Within the research question several sub questions were identified:

- To what extent are there similarities and differences across differing cultural contexts in terms of students' experiences of using mobile phones for learning?
- To what extent do existing frameworks and theories for mobile learning address the cultural context of the learner?

Given the methodological stance chosen for this study, which is to examine mobile learning from the perspective of the learner, this interpretivist approach differs from the predominantly positivist approaches used to describe mobile learning in other literature.

1.4 Significance of the research

This study presents the lived experiences of learners, in three cultural contexts, using mobile phones as part of their learning. It offers insights into how mobile phones are used, which comprises technological aspects, social aspects and issues such as tutor and student positioning and presence within the spaces and tools used on mobile devices, the language used in communications and the ways in which devices are perceived in formal and informal settings.

The findings of this study are of immediate relevance to educators and educational institutions who seek to understand a) how undergraduate students are using mobile phones for educational purposes and b) how the cultural context of the learner impacts on their perceptions and subsequent uses of mobile phones for learning.

Gunawardena et al (2018) suggest that there are several cultural 'spaces' that need to be understood when designing and developing mobile learning solutions, including: identity negotiation, power, status and authority, communication, relational, resource sharing, and organizational spaces. These cultural spaces lead to clear distinctions between differing cultural contexts in terms of how mobile phones, and associated tools, are utilised, how communications are conducted and the relationships between tutors and students. It cannot therefore be assumed that students will readily relinquish the influence of these cultural spaces when moving from one cultural context to another.

1.5 Research approach

A phenomenographic research approach was adopted for this study as it was considered the most suitable method to uncover students lived experiences of using mobile phones for learning. Phenomenography was designed to answer questions about learning and how people make sense of their experiences and was developed by a research group led by Ference Marton in the Department of Education, University of Gothenburg, Sweden.

Phenomenographers operate with the assumption that there are a limited number of ways of experiencing a phenomenon and that these ways of experiencing can be organised in a hierarchy, moving from least complex to most complex (Tight 2016). Rather than accessing the phenomenon directly, phenomenography is concerned with people's experiences of the phenomena and how these vary between people of the same circumstances and/or people under different circumstances (Cibangu and Hepworth 2016).

Interviews are the primary data collection tool in phenomenography, with semi structured questions that allow the interviewee to focus on describing their conceptions of the phenomenon. Phenomenography advocates the bracketing of prior assumptions before conducting research, such that the researcher's own views and beliefs are set aside so that the situation can be seen from a new perspective (Marton 1986). As such interview questions are aimed at encouraging participants to describe how participants view the phenomenon in their own words as opposed to going in with pre-conceived notions about how the phenomenon is experienced. Purposive sampling is used to identify participants who have had experience of the phenomenon in question and conceptions relating to the phenomenon are gathered from the group of transcripts as the focus is on the collective, rather than individual, understanding of the ways of experiencing the phenomenon (Boon et al 2007).

Three sets of interviews were conducted in three countries: Japan, the UK and China. More than thirty interviews were conducted across the three contexts and of these twenty-three were used for analysis, eight from China, eight from the UK and seven from Japan. Participants were undergraduate students at higher education institutions in each country.

The aim was to understand general attitudes towards mobile phones, intents behind the use of phones across formal and informal settings and how students described these uses within their particular social and cultural context.

Studies into mobile learning across cultural contexts have approached the use of mobile phones from a variety of perspectives. As highlighted earlier, these tend to be positivist approaches. My study, however, follows an interpretivist approach which aims to view mobile learning from the perspective of the learner.

1.6 Structure of the thesis

This section is the introduction to the thesis, which identifies the motivation behind the study, the rationale, and research approach and research questions. Chapter 2 is a literature review that discusses definitions of mobile learning, outlines mobile learning frameworks, discusses the issues of culture and context and describes mobile learning research from a global perspective. Chapter 3 is a discussion of the research approach taken in this study, providing a rationale for the selection of phenomenography as the research approach, the methods of collecting the data, the selection of participants, the

issues of ethics and a discussion of validity and reliability. Additionally, an examination of the variation in phenomenographic data analysis is presented, as a means of discussing the approach taken in this study. In Chapter 4 the findings of data analysis are presented in the form of three phenomenographic outcome spaces and extracts from the interviews conducted in the three cultural contexts, as well as an attempt to present expanding themes of awareness that describe the variations of aspects of the phenomenon moving through the hierarchical categories of description that form the outcome space. In chapter 5 findings from the study are related back to the literature in order to place the findings in context. Additionally, a framework is presented that attempts to highlight aspects of mobile learning that are culturally mediated. Implications for policy and practice are discussed and areas for further research are outlined and a reflection on the phenomenographic research approach concludes the thesis.

2 Literature review

This chapter will be a detailed literature review about mobile learning. Initially, the context for the study will be introduced through a discussion of technology and learning, of which mobile learning is an example. The evolving definitions of mobile learning will be discussed, and notions of learner context, culture, cognition and communication will be examined. Various learning theories and frameworks as applied to mobile learning will be highlighted. Methods by which mobile learning interventions can be measured in terms of their effectiveness will be presented and discussed. Finally, a survey of mobile learning interventions across the globe will be presented.

2.1 Technology and learning

Advances in information technology have impacted on all aspects of society. In education, technology has provided an opportunity for educators to enhance the learning experiences of their students, for example by providing rich learning environments or creating online spaces where students can communicate and collaborate. A number of terms have been used to describe the relationship between learners, educators and technology e.g. Technology Enhanced Learning (TEL), Technology Mediated Learning (TML) or Technology Assisted learning (TAL). Definitions tend to be broad and arguably interchangeable, encompassing a broad range of technologies and educational approaches. For example, Alavi & Leidner (2001, cited in Wan et al 2007) defines TML as "an environment in which the learner's interactions with learning materials, peers, and/or instructor are mediated through advanced information technology". Walker et al (2012) define TEL as "any online facility or system that directly supports learning and teaching. This may include a formal VLE, an institutional intranet that has a learning and teaching component, a system that has been developed in house or a particular suite of specific individual tools".

Dror (2008) considers that a large number of technologies can be viewed as 'learning' technologies, include mobile phones, email and the Internet and suggests that too many interventions focus on the specifics of the technology rather than how the technology can reduce cognitive load and emphasis the most relevant and important information. Balacheff et al (2009) sees TEL as growing out of five areas of research: *design*, the design and evolution of new learning activities; *computation*, what is made possible by technology; *cognition*, what the individual can learn in given contexts; *social and cultural*,

how the individual can construct meaning across formal and informal contexts and *epistemological* , how the knowledge domain constrains how the technologies are used.

Jean Piaget and Lev Vygotsky, two development psychologists, offered alternative theories concerned with development, knowledge, and learning. Piaget argued that the individual constructs his or her knowledge individually or solitarily. Vygotsky's Cultural-Historical theory argues that child development is the result of interactions between the learner and their social environment. This interaction involves people such as teachers, parents and schoolmates as well as cultural artefacts and practices (Lourenço 2012).

Vygotsky's socio-cultural approach to learning complements the ethnographic framing of studies into culture and learning, where culture is considered to have a localised meaning as opposed to being an independent variable that influences learning (Kumpulainen and Renshaw 2007). It has also led to an increased interest in constructivism, a theoretical perspective on learning which emphasises an individual's active involvement in social practices i.e. interacting with others, as opposed to traditional approaches to teaching which focus on individual achievement and the transmission of knowledge (Thanh 2014). From a pedagogical perspective, teachers model expected behaviours and qualities and engage students in relevant activities that are mediated by tools such as language, diagrams and computers or any other tool that can facilitate learning (Windschitl 2002).

Whilst there is recognition of the benefits of technology in an educational context, Zhang (2010) identifies two phenomenon that have been highlighted by research. The first concerns the adoption of technologies across differing cultures, where educators in some cultures choose to use technologies that do not impact significantly on existing practice or use them in culturally familiar ways. Secondly, supposedly transformative innovations, such as cooperative learning, are degraded and mutated in some cultural contexts such that the deep change that should occur in the learning culture is not realised. Using the example of Eastern versus Western teaching, he identifies differences in the epistemological beliefs of Eastern versus Western learners. Eastern learners have an authoritative view of knowledge and learning (where intellectual elites create knowledge that is then communicated by scholars to students) and the classroom structure is more teacher focused with a strong emphasis on essential knowledge. As a result, Eastern teachers prefer content focused and curriculum compliant courseware and resources, which includes drill and practice and computer assisted tests. This is not simply a focus on rote learning: Chinese students are both deep and surface learners, challenging the

assumption that they are prone to surface and rote learning (Rambruth 2001, cited in Selinger, 2004).

Warschauer (1996, cited in Economides, 2008) found that, in an online discussion forum, Japanese students participated more than in face to face discussions. Selinger (2004) discusses how a global learning program offered by Cisco technologies, developed according to a social constructivist view of learning, varied widely in terms of delivery in different territories with some countries focussing on rote learning and others emphasising group interaction and practical tasks.

Zhang (2007) identifies two approaches to integrating new technologies in an educational content. In the first approach educationalists will assimilate technology into existing pedagogical practice and culture, adapting them where necessary to fit with features of the existing system. Distance learning is given as an example, where distance learning in China has been localised as group-based distance lecturing as opposed to the individualised, self-paced learning model adopted by countries in the West.

In the second approach the cultural artefacts associated with the technology are also imported, requiring educators to make adjustments to accommodate the technology. Lin (2001) calls this process *reflective adaptation*, where an Individual reflects on their existing practice and goals, chooses aspects of an artefact for adaption and reflects on their choices. Lin uses the example of a video based story that involves the use of learning activities involving collaborative problem-solving skills, negotiation around possible solutions, and communication. The educator was unable to reconcile the use of a structured approach to teaching with the open-ended affordances of the technology and altered their approach to include more group work, discussions and problem solving activities.

Vatrapu (2008) contends that technology mediated learning environments are characterised by socio-technical interactions, where individuals interact with technologies and with other individuals via technologies, and that the social affordances of these environments vary along cultural lines.

Traxler (2013a) suggest that common mobile learning strategies, such as individual or competitive games, experiential learning, group-work and student-centred learning, may not translate into every culture because of dissonance with its conception of learning. He observes that theories of mobile learning represent or facilitate a trend to take learning

away from the classroom and the lecture theatre and represent a specific set of pedagogic assumptions about relations between the institution, experience, learning and education that are not necessarily universal.

Grönlund and Islam (2010), suggest a number of issues that could arise when developing mobile learning courses in developing countries. In the development of a large-scale interactive learning environment in Bangladesh that used video, mobile phones and SMS they found that learning is traditionally based on a repetitive pedagogy that discourages interactivity. They also highlighted the organisational challenges involved in providing support for meaningful levels of interactivity in such courses. This suggests that educational culture and organisational readiness are possible factors to include in a proposed framework.

Frambach et al (2012) consider that group discussion is viewed as a useful tool to encourage critical thinking and motivation but it reflects a Western view of learning which can cause tensions in different cultural settings. They report on studies into problem-based learning where there were issues in group dynamics, communications and the discussion process, with the example of Chinese students who were showing a strong sense of politeness, harmony, and conformity as well as reluctance to directly introduce arguments in the discussion.

Applying a socio-cultural perspective to a study of international students undertaking problem-based learning, they attempted to establish the extent to which students across three cultures externalized their cultural backgrounds and simultaneously internalized the discussion aspect of problem based learning, and whether this shaped their discussion behaviours and skills. Participants were from Dutch, Middle Eastern and Hong Kong medical schools.

They found that behaviours of speaking up, asking questions, and challenging others in the discussion were influenced by four cultural factors and that these factors were stronger in non-Western students:

- uncertainty and tradition, which was more pronounced in Middle East students and inhibited their participation to a greater extent than the other students
- group relations and face, where Hong Kong and Middle Eastern students were concerned about participating in group discussions when they did not know the other members.

- hierarchical relations, students from societies where authority roles were not challenged were less likely to ask questions of, or criticise, the teacher but it was acknowledged that this aspect is evolving.
- achievement and competition. Students from Hong Kong and the Middle East felt their societies instilled a strong sense of achievement and that this could hinder participation in group discussions because sharing information may lead to a diminished status compared to peers.

They also found a number of contextual factors that also inhibited or enhanced group discussion:

- The nature of prior school education: a teacher centred and traditional approach was more likely to lead to problems in participating in group discussion.
- Scope of implementation of problem-based learning: a greater amount of content in lectures led to lower levels of participation in PBL sessions in order for students to construct their own knowledge.
- Student personal characteristics: quiet or loud students were not appreciated within the group dynamic
- Language of instruction: where English was not the first language of students they would be less likely to contribute because they felt they could not adequately articulate what they wanted to say. It was noted that participation increased when students were allowed to use their own language in sessions.
- Tutor behaviour: a tutor approach that either dominated the discussion or remained passive would be less likely to engage students.

In an examination of the perceptions of Chinese students in an online MBA programme Liu et al (2010) found that students experienced several issues. Time management was a significant factor: students would have family or work commitments which reduced the amount of time they had to study. Language issues meant that they needed more time to read materials and were less likely to engage in discussions. Chinese textbooks are very clearly structured and allow for memorisation of key concepts while Western texts tend to provide resources but no definite structure or explanation of key theories. Chinese students frequently felt overwhelmed by the amount of content. They were less likely to engage in collaborative activities and approaches to problem solving would be different which could lead to tensions.

Henderson (1996) presents a Multiple Cultural Pedagogic Model of interactive instructional design which presents a number of cultural dimensions that need to be taken into account, these include epistemology; the role of the instructor and the underlying pedagogical philosophy e.g. constructivist, instructivist. Collis et al (1997), in their research into the development of a trans-European training project, identified 19 dimensions related to 'flexibility', including time, content and instructional approaches.

Bower (2019), in examining what it means for learning to be mediated by technology, argues that intentionality resides within the actors (e.g. staff, students) rather than the technology and presents seven 'premises', underpinned by existing theories and research. He presents this encapsulation of the various theories visually (Figure 1) in order to show the interplay between educators and learners, mediated by technology. The broader environment is described as an overarching influencing factor which influences how learning occurs. He posits that learning occurs in a social context which impacts on learner beliefs and practices and that technology cannot be assumed to have fixed effects across all contexts. This is an implicit recognition of the importance of cultural context.

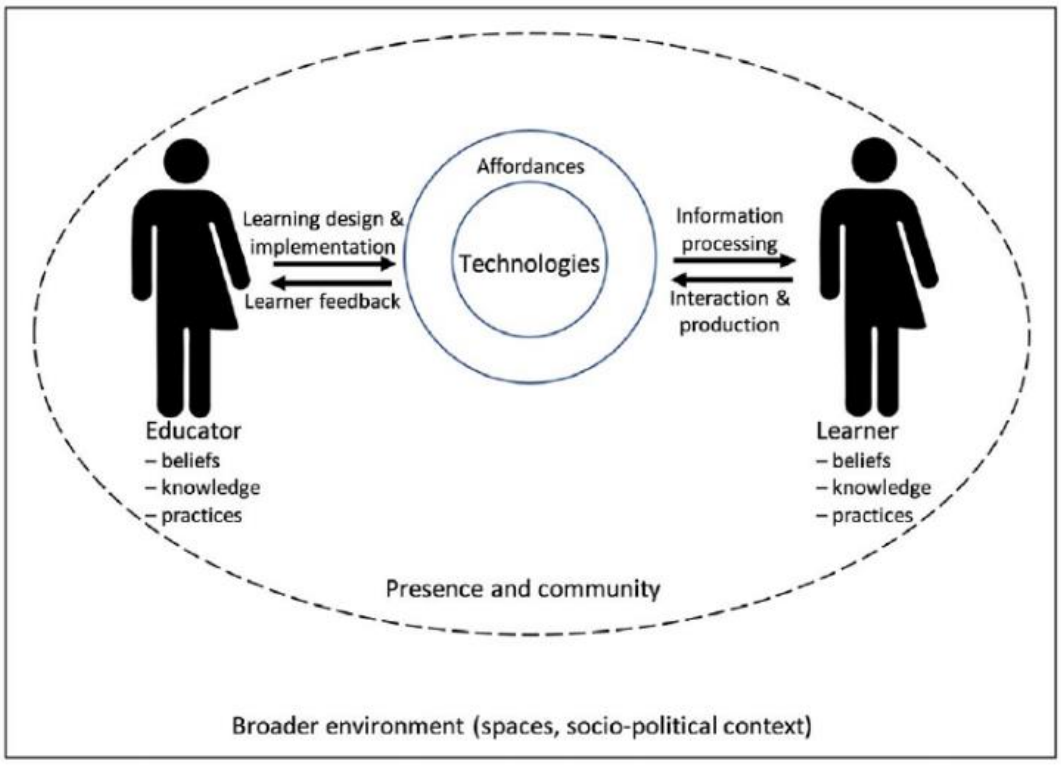

Figure 1: Encapsulation of technology mediated learning theories (Bower 2019)

He and Li (2019) also highlight the importance of culture, suggesting that users use of technology can be said to be influenced by their social and personal context and cultural norms.

The importance of culture and cultural factors will be discussed in more detail later in this literature review and will be used to frame the investigation into mobile learning in a global context.

Clearly, educators need to consider the extent to which the use of technologies to facilitate learning will be impacted by cultural preferences and attitudes and lead to either a resistance to the technology on the part of learners or a dilution of the impact of the chosen technology because of local influences.

2.2 Mobile learning definitions

A universal definition of mobile learning is difficult to establish. Many of the definitions of mobile learning can be classified as either learner focussed or technology focussed, with some hybrid definitions which attempt to encompass the learner, their learning context and the technology that facilitates the learning. Winters (2007) groups perspectives on mobile learning into four broad categories:

- Technocentric – mobile learning is viewed as learning using a mobile device (the predominant perspective identified in the literature)
- Relationship to e-learning – mobile learning is considered a subset of e-learning
- Augmenting formal education – where formal learning is characterised as face to face teaching
- Learner-centred – considering mobile learning from the perspective of the mobility of the learner

O'Malley (2003) offers a definition of mobile learning as "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies". Park (2011) considers mobile learning as "the use of mobile or wireless devices for the purpose of learning while on the move".

Berking (2012) attempt to offer a broader definition of mobile learning as "leveraging ubiquitous mobile technology for the adoption and augmentation of knowledge, behaviours or skills through education, training or performance support while the mobility of the learner may be independent of time, location and space". This broad definition encompasses many of the previous definitions of mobile learning. Laouris and Eteokleous (2005) comment on the oversimplification of the term mobile learning which equates the word mobile with mobile phones and does not adequately address the opportunities that mobile technologies offer. Peters (2007) identifies a range of devices that can be considered under the definition of mobile technologies, including PDAs, mobile phones, laptops, and PC tablets, considers mobile learning to be a subset of e-learning and identifies its key features as 'just in time, just enough and just for me' learning that is mediated by tutors and peers and provides individualised learning.

Sharples, Taylor and Vavoula (2007), in their consideration of what distinguishes mobile learning from other types of learning activity, takes as its starting point the idea of learners

who are constantly ‘on the move’. However, this movement is defined as being contextual as well as physical and is made up of a series of conversations that facilitate learning, underpinned by mobile technologies.

El-Hussein et al (2010) consider mobile learning as comprised of two elements, mobility and learning, and suggest that ‘mobility’ refers to not just the technological capabilities offered by the technology but also encompasses the activities of the learning process and the behaviour of students as they learn. Kukulska-Hulme et al (2011) expands upon this and provide an extended description of mobility that includes:

- Mobility in physical space: where learning occurs in the time available between other, non-learning, activities. Location may or may not be relevant to the learning experience.
- Mobility of technology: where students carry around technologies that can be utilised for learning and may also switch between devices.
- Mobility in conceptual space: learning and attention moves between a number of topics
- Mobility in social space: learning is as a result of interactions with different groups e.g. classroom, office
- Learning dispersed over time: a variety of learning experiences in both formal and informal contexts enable the learner to make connections and reinforce the material.

The notion of ‘context’ is used as a means of linking together the various aspects of mobility in this extended description. Context will be discussed further in the next section of this literature review.

Grant (2019) considers that previous definitions of mobile learning are problematic and should therefore be ignored when operationalising research questions in mobile learning, since they do not clearly capture the affordances of learning while mobile. He proposes that design characteristics should be the focus when designing or implementing mobile learning and presents a framework of seven characteristics that identify essential features within a mobile learning environment. The framework, presented in Figure 1, has as its core assumption that all of these characteristics are required of a mobile learning environment, with the continua highlighting that these characteristics can vary, which will lead to variations of mobile learning. Interestingly, culture (and context) are highlighted as

aspects that can influence mobile learning. These aspects are discussed in more detail further in the literature review.

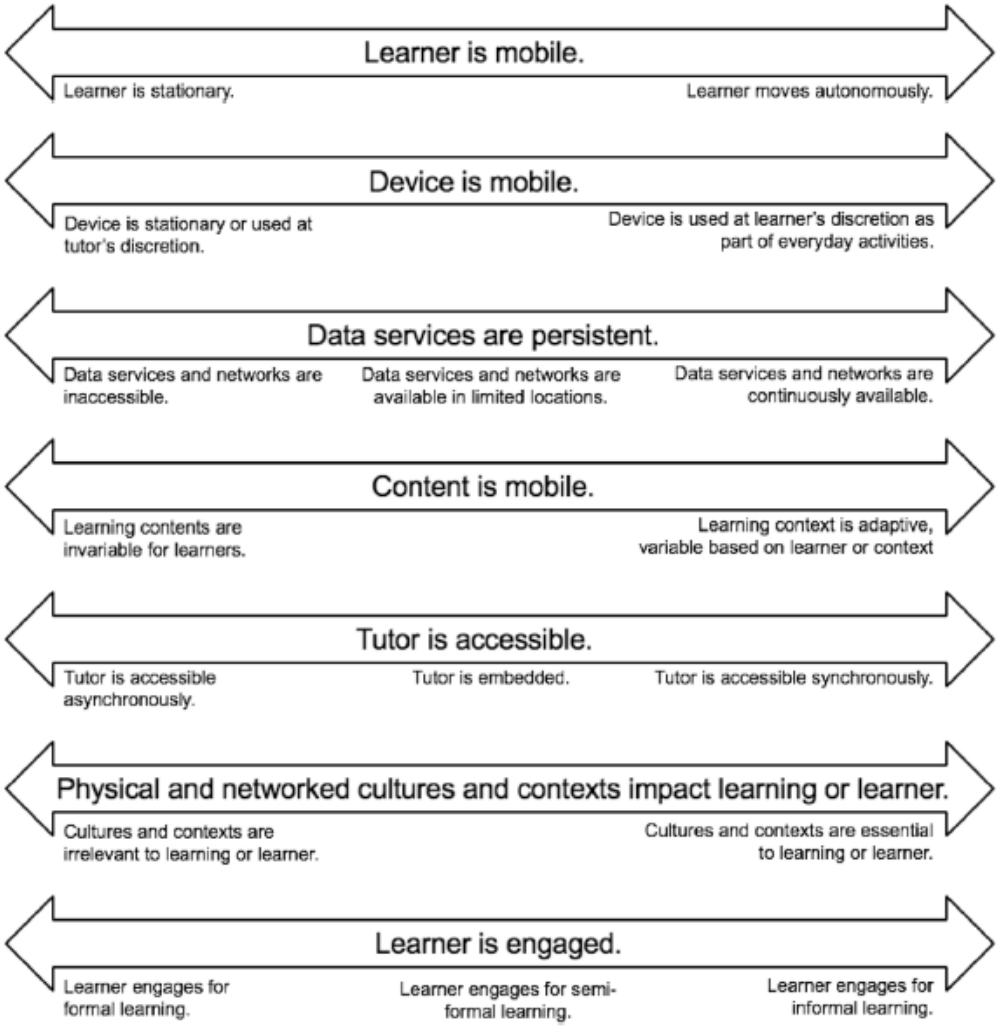

Figure 2: Design characteristics in a mobile learning environment to (Grant 2019)

Finally, in line with the suggestion from El-Hussein et al (2010) that mobility encompasses both technological affordances and learning activities, Gay, Rieger, and Bennington (2002), propose a 'mobility hierarchy', where the affordances of mobile devices encourage use at different levels, moving from a content focus and individualised activity at the lower level to a collaborative focus at the highest level, with different features of mobile devices being used at the different levels. Park (2011) presents an adapted version of this hierarchy graphically, as seen in Figure 3, highlighting what tools are used at the different levels. At the lower level, mobile devices are used to access information, schedules and grades

whereas at the higher level students use tools such as real time chat, SMS and email to communicate and collaborate.

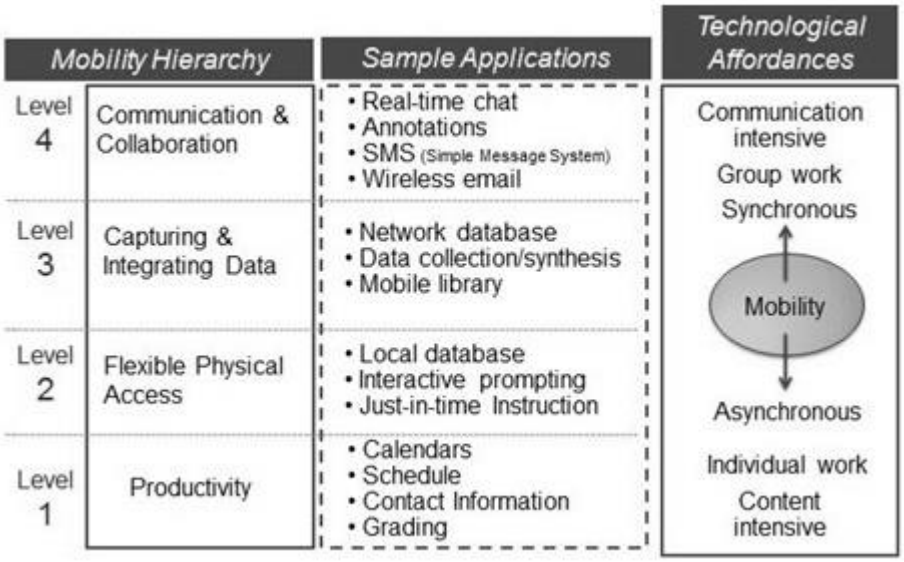

Figure 3: Mobility hierarchy, sample applications, and technological affordances (Park 2011)

2.3 Context awareness and adaptive learning

Wang and Wu (2011) outline the limitations of the traditional classroom-based learning environment, where the formal nature of the learning activity tends to produce a passive attitude towards learning and therefore impacts on motivation. In addition, education providers tend to adopt a one size fits all approach to teaching which does not accommodate individual differences. (Shute and Towle, 2003). Adaptation, which offers the opportunity to overcome these limitations by providing learning that can be tailored to the needs of the learner, has been the subject of a number of research initiatives that seek to move away from the one size fits all approach.

Sampson and Zervas (2013) discuss adaptivity and personalisation as it applies to mobile learning. Adaptivity is the generation of learning experiences that recognise learner needs and personal characteristics, whereas personalisation is concerned with aspects that can be adjusted by the learners, such as the interface and language used.

This leads them to propose that there are two aspects that need to be addressed when designing mobile learning systems: the learner's contextual information and the adaptations that can be performed in response to this information.

Aligned to this, Kumar and Sharma (2020) attempted to identify the key components of context aware mobile learning applications across a number of studies. Their systematic literature review identified eight different types of context information used in the development of mobile applications: physical condition, time, learner, cognitive, learning style, location, device and people. Additionally, six types of learning adaptation were identified: adaptation to learning resource, resource presentation, feedback, navigation to location, interaction and hardware resource. Since they are identified as important aspects of mobile learning, context and adaptation will be explored further in this section.

2.3.1 Context

In their discussion of learning Sharples, Taylor and Vavoula (2005) considers that context can be considered either as a 'shell' that surrounds the user of technology or as a result of the interaction that occurs between users and technology. As an example of the first model they consider a classroom based learning experience delivered by a teacher where knowledge and meaning are constructed through a transfer of information from the teacher to the student, using intermediary tools such as books and whiteboards. However, with the advent of mobile learning, where the mobility of both learners and the technology frees them from the constraints of learning at a fixed location, Sharples, Taylor and Vavoula (op cit) suggest that context is not static and therefore the second model is more appropriate. Thus, context is created from the interactions and conversations that occur between learners as they move between locations and across different forms of technology.

Understanding context as it applies to mobile learning offers opportunities for personalisation, adaptation, intelligent feedback and recommendation. Without this context information, which allows for the creation of context aware learning that takes into account characteristics that situate the learner in a given context, every learner has to be treated the same (Drachsler et al 2007).

Dey (2001) provides a definition of context that can be used by developers when creating context aware applications.

"Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves".

Zimmermann (2007) provides a more detailed definition of context, seen in Figure 4, which is presented as five categories that impact on an entity: individuality; time; location; activity and relations.

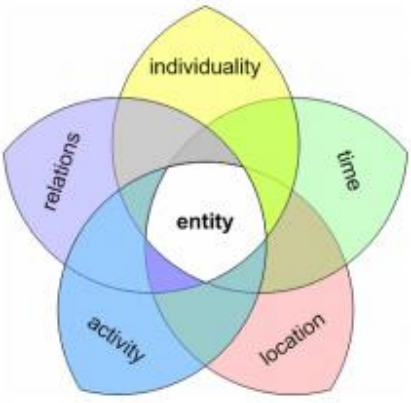

Figure 4: Five Fundamental Categories for Context Information (Zimmermann 2007)

The individuality context contains properties about the entity under consideration. Zimmerman (2007) clusters individuality information under 4 sub contexts: natural, human, artificial and group, where natural considers environmental factors, human is concerned with the characteristics of human beings, artificial encompasses technical and software related factors and group considers the common characteristics shared by members such as social and technological aspects, skills, cultural background and network connections.

The location context considers the spatial characteristics of mobile devices and learners, using the concept of mobility as developed in some definitions of mobile learning. Brown et al (2010) describe contextual learning as the formal or informal setting where a situation occurs which can be influenced by factors such as location, tasks and resources. If mobility is introduced they consider location to be an important contextual factor, which is itself influenced by other factors such as user goals and network access.

The time context considers not just the current time zone but time intervals and workflows. Karlson et al (2010) found that mobile users experienced a variety of frustrations in terms of task completion on mobile devices, for example when dealing with interruptions to network access or when resuming a task following a distraction.

In terms of activity the context considers the activities that the entity is involved in that can be described in terms of tasks, actions and goals. Martin and Etzberger (2013) discuss the importance of authentic learning activities which are specific to the context of the learner.

Examples include gathering data from their surroundings and reinforcement of theoretical learning by applying it in a real-world context. The suggestion is that the portability of mobile devices makes it easier to design authentic activities that can be situated in a particular context.

Finally, the relations context encompasses interpersonal relationships between members of the group, as well as commonalities and differences between group members. The suggestion is that a greater shared relationship between entities leads to a larger shared context and therefore better communication (and fewer opportunities for misunderstanding).

This multi-faceted definition of context underpins several subsequent pieces of research into mobile learning, with different aspects of the definition being emphasised as authors consider the role of context within their framework.

Sampson and Zervas (2013) models mobile learning as being comprised of two dimensions: *learning context,* which is related to learning design and *mobile context*, which is the mobile environment in which learners complete learning activities. Their model uses a number of factors previously identified by Zimmerman (2007), grouped under the two dimensions.

Sampson and Zervas (2013) present a summary of the elements (Table 1) that comprise the learner context.

Dimensions	Elements
Learning context	
Learning design	Learning objectives, pedagogical strategy, learning activities, participating roles, tools, and learning resources
Learner profile	Competence profile (knowledge, skills, attitudes), role, and semipermanent personal characteristics (learning style, learning needs and interests, physical or other disabilities)
Mobile context	
Learner temporal information	Temporal personal information: mood, preferences, needs, and interests
People	Role, relationship, contributions, and constraints
Place	Location, zones, interactive space, cultural background, and learning setting
Artifact	Technological: physical properties and digital properties and non-technological
Time	Task duration, task scheduled, action happens, and availability
Physical conditions	Illumination level, noise level, and weather conditions

Table 1: Elements comprising the learner context, from Sampson and Zervas (2013)

Within the learning context dimension, they define learning design as the process of utilising a pedagogical strategy to address specified learning objectives, using appropriate tools and learning resources.

There is some overlap with Wang's (2004) six dimensions of learning context. Wang defines learning context as "any information that can be used to characterize the situation of learning entities that are considered relevant to the interactions between a learner and an application." These six dimensions are defined as: identity, learner, activity, collaboration, spatio-temporal, and facility.

Parsons et al (2006) uses Wang's six dimensions as the basis of their understanding of the contextual dimensions of mobile learning design and suggest that the organised delivery of content is an essential starting point, using a narrative framework that learners can easily follow.

Yau and Joy (2011) consider learning preferences in their development of a context aware application. These preferences include levels of motivation and tendency to work individually or in groups. Coupled with information such as location data (e.g. gps, wireless lan) and sensor data (e.g. noise levels) they propose that recommendations could then be made as to appropriate learning objects with which to interact.

The learning context dimension considers learner characteristics such as learning styles and competences. Wang and Wu(2011) developed a learner profile based on interactions with their context aware recommender system, recording frequency of interaction as well as selection of learning objects in order to improve the quality of recommendations.

The mobile context dimension considers, amongst other factors, the willingness of the learner to engage with the learning process, as well as time-space factors and the cultural background of the learner. Rachuri et al (2010) presented a framework, EmotionSense, that utilised sensor data from smartphones to capture emotions, proximity and patterns of conversations with the aim of examining the impact of activities and interactions on emotions and behaviour patterns of individuals.

2.3.2 Adaptation

Lee and Park (2003) contend that any form of instruction is adaptive if it involves instructional techniques and approaches that are designed to meet the needs of individual students. Similarly, Gomez et al (2012) states that adaptivity is concerned with the

generation of appropriate learning experiences, taking into account learner characteristics such as learning styles, location and preferred language. Alian (2010) views adaptation as the process of presenting learning materials differently according to the interest of the learner, based on their previous learning behaviour. Khalfallah et al (2014) consider adaptivity to be the process of enabling a mobile system to match its behaviours and capabilities to the educational needs, personal characteristics and circumstances of the learner.

Akbulut and Cardak (2012) view adaptivity and adaptability in terms of a continuum between learner control and program control, where *adaptivity* is seen as a programming intervention that is used by instructional systems to modify lessons according to learner needs and *adaptability* is where learners customise their learning experience by selecting from available options. In their review of studies focused on adaptive systems they found the majority covered learning style based adaptivity but highlighted the lack of empirical evidence that supports the effectiveness of interventions based on the use of learning styles.

There are several different frameworks that can be used to delineate adaptive training and instruction: macro adaptive; aptitude treatment interaction (ATI); micro adaptive and two-step.

In a macro adaptive approach instructors assume that learners move through a course at a speed according to their ability. Students are therefore present with instructional modules that they work through at their own pace; with progress to the next level once they have demonstrated a certain level of proficiency. Alternatively, the system assesses a student's learning, identifies weaknesses and provides learning based on this assessment. There is little variation in the instructional material itself (Landsberg et al 2012).

In the Aptitude Treatment Interaction (ATI) approach training is tailored to a student's aptitudes or individual differences. Pre-task information about learner characteristics can be used to deliver a learning environment that is optimised for individual students. Shute and Towle (2003) identify a number of 'learner traits' that can be used in this approach, such as cognitive abilities, working memory capacity and exploratory/non exploratory learning styles.

The micro-adaptive approach uses real time performance measurement in order to diagnose specific learning needs and provide specific instruction tailored to these needs.

Intelligent Tutoring Systems, driven by artificial intelligence, are an example of micro adaptive systems. Information processing is a central component of this approach (Vandewaetere et al 2011).

The two-step approach combines the micro-adaptive and ATI approaches so that adaptation is based on both pre-task assessment and performance on-task. Tennyson and Park (1980) found that on-task information provides a better basis for adjustment of instruction compared to pre-task information.

Tan et al (2011) proposed a 5R framework that can be used to provide adaptive learning contents based on learner preferences, which is stated as "at the right time, in the right location, through the right device, providing the right contents to the right learner". The location of the learner, the device being used, the time learning takes place and the learner's learning profile, style, and progress are all brought together when considering the right learning content to deliver to the learner.

In terms of this study 'context' can be used to describe the entity under consideration i.e. the learner, using variables such as performance, cognition, prior knowledge and competences. 'Adaptation' can be used to consider what to adapt, including resources, sequencing of tasks and pedagogical approach. Both context and adaptation can be examined using culture as the lens through which these issues are viewed, in order to determine the extent to which effective learning needs to take culture into account when designing and delivering mobile learning activities. Supporting this, Kumar and Sharma (2020), in concluding their literature review of mobile learning applications, suggest that cultural context is an important area of further study. Culture will be considered in more detail in the next chapter.

2.4 Culture

A number of factors that impact upon technology and learning interventions in a global context (in other words, factors that are influenced by differences in culture) have been identified: cognition; attitudes towards technology; communication preferences; attitudes towards group work and epistemology.

Mason (1999, cited in Selinger 2004) suggests that global learning comprises five elements and that very few programmes contain more than three of these: communication between students and the teacher happening in more than two parts of the world; an aim on the part of the teacher or institution to attract international students; content designed specifically for participation by transnational students; the ability to cater to and administer a global student body, through appropriate institutional and technological infrastructure and operations that span more than one curriculum or programme and cater to more than 100 students.

Pincas (2001) notes that learning that is offered to international students is often framed in terms of subject content and the English language rather than considering how a learner's culture, comprising a set of beliefs, behaviours, interaction patterns and goals, needs to inform pedagogy and assessment. Olaniran (2009) observes that differences in oral and verbal traditions may impact on the effectiveness of learning, for example in the case of e-learning and the use of social software, which suits individualistic cultures with written traditions as opposed to collectivistic cultures with more oral traditions. Western educators should not assume that classroom practice can be translated from one cultural context to another without recognition of the influence of culture and 'regional' pedagogies, which may lead to a rejection of these transplanted educational interventions (Kennedy 2013). Pham and Saltmarsh (2013), when discussing the commercialisation of higher education, comment that international students are assumed to be global citizens that can fit easily into Western society but this ignores the fact that student identities are shaped by culture and historical experiences.

2.4.1 Defining culture

The study of culture has its origins in anthropology and archaeology, with an emphasis on traditions, artefacts and language. Cross cultural issues have become increasingly important across other areas of research, fuelled by business expansion and immigration,

with a shift from artefacts and cultural practice towards scholarly examination of cultural values and attitudes. Taras et al (2009).

There is no commonly accepted definition of the word culture, Ajiferuke and Boddewyn (1970, cited in Obeidat et al, 2012) comments that “culture is one of those items that defy a single all-purpose definition and there are almost as many meanings of culture as people using the term”.

The term ‘culture’ may include factors such as nationality, religion, history, political views and socio-economic conditions (Viberg and Gronlund 2013). Evans (2011) defines culture as “learned language, beliefs, values and behaviours infused into every aspect of our lives”, whereas Uzuner (2009) defines culture as “acquired behaviors, perspectives, and values characteristic of a particular group or community”.

Kroeber and Kluckhohn (1952, cited in Vatrapu and Suthers 2007), compiled a list of more than 200 definitions of culture, which they organised into six groups: descriptive, historical, normative, psychological, structural and genetic. Descriptive definitions commonly include habits and behaviour as key components and attempt to enumerate aspects of culture as part of the definition. Historical definitions use social tradition and heritage as the core feature, with the implication that the individual is passively carrying forward traditions as opposed to creating and manipulating them. Normative definitions frequently mention “way of life” alongside ideals and values. Psychological definitions consider culture as a problem solving device and introduce the concept of adaptation and learning. Structural definitions emphasise the patterning or organisation of culture. Genetic definitions see culture as an output of socialisation and interaction, fuelled by the use and application of ideas. These groupings are still evident in more recent definitions of culture.

Based on various definitions Hoecklin (1995, cited in Arenas-Gaitán et al 2011) identifies four main characteristics of culture:

- members of a group interpret each other’s actions through a shared system of meaning.
- culture is considered to be relative rather than absolute and how a culture perceives the world is relative to other cultures perceptions of that world.
- culture is learned not inherited and derived from the social environment of the individual.

- culture is a collective phenomenon rather than an individual one. Within a culture there may be wide differences in individual behaviours and values.

2.4.2 Models for examining culture

Conceptualisations of cultural variation and its dimensions have been proposed by authors such as Hofstede (1980), Hall (1976), Schwartz (1990), House et al (2001) and Trompenaars and Hampden-Turner (1997).

Hofstede (1980, cited in Popov et al 2012) defines culture as "the collective programming of the mind which distinguishes the members of one human group from another. . .the interactive aggregate of common characteristics that influence a human group's response to its environment." This definition emphasises the social nature of culture, which impacts on cognitive processes. The four main assumptions of the Hoftstede paradigm can be summarised as:

- culture is the cause not the effect.
- cultures can be clustered according to geographical boundaries.
- when comparing cultures matched samples should be used to eliminate the problem of individual characteristics.
- Individual behaviours cannot be inferred from group level data.

At an individual level the implication is that a person can have different cultures, if they are members of different social groups. Hofstede refers to this as the 'layers of culture'.

There are four primary dimensions in Hofstede's work that differentiate cultures (Gouveia and Ros, 2000):

- Power distance: the degree to which members of a society expect power to be distributed equally.
- Uncertainty avoidance: the extent to which members of a society accept uncertain or ambiguous situations and create mechanisms for dealing with these situations.
- Individualism: the extent to which individuals operate independently of each other or within groups.
- Masculinity: the importance of qualities such as aggressiveness, assertiveness and personal success compared to nurturing and supportive behaviours.

However, Signorini et al (2009) summarises some of the common criticisms of Hofstede's work:

- a depiction of culture as a static concept, particularly in terms of values which does not take into account changes that have occurred, for example in educational systems, since the research was undertaken.
- a homogenisation of students and educational systems through nationality which can lead to stereotypes e.g. Chinese students and the Confucian tradition.
- given that Hofstede's research was originally an investigation into attitudes towards work related issues, a lack of research into whether Hofstede's work is actually applicable in educational settings.

Hall (1976, cited in Nishimura et al 2008) categorised cultures under categories, namely high context and low context, in order to understand differences in communication styles and cultural issues. According to Hall cultures differ in their use of communication and context to create meaning. In a high context culture the emphasis is on interpersonal relationships and collectivism and meaning has to be interpreted from what is unsaid as opposed to what is explicitly said or transmitted. In a low context culture meaning is explicitly stated through language and communication is direct and precise. Hall also states that high context cultures are stable, cohesive and slow to change and people use their shared history, relationships and cultural artefacts such as religion in order to assign meaning to an event, whereas low context cultures value individualism over collectivism. Japan, England and Greece are listed as high context cultures, whereas Germany, the USA and Switzerland are labelled as low context. Kittler et al (2011) highlight a number of criticisms of Hall's concept, which include the lack of empirical foundation and the appropriateness of an approach based on national cultures given the onset of globalisation. In their review of studies which used Hall's framework, published between 1991 and 2007, they highlighted a number of issues: US and Asian countries dominate with Arab and African countries poorly represented; a tendency to use nationality as a proxy for culture; contradictions between studies where a country is classed as both high and low culture and a methodological bias that tends towards quantitative, with questions raised as to the validity of the methods used to recruit participants for the studies.

Trompenaars and Hampden-Turner (1997) identified seven dimensions where cultures can be distinguished from one another and presented these dimensions as opposing qualities.

The first five dimensions are concerned with relationships with other people: universalism versus particularism; individualism versus communitarianism; specific versus diffuse; neutral versus emotional; achievement versus ascription. One arises from differing conceptions of time: sequential time versus synchronous time. The last concerns the relationship between people and their natural environment: internal direction versus outer direction.

In a *universalist* culture rules are dominant and more important than relationships, whereas in a *particularist* culture rules are applied in context and are governed by relationships. *Individualist* cultures emphasise the importance of personal freedom and achievement as opposed to the group mentality found in *communitarianism*. *Specific* and *diffuse* cultures differ in their attitudes towards the overlap of work and personal spaces, *specific* cultures do not see a requirement for relationships to be maintained outside of a work context in order for work objectives to be achieved. Neutral *cultures*, unlike *emotional* cultures, make an effort to suppress their emotions and are governed by reason. *Achievement* cultures value performance whereas *ascription* cultures place a greater emphasis on power and position. *Sequential* cultures value planning and punctuality whereas *synchronous* cultures view plans and commitments as flexible. Finally, *internal direction* cultures have an internal locus of control where they believe they can control how they work with teams and organisations to achieve objectives while *outer direction* cultures believe that their environment controls them.

Schwartz (1994) conducted a series of studies on the content and structure of human values, where content relates to the criteria used to evaluate and respond to events and structure is the organisation of values based on differences and similarities.

He identified three universal dimensions or challenges, and bi-polar orientations within them that all cultures share, in order to develop a framework for cultural comparisons.

The first dimension is the nature of the relationship between the individual and the group. In an *embedded* culture orientation people are viewed as entities embedded in the collective and emphasis is placed on social order, respect for tradition and maintenance of the status quo. In an *autonomous* culture people are encouraged to express their individuality and pursue their own ideals.

The second challenge is the relationship of people to the natural world. The *mastery* orientation encourages people to change the natural and social environment in order to

achieve group or personal goals. The opposing orientation, *harmony*, focuses on acceptance of the world as it is and fitting in.

The third dimension concerns the preservation of society through socially responsible behaviour. The *egalitarian* orientation emphasises equality, co-ordination with others and acting to benefit the group, whereas the *hierarchical* culture creates an unequal distribution of power and rules and obligations that must be followed.

Schwartz (1994) acknowledges the individual-collectivist dimension present in a number of studies of culture but argues that it does not address some of the values associated with it that could be viewed as both individual and collectivist and those values, such as hedonism and self-direction, can benefit an individual without necessarily impacting negatively on the group.

The Globe (Global Leadership and Organizational Behaviour Effectiveness) study, conducted in the 1990's, was designed to expand upon Hofstede's research on cultural dimensions. Nine dimensions of culture were identified, four of which overlap with those of Hofstede : *uncertainty avoidance*, *power distance*, *institutional collectivism vs. individualism* and *in-group collectivism*. The remaining dimensions are given below (Connerley and Pedersen, 2005):

- *assertiveness*, the extent to which individuals are either confrontational or more passive and reserved. Germany is given as an example of an assertive country and Sweden and example of a country that aims for harmony.
- *future orientation*, the extent to which planning ahead is preferred as opposed to being short term and immediate in making decisions. Switzerland is an example of a future-oriented country. Russia is said to favour instant gratification and results over long term decision making.
- *performance orientation*, the extent to which group members are rewarded for excellence. Singapore and the United States score higher on this dimension than Russia and Italy. Training and development and direct communication styles are preferred by high performance-oriented countries. Feedback is viewed as uncomfortable by low performance-oriented individuals.
- *humane orientation*, where rewards are for caring and generous behaviours. This orientation reflects the extent to which individuals express sympathy for weaker members of the society or value self-improvement, material possessions and

power. Ireland and Egypt score highly and France is one of the lowest scored on this dimension.

- *gender differentiation*, which examines gender role differences. In higher scoring countries such as South Korea and China men occupy more positions of authority than women and have a higher social status compared to low scoring countries such as Denmark and Poland where men and women tend to have the same levels of education and women occupy a higher percentage of positions of authority.

Lewis (1999) classes cultures as linear-active, multi-active or reactive. Japan is given as an example of a reactive culture, along with China, Korea and Turkey. Reactive cultures are described as introverted, listening and reflective, preferring subtle and non-verbal communication and avoiding confrontation. Linear-active cultures, such as the Swiss and Germans, focus on one task at a time, rarely interrupt, dislike losing face and confront with logic. Multi-active cultures are impatient, multi-tasking and people-oriented and prefer to get their information first hand. India, France and Spain are given as examples of multi-active cultures.

In reviewing the literature on frameworks for examining culture it is clear that debate exists as to the efficacy of these frameworks in identifying where differences occur across cultural contexts. However, Hall's and Hofstede's work is still widely used and cited by researchers when examining cross-cultural differences.

2.4.3 Culture, cognition and learning

Theories of cognition have long been underpinned by assumptions of universality, where processes such as reasoning, inference and learning were presumed to be the same among all human groups. Nisbett and Miyamoto (2005) challenged these assumptions and contend that culture impacts on perceptual categorization, information processing and storage and perceptual attention. Many researchers have compared students from differing cultural contexts in order to identify differences in approaches to cognition and learning and associated influencing factors. Some representative studies will be discussed in this section.

Research into cognitive processing from a cross cultural perspective views it as either culturally relative (specific to a certain culture or set of cultures) or culturally universal (common to humankind). Where a process or capacity is assumed to be universal and therefore exists in all cultures research is likely to focus on how culture influences it. If the

cultural relativism stance is taken, it is not assumed that processes or strategies exist across all cultures and theories of cognition are therefore different to encompass these differing cultures (Galotti 2014).

Freedman and Liu (1996) studied American middle school students who corresponded electronically across three school sites with other students. They found that students from different ethnic backgrounds used different learning processes when working with computers. Asian American students tended to ask fewer questions and were less likely to use experimental methods or trial and error methods than non-Asian American students.

Kanu (2005) regards a student's cognitive style to be a result of their cultural behaviours i.e. the values and preferences that develop during the childhood cultural socialisation process. This socialisation influences how learners negotiate aspects of learning such as curriculum, communications and instructional approaches.

Researchers have proposed that approaches to reasoning and problem solving vary across cultures. Bentley et al (2005) compares Anglo-American and Japanese models of thinking, where the former use the linear model of thinking, also known as the 'bridge' model whereas the latter use the 'stepping stone' model that is characteristic of circular thinking.

Sanchez and Gunawardena (1998) identify several theories related to cognitive processing:

- *field-dependence* versus *field-independence*. Field-independent learners are internally motivated, preferring to learn on their own. Field-dependent learners are global learners who prefer instructor guidance and involvement and group work.
- *Global* versus *analytical*. Global learners are intuitive thinkers, consider feelings in making decisions and are impulsive, analytical thinkers prefer step-by-step, sequential, organized schemes and are good at logical thinking.

Neuroimaging studies have found differences between individuals from different cultural contexts, particularly when comparing Western and Eastern cultures. Paige et al (2017), in finding differences between American and East Asian students in terms of processing and encoding information and storing it in memory, suggest that previous studies focused on Westerners and failed to consider neural differences that could occur cross-culturally.

Huang et al (2019) attempted to quantify differences in cognitive processing by using MRI scanning to examine structural differences in the brain between Eastern and Western cultures. They found that there were key differences between Western university students

(from the United States, Canada, Germany and France) and Eastern students from Taiwan, where differences in areas of brain activation showed that the Western students scored higher on field independence and the Taiwanese students scored higher on field interdependence. They suggest that behaviour, neural function and brain structure are influenced by the cultural context in which they occur.

Using the metrics of cognitive persistence i.e. the ability to overcome task difficulty in order to achieve a goal Telzer, Qu and Lin (2017) found differences in neural structure and function between American and Chinese students, where Chinese students were more likely to persevere with tasks and suggest that this is due to a cultural emphasis of the importance of self-improvement.

In terms of learning and how students engage with learning a number of models and tools have been developed which attempt to classify learners into groups that can then be targeted using a variety of learning strategies and interventions. Two key concepts have emerged from work in this area: learning styles and learning approaches. Where sometimes these terms are used interchangeably it is stressed that there are substantial differences between the two, where 'learning styles' are an individual's preferences for acquiring and assimilating knowledge whereas 'learning approaches' are concerned with the methods employed when undertaking a learning task (Dennehy, 2015, Bati, Yilmaz and Yagdi 2017)

Kirschner (2017) is typical of a number of academics that suggest learning style theories are a myth with no scientific validity and are therefore unhelpful in determining how to develop instructional methods that match supposed preferences for visual, auditory and verbal content, proposing instead that cognitive abilities are a better indicator of how people learn. Feeley and Biggerstaff (2015) compared two of the most common models for learning styles and learning approaches, VARK (Visual/Auditory/Read-Write/Kinaesthetic) and Tripartite (Deep/Strategic/Surface) across 57 studies. They found no consensus as to the reliability or validity of learning styles questionnaires but clear evidence that approaches to learning *do* have an impact on academic success and where Santosa (2017) proposes that surface and deep approaches are related to the cultural context in which learning occurs, this ties in with the literature outlined in this section that links culture, cognition and learning related behaviours.

2.4.4 Culture and communication

There are two approaches to studying communication differences: the *emic* approach, where communication is studied from inside the culture i.e. as the members of the culture understand it or *etic,* understanding communication from the outside by comparing across cultures using predefined characteristics Gudykunst (1997).

Cultural differences are evident in the styles of communication preferred by learners. Hall (1976, cited in Nishimura et al 2008) suggests communication in high context cultures relies on indirect clues whereas in low context cultures communication is explicitly embedded in the message.

Anakwe et al (1999), using the individualist-collectivist paradigm, finds that there are cultural differences in communication preferences in distance learning programs, where collectivists tend to be distance learning averse if no opportunities exists for relationship building. This is explained by using Hall's framework, where low context individualists, for whom the medium of communication is unimportant, will be less adversely affected than high context collectivist where face to face interactions are an important part of their sense making. These findings are also echoed by Koskimaa et al (2007), who found that the use of instant messaging tools was more favourably viewed by individualists (who preferred it for quick enquires and problem solving) than by collectivists.

Gunawardena et al (2001) highlight three attributes of computer mediated communication where problems may occur due to cultural differences:

- *time independent communication*, asynchronous group interaction may cause anxieties for group members who expect immediate feedback or response.
- *text based communication*, the lack of nonverbal cues, coupled with language issues if it is not the native language of the user, may deter some participants.
- *computer mediated interaction*, which may deter those who do not wish to interact or who have poor computer skills.

Golonka et al (2014) in their investigation of the technologies used by foreign language learning students, suggest that use of text-based communication tools can lead to positive outcomes. Whilst recognising that synchronous communication can impact on the negotiation of meaning they suggest that there are benefits in terms of affording greater time for processing of language input and learner self-correction.

In a study of communications between three groups of students in Malaysia, China and the USA, Sandel, Buttny and Varghese (2019), found differences in terms of self-disclosure, formality and use of emoji's to convey emotion and create affinity, where Malaysian and Chinese students tended to try and form personal connections compared to the US students who were more task oriented and averse to disclosure of personal information. They found that students reported their interactions as either positive or negative, with communications between Malaysian and Chinese partners being rated more positively than those between US and Asian partners. The authors suggest that cultural misunderstandings and conflicts between cultural norms were the reasons for these differences in ratings.

Ghanem et al (2013), recognising that cultures are dynamic rather than static, challenges some of the assumptions made about the Arab culture and their propensity to adopt a collectivistic stance in technology mediated communications. In a study of responses in an online news magazine they found a significantly high number of users adopting an individualistic rather than collectivist perspective, or low context rather than high contest as described by Hall's theories.

Barak and Suler (2008) suggest that technologies such as the Internet, which offer affordances such as text based communication, anonymity and lack of eye contact require new conceptualisations to reflect changing behaviours in cyberspace.

2.4.5 Technology acceptance and the influence of culture

A number of models that examine acceptance of technology by users are identified in the literature, including the Theory of Reasoned Action (Fishbein and Azjen, 1975), the Technology Acceptance Model (Davis et al, 1989), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al 2003). The influence of culture on these models is also discussed in the literature, such that differences are seen across cultural contexts in terms of attitudes towards technology and how it is used.

The Theory of Reasoned Action (TRA) can be used to interpret the intention to adopt a technology. Its major constructs are *behavioural intention*, the decision to engage or not engage in information systems; *attitude*, a person's attitude towards information systems and *subjective norm*, the social pressure exerted on an individual to use or not use an information system (Oni et al 2017). In discussing how culture impacts on the model Arpaci and Baloglu (2016) suggest that cultural effects, such as collectivism, have a significant

impact on attitudes and subjective norms, for example when sharing knowledge in online collaborative communities.

The Technology Acceptance Model (Davis et al, 1989) originates from the TRA and is frequently used to examine user acceptance of technology where a number of factors influence their decision about how and when they use the technology with *perceived ease of use* (PEOU)and *perceived usefulness* (PU) being the factors that affect acceptance. Since its conception extensions to the model have attempted to enhance its validity and provide greater depth in terms of identifying influencing factors, such that more recent versions of the model include four major categories of modifications (Figure 5)

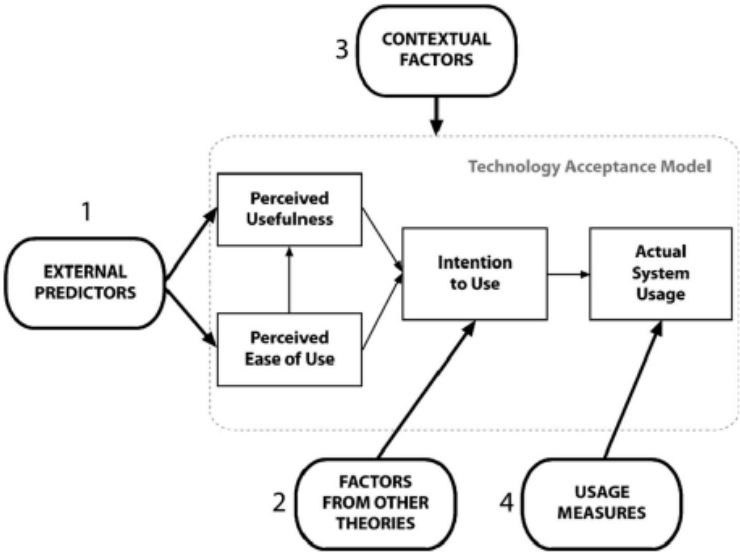

Figure 5: extensions to the Technology Acceptance model, from Marangunic´ and Granic´ (2015)

Contextual factors include the effects of cultural diversity, which suggests that the TAM could be a universal predictor of the extent to which technology is adopted. However, a number of studies have advised caution when using TAM across different cultures. Tarhini et al (2015) highlight that the TAM has been used more widely in western contexts that non-western/developing countries, that the TAM has been accused of bias in cross-cultural studies and that much of the research into TAM has been conducted in non-educational settings. Straub et al (1997) in a cross cultural study applying the TAM to the acceptance of use of email amongst airline staff in Japan, Switzerland and the United States found that the model was a useful predictor for technology acceptance in Switzerland and the United States but not Japan. McCoy et al (2006), in a study of nearly 4000 students from 25

countries, also found that the model did not hold for certain countries, such as Sweden and Singapore.

A large number of studies use Hofstede's cultural dimensions as the basis of their research, suggesting that dimensions such as power distance (deference to authority figures) and uncertainty avoidance (risk avoidance and openness to change), may impact on how users adopt technology. In a systematic review of information systems technology and cultural conflict Leidner and Kayworth (2008) identified several studies that investigated whether culture influences the adoption and diffusion of technology. Most of the studies they surveyed also used Hofstede's cultural dimensions as the framework for the investigation, in particular Uncertainty Avoidance. There are, however, inconsistencies between the various studies in terms of whether high or low values of the dimensions are useful indicators of the intention to adopt technology. McCoy's study proposed that low scores on Hofstede's uncertainty avoidance dimension, for example Sweden's low score of 29, led to a breakdown of the TAM across the all the relationships of the model and was therefore unhelpful in predicting technology adoption. Conversely, Khanh and Gim (2014), in a study of attitudes of Vietnamese students towards mobile devices for accessing course material, sharing knowledge and conducting assignments suggested that the TAM was a *good* predictor of adoption of mobile devices amongst students. Vietnam has a score of 30 on Hofstede's dimension of uncertainty avoidance. More recently, Huang et al (2019), in a comparative study between Spanish and Chinese teachers and their intention to use technology, found differences in their cultural norms and intentions and attributed this to their cultural context. Their test instruments were also based on Hofstede's dimensions.

As discussed elsewhere in this literature review Hofstede's model, whilst highly influential in cross cultural studies, has been subjected to criticism in terms of its validity and is applicability in education. The TAM and it's factors of ease of use and perceived usefulness, as well as the context factors extension to the model, may be helpful in identifying where cultural context can play a part in terms of influencing use of mobile phones but this needs to be considered in relation to the extent to which Hofstede's cultural dimensions are a useful indicator of technology acceptance and the lack of agreement as to whether the model can be applied across all contexts.

The unified theory of acceptance and use of technology (UTAUT) model is an attempt to consolidate previous models on user acceptance. Four core determinants of ICT acceptance are identified which impact on behavioural intention (BI) and user behaviour (UB):

performance expectancy (PE), developed from perceived usefulness in the TAM, as well as factors from other models; effort expectancy (EE), which has the TAM's perceived ease of use as one of its roots; social influence (SI), which is based partly on the TRA model's subjective norms and facilitating conditions (FC) (Venkatesh et al, 2003). To test the validity of the model in cross cultural contexts Oshlyansky et al (2007), conducted a study in nine countries amongst undergraduate and postgraduate students with regards to their use of website and found that the model can be used cross-culturally. In their study they found that performance expectancy (PE)and effort expectancy (EE) were the biggest indicators of acceptance.

Finally, Grandon et al (2005) developed a research model to test cross cultural factors that influence student intentions to participate in online courses, comparing students from the US and South Korea. They found American students were more influenced by factors such as convenience and ease of use, partly explained by the fact that American students were more likely to study part time and the majority of Korean students in the study were full time 'traditional' students.

2.4.6 Culture and epistemology

Epistemology is the study of knowledge. Breidlid (2009) cautions against "the lack of respect for local or indigenous knowledge and the assumption by many Western scientists about the superiority of Western epistemology and scientific discourse".

Schommer (1990, cited in Tutty and White, 2005) describes epistemology as being comprised of five elements: how knowledge is organised i.e. either in a simple or compartmentalised manner or in a complex and integrated way; the certainty of knowledge, so that it is either absolute or in flux; the source of knowledge, either passed down by a 'guru' or capable of being derived; control of knowledge acquisition i.e. the extent to which it is believed that the capacity to learn or it is fixed at birth or can be subsequently developed and finally the speed of knowledge acquisition, so that it is either learned quickly or over some time.

So et al (2012), in their investigation of collaborative learning using mobile devices in a Singaporean context, found that the creation of a knowledge building culture requires an epistemological shift away from viewing a class as a collection of individual students towards one in which they are viewed as a collaborative community.

Zhang (2007) describes the educational context of Chinese classrooms as group based, centrally organised and teacher dominated, based on the epistemological belief that great minds create knowledge which is communicated to students by scholar and learners should respect teachers, be modest and reflect on their learning and actions regularly.

Petocz and Reid (2008) suggest a student's previous educational experiences and their epistemological beliefs will influence whether knowledge is learned through repetition or constructed through socially mediated discussion.From an educator perspective, Bulterman-Bos (2020) comments on the use of Lesson Study, a Japanese model of teacher led research where teachers work together to target areas for development for their students, suggesting that the use of this approach outside of the Japanese context is not as successful because of differences between the epistemological culture of Japan and that of other educational contexts.

In conclusion, a number of aspects of culture were examined in this section, encompassing aspects such as epistemologies, cognition, communication, attitudes towards technology and learning preferences. The extent to which students in different cultures view and use mobile devices differently based on their cultural context is a key aspect of this study. However, there is a question as to how to frame this examination of the impact of cultural context. One approach would be to use the dimensions of a framework such as Hofstede or Hall, thus examining culture as mediated through their labels of culture. Alternatively, using a model such as TAM or UTAUT, attitudes towards technology across different cultural contexts could be measured. An alternative approach would be to not use a framework or model but instead seek to uncover whether aspects of culture emerge from the data. This will be discussed in more detail in the methodology section.

2.5 Student perceptions of mobile learning

Crompton and Burke (2018) in a systematic review of mobile learning research, found that studies into perceptions of mobile learning could be grouped into various categories: studies into general perceptions of mobile learning, studies that looked at specific types of perceptions, such as comparing mobile devices to laptops and studies that examined students' perceptions of mobile technologies.

A number of studies examine perceptions of mobile learning within a particular country context and identify similar characteristics that act as drivers for the use of mobile devices.

Al-Hunaiyyan, Alhajri and Al-Sharhan (2018), in a study of Kuwaiti students, found positive perceptions of mobile learning related to mobility and increased opportunities for accessing information and working collaboratively.

Lin et al (2019) in a study of Chinese students found that conceptions and perceptions of mobile learning could be arranged hierarchically, with a focus on reproducing and capturing information at the lower level to facilitating communication and collaboration at the highest level. Jan et al (2016) in a study conducted with 1500 students in Pakistan, found that flexibility of learning at a time and place to suit the learner and a reduction in formality resulting from moving outside of the classroom setting were key attributes of mobile learning that fostered independence and confidence.

Bastos et al (2019), in a study of Portuguese university students, found differences in perceptions when comparing mobile devices to laptops and desktops. Mobile devices were seen as having potential for use in learning contexts but students preferred stable spaces such as home and work and fixed devices such as desktops and laptops.

Ariel and Elishar-Malka (2019), in a study investigating perceptions of legitimacy of smartphone usage in a classroom, found that students acknowledged the benefits of using mobile devices in terms of enhanced access to learning materials and opportunities for more diverse pedagogical activities but highlight impacts on levels of classroom discussion and internalisation of material, as well as the potential for distraction.

In a comparative study between Brazilian and Emirati students Santos and Bochecho (2020) found that both groups favoured policies for the use of mobile devices in the classroom but Emirati students were less inclined to see the use of devices as a distraction. Their suggestion is that could be related to characteristics such as student age, culture and context.

2.6 Learning theories relevant to mobile learning

Much of the literature on mobile learning in educational settings is focussed on technological issues. Rajasingham (2011), in reviewing empirical literature on the status of mobile learning, highlights the need for the development or adaptation of learning theories for mobile learning and critical frameworks to evaluate the use of mobile technologies.

Keskin and Metcalf (2011) identify a number of theories relevant to mobile learning, including: Behaviourism, Constructivism, Situated Learning, Problem Based Learning, Context Awareness Learning, Socio Cultural Theory, Cognitivism, Activity Theory and Connectivism. These will be discussed in this section.

2.6.1 Behaviourist learning

Behaviourist learning occurs when learners adopt new behaviours or demonstrate a change in behaviour as the result of an individual's response to stimuli (Anderson and Dron 2012). With the emphasis on stimulus-response, mobile devices in this type of learning are used for quick feedback or reinforcement (Traxler 2009). Patten et al (2006) suggest that mobile learning initiatives where the emphasis is on administrative functions such as timetabling, reference functions such as retrieval of information and interactive functions such as supplying answers to quiz questions are largely behaviourist in nature. Pegrum (2019) suggest that the majority of mobile learning apps are not only traditional in nature, with a focus on transmission of knowledge and behaviouristic approaches but also limited in terms of customisation, operating as walled gardens with no interaction with other apps or platforms.

2.6.2 Constructivism and Social Constructivism

Constructivism is highly individualised active learning where the learner is responsible for constructing meaning and knowledge based on prior experience (Peng et al 2009).

Nanjappa and Grant (2003) make the link between constructivism and technology in 3 distinct areas:

- technology as cognitive tools. The focus is on the learner using technology to support cognitive processes, rather than viewing technology as the teaching tool
- a constructive view of the thinking process, rather than a passive transmission of knowledge from teacher to learner critical thinking is encouraged so that the knowledge constructed by the learners reflects their comprehension and conception of the information
- the role of the teacher in technology enhanced environments. The teacher acts as a facilitator, helping students to construct their knowledge.

Social constructivism views learning as a social process rather than as an individual activity, relying on communication and discourse between peers and tutors (Barak 2016).

Low and O'Connell (2006) consider that mobile technologies offer opportunities for communication and collaboration i.e. messages can be shared via e-mail and SMS, learners can connect to the Internet for synchronous and asynchronous conversations and media storage cards containing video and other resources can be shared between devices. They suggest that social constructivism, building on the work of Vygotsky, can be used to frame mobile learning interventions by considering the social context of learners and their connections to knowledge and learning. They propose a model called the 4 R's of net-generation learning:

- Record: the learner gathers and build new knowledge, for example using a portable device to generate or capture information, either prompted by the device itself or by a teacher.
- Reinterpret: the learner uses a portable device to 'remix' existing knowledge into new information and the device supplements the learners own abilities.
- Recall: the learner uses a device to recall existing information.
- Relate: the learner uses a device to communicate with other learners, either synchronously or asynchronously, and share resources.

Al-Qaysi, Mohamad-Nordin and Al-Emran (2020) use the example of the social media tool WhatsApp as social constructivism in action, explaining that it allows not just access to information but an opportunity to work with peers and tutors to analyse and evaluate information, create meaning and redefine goals. They reference Koole's (2006) FRAME model for mobile learning, explaining how the use of WhatsApp on mobile devices aligns with aspects of the model in terms of device aspects, learner aspects and teacher aspects.

2.6.3 Situated learning

A means of achieving authenticity, situated learning is concerned with providing an authentic context in which learning can occur, as opposed to activities unrelated to the tasks that practitioners undertake in their normal work context (Herrington and Oliver 1995). Holzinger et al (2005) see situated learning as a combination of constructivist and cognitivist approaches, where the mental representation of a concept occurs not in isolation or an abstract sense but in connection with the social and material context of a

specific learning situation. Mobile devices are seen as an optimal method by which students can engage with learning in a real world context, for example on field trips such as a biodiversity exercise where students identified species of fish (Pfeiffer et al 2008). Ahmed et al (2013) suggests that mobile technologies can not only be a powerful linking tool between formal and informal contexts, helping to build a community of learners, but also encourage learners to personalise their learning experience which enables them to play an active role in the knowledge building process.

Li et al (2019) present an example of situated learning in their study of nursing students use of mobile devices on wards, where participants used apps to conduct clinical assessments and look up clinical skills and procedures. They found that the use of mobile devices led to efficiencies in terms of tracking of student progress, improved communication between students and mentors and enabling assessment to be captured in the real environment immediately after the student demonstrated their skills.

2.6.4 Problem Based Learning

Problem based learning is learning that results from the understanding or resolution of a problem, fostering discussion and discovery through collaboration (Dai et al 2012). In their study of mobile technology for use in medical education Luanrattana et al (2012) identified a number of themes that influence use of pda's for problem based learning: functionalities, such as the ability to look up information, communicate with others and act as address books; technical aspects such as data transmission, privacy and interoperability and practical aspects, such as social acceptance and ease of use. These aspects of mobile devices are seen as key enablers of a PBL based curriculum, facilitating communication among peers and learning in context.

In the use of a problem based learning app designed for students studying engineering and materials synthesis, it was found that the app could overcome limitations in terms of access to materials and equipment and engage students in interactive exercises and communication leading to improved scores compared to a control group that did not use the app (Jou, Lin and Tsai, 2016)

2.6.5 Activity theory

In activity theory (AT) an activity consists of a subject and an object, mediated by a tool. A subject can be an individual or a group engaged in an activity. A subject undertakes an

activity in order to achieve an object (or objective) and mobile learning can be classed as a mediating tool. Uden (2007) provides an example of a student (subject) who learns about a particular problem (object) by using a mobile device, textbooks, and internet (tools) to complete their assignment (outcome). The student may be assigned to work in a group (rule) in which the success of their assignment can be influenced by their team/classmates (community) and the relationship between teacher and students in the classroom environment (division of labour).

Cowan and Butler (2013) used activity theory to consider the role of the teacher in mobile learning. They present an extended model of activity theory (Figure 6) based on the original model:

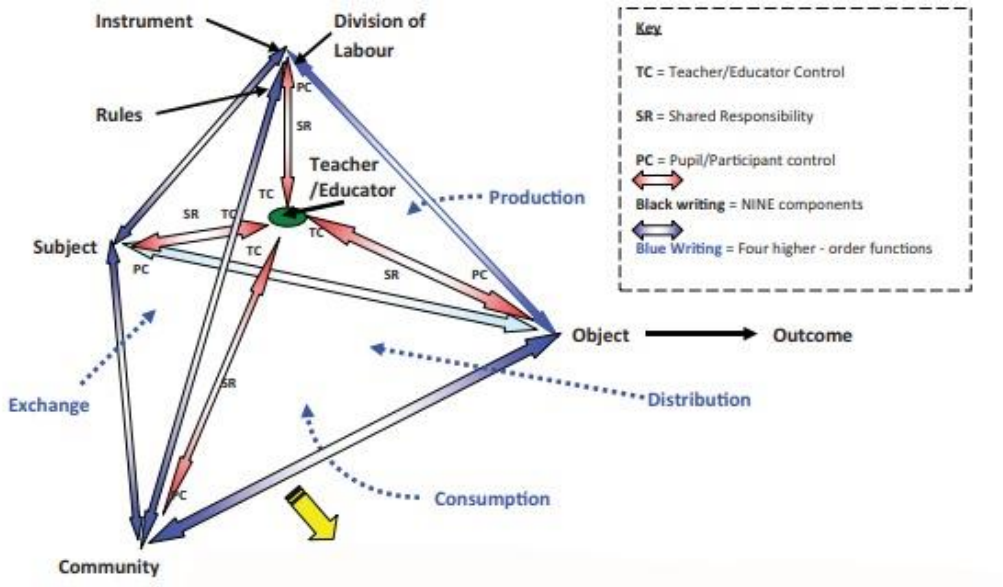

Figure **6**: 3D model of the Activity System associated with mobile learning with the teacher/educator at the heart of the system, Cowan and Butler (2013)

Rules control how the system operates and can be defined by teachers or the school community. For peer interactions additional rules can be defined by learners. The community is distinct from the subject and can be the wider class or institution. The division of labour refers to the division of tasks between the members of the community and to the division of power and status.

Sharples, Taylor and Vavoula (2005) analyse learning as a socio-cultural activity system where learners transform their knowledge using tools that both support and constrain them and follow rules that are generated from their cultural context. They consider these cultural factors under 3 distinct headings: control, context (discussed previously) and communication.

The control of learning may rest with the teacher, be distributed among the learners or passed between the learners and technology. Benefits arise from effective learning delivery methods, access to learning materials at a time and place that suits the learner and the extent to which learners can control the pace of learning. Since learning is viewed as a social construct that involves people and technology social rules and conventions govern acceptable behaviour and attitudes towards technology may be influenced by peers.

Communication, and the extent to which technologies allow various forms of communication, allows learners to create new rules and learning communities as they become familiar with the technology, for example inventing 'smileys' in text messaging. The suggestion is that learners adapt their communication and learning activities according to the capabilities of the technology. Ismail et al (2010) considered the extent to which students accept and use new technologies, in particular short messaging service (SMS). Using the Technology Acceptance model as a framing mechanism, they considered the factors that influence acceptance, namely ease of use, perceived usefulness and usability. It was found that learners were open to the use of new technologies but that the introduction of a new technology needs to consider cultural norms and expectations, for example the perception of the value of short texts compared to the amount of material available in a book.

More recently, in reviewing 28 studies into mobile assisted language learning Lin et al (2019) examined whether the constituents of AT (object, subject, rules etc) could be mapped to these studies and found there was a positive correlation with aspects of the model, where communities of practice and associated norms govern how the system is designed and mobile devices mediate the learning process for learners as subjects, following the rules of instruction to reach goals and outcomes.

2.6.6 Sociocultural learning

In the sociocultural theory of learning communication between learners is considered to be as important as the content. Pachler (2010a) recognises the contribution made by activity

theory in the attempts to understand mobile learning but suggests an alternative approach, one which focuses (using the nomenclature of AT) on the subject rather than the object or outcome.

2.6.7 Cognitivism

Cognitivism is concerned with the mental constructs learners bring to an educational situation, the assumption is that the learning process is about relating new information to previously learned information and that learners are actively involved in the process. (Kadirire 2009). The acquisition of knowledge is a mental activity that requires internal coding and structuring by the learner and the emphasis is on changing the learner by encouraging them to use appropriate learning strategies (Ertmer and Newby 2013).

2.6.8 Connectivism

Connectivism, a relatively new theory, has attempted to develop a model through which learning and teaching using digital technologies can be examined. Siemens (2004, cited in Garcia et al 2013) considers that some of the key principles of connectivism are that learning occurs through a process of connecting information sources, or 'nodes', that learning can be located in non-human 'appliances' and continual learning occurs as a result of maintaining and nurturing connections.

Knowledge is considered to flow through a network comprised of nodes. These nodes can be an individual, a resource, a group or a community. Learners use technology to create networks which are populated with nodes created by the learner and are thus highly individualised.

Boitshwarelo (2011) also characterises the key pedagogical features of connectivism as learners connecting to a learning community and benefits resulting from a two way relationship where they contribute information as well as taking information away. Again, the notion of nodes is discussed, where the community is viewed as a node in a wider network of nodes. Knowledge is described as distributed across a network of individuals and information is continually evolving, such that learners must continually assess existing knowledge in light of newly acquired information.

Garcia et al (2013) use the example of collective blogs as a way of demonstrating a connectivist approach to learning. They found that while students did appear to engage

with blogs and formed the connections that would be expected this was not maintained when the intervention was over. Staff also commented on the lack of critical review that would normally be offered by a tutor, as well as their tendency to maintain an authoritative role rather than one of a peer.

Ghasia et al (2018) identify barriers to fully implementing connectivist mobile learning and in their study of universities in Tanzania suggest that infrastructure issues, lack of expertise, financial challenges, policy issues and individual acceptance can all act as confounding factors to the development of nodes.

2.6.9 Transactional Distance Theory

Transactional distance theory is an educational theory that defines the critical concepts of distance learning. It presents a definition of distance education which implies the separation of teachers and learners (Moore, 2007, cited in Park 2011).

Transactional distance theory consists of three elements: 1) dialogue i.e. two way communication and interaction, 2) course structure and organisation, and 3) learner autonomy i.e. how the learner perceives independent and interdependent participation and the extent to which the student undertakes self-directed learning. Any of these elements can affect the perceived sense of distance a student feels (Isaacson 2013).

Elyakim et al (2019) suggest that transactional distance in location based mobile learning may be different from transactional distance in distance learning, where in location based mobile learning the location becomes an important aspect of the learning experience compared to distance learning where location is immaterial.

2.7 Frameworks for mobile learning

A number of frameworks for the analysis, design and evaluation of mobile learning have been proposed in the literature. These frameworks highlight aspects such as socialisation, mobility, technological affordances and formal and non-formal contexts. Hsu and Ching (2015), in a review of peer reviewed research articles published between 2006 and 2013, found that frameworks could be grouped according the following foci: pedagogies and learning environment design; platform and system design; technology acceptance; evaluation and psychological constructs. They suggest that frameworks that they discuss under these categories are not mutually exclusive and that aspects of these frameworks

are evident in other categories. Some examples of frameworks that fall into the groupings suggested by Hsu and Ching (2015) are presented in the following sections.

2.7.1 Frameworks for pedagogies and learning environment design

Koole (2006) developed the Framework for the Rational Analysis of Mobile Education (FRAME) model to describe learning as a process resulting from the convergence of three key aspects: mobile technologies; human learning capacities and social interaction. In this model (Figure 7) learners are viewed as consumers and creators of information, mediated through technology.

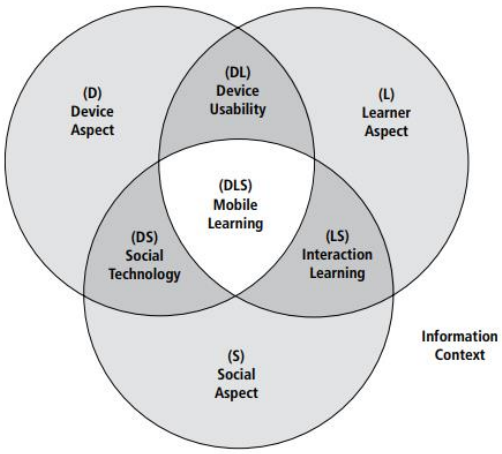

Figure 7: The Frame Model, from Koole (2006)

Device Aspects refers to the physical and technical characteristics of the device. Learner Aspects are concerned with areas such as cognitive capabilities and motivation. The Social Aspect is concerned with communication and rules governing interaction, which may be culturally situated. At the intersections of these areas, Device Usability is concerned with aspects such as portability and information availability, Social Technology describes how mobile devices facilitate communication and collaboration and Interaction Learning is concerned with how different types of interaction, which may be culturally situated, can simulate learning.

Park (2011) uses transactional distance and its relationship with social learning for their framework, which classifies mobile learning activity as being one of four types, as show in Figure 8:

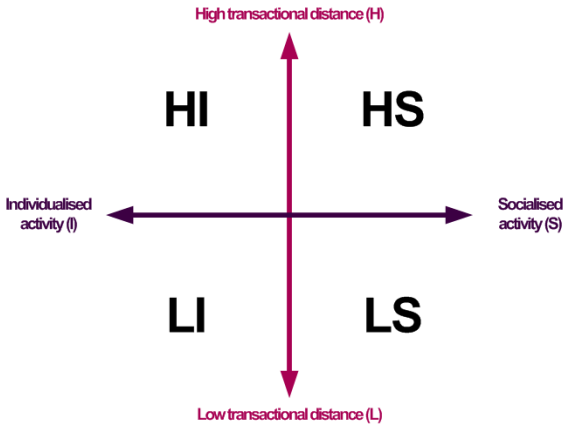

Figure 8: Four types of mobile learning: a pedagogical framework, from Park (2011)

- Type 1: High Transactional Distance and Socialized Mobile Learning Activity (HS) Social Learning activities with high transactional distance: It involves activities in which there is a high psychological distance between the students and the teacher or institution, and which have a highly structured content. Interactions happen mainly between the students, and the teacher has a facilitating role.
- Type 2: High Transactional Distance and Individualized Mobile Learning Activity (HI) Individual learning activities and high transactional distance: These are also activities in which there is a high psychological distance between the students and the teacher or institution, and a very structured content. However, in this case, the main interaction takes place between the learner and the content, which is highly structured and organised.
- Type 3: Low Transactional Distance and Socialized Mobile Learning Activity (LS) Social learning activities and low transactional distance: It involves loosely structured content and lower psychological distance between the student and the teacher or institution. The learners work in groups to solve a problem, and interaction processes are established in a natural way.
- Type 4: Low Transactional Distance and Individualized Mobile Learning Activity (LI) Individual learning activities and low transactional distance: These are loosely structured activities with a lower psychological distance between teacher and learner. In these activities, the learners frequently interact with the teacher that monitors their learning process, trying to adjust the contents to their individual needs but also striving to maintain the role of the student as an independent learner.

The suggestion is that interactions occur with different actors, either student to student, student to teacher or student to content and that these interactions are either tightly controlled or occur more naturally.

Laurillard (2002) developed the Conversational Framework, based on analysis of student learning, suggesting that the framework can be used for all forms of learning from traditional to digital because it is derived from research into what it takes to learn. The framework is presented as a process of dialogue between the teacher and the student, proposing that learning should be built around a series of activities that encompass a variety of modes of active learning: attending, questioning, adapting, experimenting, analysing, sharing, commenting, reflecting and articulating.

These learning activities are grouped according to their logistical and pedagogic characteristics, such that five media forms are identified that encompass the range of active learning modes outlined above: narrative media, which shows the learner something e.g. text; interactive media, which responds to user input in a limited way e.g. multiple choice tests; communicative media, which facilitates exchanges between people e.g. forums, emails; adaptive media e.g. virtual worlds and productive media, which allows the learner to produce an artefact e.g. word processing software (Conole et al, 2005)

Laurillard (2007) suggests that educators can use the framework to evaluate the extent to which mobile learning supports the active learning activities of the framework, across both formal and informal contexts. They suggest that effective mobile learning should: allow students to ask questions of the teacher and their peers and offer their own ideas; repeat their practice using feedback to improve on their performance; discuss and debate ideas with other learners and present ideas to others and through this reflect on their experience.

Qi and Boyle (2011) offers an additional cultural lens through which the Conversational Framework can be considered, where they propose four dimensions that cover the main aspects of the design and development of learning objects. Whilst not specifically referring to mobile learning, their work is highlighted here because learning objects may be accessed via mobile phones, culture is highlighted as an influential factor in some of the dimensions and there *is* overlap with aspects discussed by Koole (2006) and Park (2011)which are related to mobile learning, namely social interaction, technology and technological competence. Their dimensions are described as:

- Knowledge dimension, where the knowledge context may differ between learners from different cultures.
- Pedagogy dimension, where teaching methods and the design of learning activities may be influenced by cultural context.
- Access Dimension, related to the expression of the content and accessibility issues, where cultural issues may be particularly present in the interface design of learning objects e.g. language used, icons.
- Technology Dimension, the technologies that are used to facilitate learning where the availability of the technical infrastructure required to develop learning objects, as well as the individual technical knowledge and competences, may be considered a cultural issue, for example when considering developed versus less developed countries.

When discussing the pedagogy dimension links are made with Laurillard's (2000) conversational framework and a number of culturally sensitive factors (Table 2) are identified.

Factors	Description and Cultural Sensitivity
Orientation	To introduce learners into the learning process in a proper way, e.g., quick introduction or extended introduction. Groups of potential learners differ in motivation of attending the learning and may need different types of introductions to attract or engage them in the learning.
Elaboration	To interpret or explain a concept with proper language, e.g. academic language or plain language, and examples. Language involves differences in acceptable tone and style of communication; Examples may reference particular social cultural contexts.
Learner control	To guide learners to accomplish a learning task in a proper way, e.g., to outline the path and ways or only direct orientation and aims. Cultural differences in perception of appropriate allocation of responsibilities between learners and teachers.
Feedback	To respond to learners' actions in a proper way. Groups of potential learners prefer or expect different feedback which may affect their performance of learning emotionally.
Motivation and Stimulation	To elicit learners' performance of learning by employing different ways, e.g., encouraging, praising, or urging. Cultures differ on meaning of success in academic and manner of stimulation.
Practical task	To require learners to apply the new knowledge by generating questions on the topic that may be closed or open-ended. Learners' experiences differ in terms of performance of practical tasks.
Collaborative task	To require learners working together to achieve a learning goal which may relate to collaborative manner, group size, division of labour and teaching support. Egalitarianism, non-critical acceptance of ideas, or presentations of thoughts are different in the Western and the Eastern culture.
Communication manner	To create channels for learners to communicate with each other which may need to be synchronous or asynchronous, and anonymous or signed. There are cultural differences in preferences for the manners of communication.
Engagement	To engage learners in a productive or creative task which may need to provide extra explanation or support. Learners may have different expectations of learning tasks that are creative, contributed, or productive.
Value of error	To consider the importance of error in learning. Cultural differences on the value of errors in learning.

Table 2: Culturally sensitive factors in pedagogy dimension, from Qi and Boyle (2010)

These dimensions, therefore, are a means of examining how culturally sensitive factors such as learner control, communication preferences, motivation and technological competence are related to Koole's model of mobile learning as learning processes mediated through technology as well as Parks concept of mobile learning as being comprised of differing psychological interactions between students and their tutors and the variation in structuring of learning content.

Finally, Pachler et al (2010b), in considering that learning is a product of the activity, culture and context in which it occurs, build on the notion of conversational learning as proposed by Laurillard and propose a framework that considers factors impacting on how mobile phone use is contextualised within the learner context (Figure 9). Three main branches are presented: *agency*, where mobile devices act as a resource that leaners use to make sense of their world and personalise their learning; *cultural practices*, where learning is seen as culturally situated and finally *structures*, where learning happens in formal and informal contexts and learner practice which is situated their particular social context may conflict with that of the institution.

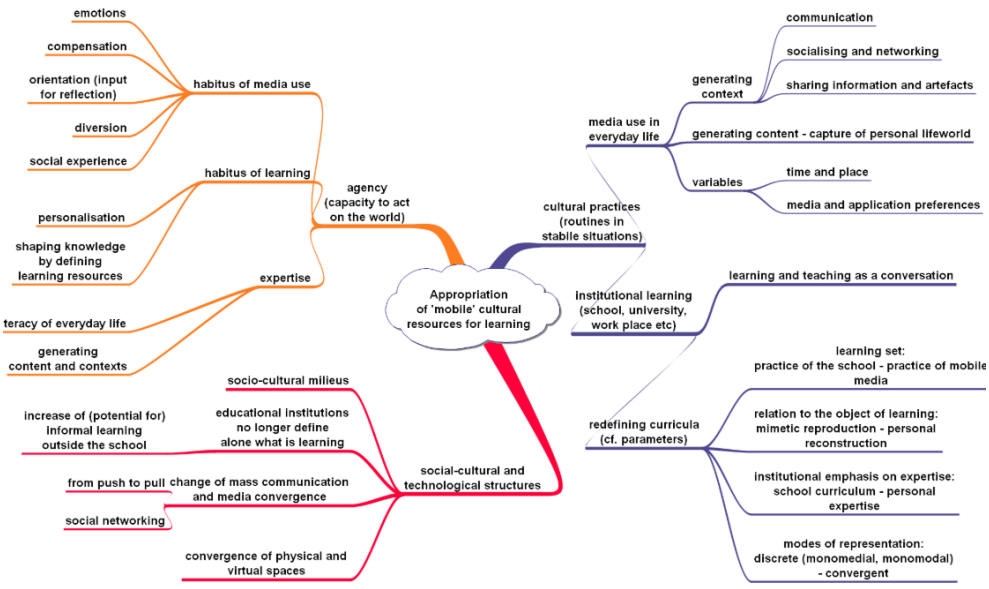

Figure 9: A typology of appropriation of mobile cultural resources, from Pachler et al (2010)

2.7.2 Frameworks for evaluating mobile learning

Wu et al (2012) surveyed 164 studies into mobile learning conducted between 2003 and 2010 (Figure 10). They classified research into one of four categories depending on its purpose: evaluating the effects of mobile learning; designing a mobile system for learning;

investigating the affective domain during mobile learning and evaluating the influence of learner characteristics in the mobile learning process.

They found that the majority of studies (58%), were in category 1, 32% in category 2 and 5% in each of 3 and 4.

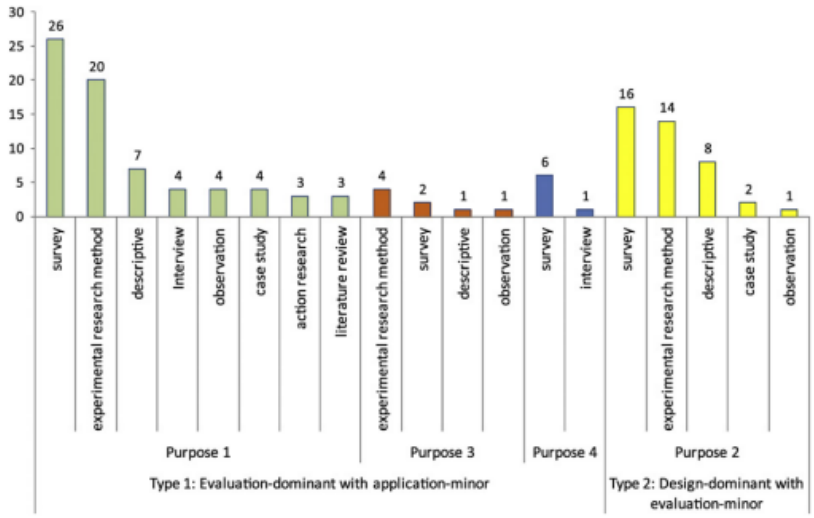

Figure 10: Classification of mobile learning studies by methodology, from Wu et al (2012)

They found that the most cited articles in their selection i.e. the ones that indicate greater recognition by others in the field were also concerned with the effects of mobile learning. However, when examining these articles, it is clear that there is a lack of studies that investigate pedagogical approaches to using mobile devices in an educational setting and in particular a *comparison* of the various approaches to assess whether a change in pedagogy leads to a greater or lesser level of involvement on the part of learners *because* of their cultural context.

The question arises as to why there is a lack of studies in this area. Traxler (2013a) suggests a number of factors: a lack of time, resources and expertise to generate credible and appropriate evidence; evaluation of mobile learning is sometimes more difficult because of the context in which these activities occur, which acts as a limiting factor; short term projects do not allow for sufficient 'soak in' of the technology and finally projects which use project supplied devices not learner devices are unsustainable for financial reasons even if positive educational outcomes are identified.

Ng and Nicholas (2013) also found that most studies of mobile learning are short term and exist only while funding is available and argue that there no appropriate models of *sustainable* learning practice using handheld devices.

In an article in the Guardian in Mar 2012, John Traxler, head of the learning lab at Wolverhampton University, states:

> "Mobile learning should be recognised as notoriously difficult to evaluate ... just because you can measure changes in attributes or behaviour doesn't mean they're educationally meaningful or remotely life-changing. It's difficult to observe, difficult to measure and difficult to explain."

Farley et al (2015) highlight a common problem of evaluation models for educational technologies such as mobile learning: a focus on isolated components e.g. the user, device or institutional context, as opposed to considering how these components interact. They suggest that a mobile learning evaluation framework should consider a number of aspects such as: the breadth and scope of mobile learning opportunities; the accessibility of mobile devices among students; the need for personalised learning; teacher competences in delivering mobile learning opportunities; the effectiveness of mobile learning from a pedagogical perspective and the role of the institution in providing support for mobile learning.

Traxler and Kukulska-Hulme (2005) attempted to present a list of attributes for an evaluation:

- evaluation should be relevant to the selected medium and technology chosen
- rigour should be applied in order for conclusions to be valid and transferable.
- evaluations should be conducted efficiently taking into account considerations of cost, effort and time
- evaluation should be proportionate, so that they do not take longer than the learning intervention or its delivery.
- it should be built in to the project.
- it should be sympathetic to the understandings that participants have of teaching and learning.
- evaluation should capture the essence of what learners, educators and other participants are trying to convey.

- it should be consistent across different groups of learners and whatever devices are used and should be repeatable.

They recognise that consistency across varied devices and technologies is particularly challenging given the rate of change of technology.

Sharples (2009) highlights challenges in evaluating mobile learning: the issues of context and capturing and then analysing learning either in context or across contexts; measuring mobile learning in terms of outcomes and processes; respecting the privacy of participants; the extent to which the usability of mobile technology can be assessed; the extent to which the wider socio-cultural context of learning, as well as the organisational context, can be considered and assessing the concepts of formality and informality.

Capturing knowledge in context is acknowledged as a major challenge to researchers, in that they must be able to capture where learning occurs, what is being learned, who is involved and how learning moves between both physical and online spaces.

Models for evaluating mobile learning have either emerged as research into mobile learning initiatives gathers pace, models have also been developed out of frameworks that examine other technologies.

The Evaluation of Technologies Framework (Ng and Nicholas 2013), considers the human centred factors that need to be addressed in order to make learning sustainable i.e. positive attitudes from teachers and students, effective communication amongst stakeholders and appropriate delegation of responsibilities between the institution, teachers and students. To a lesser extent the interaction between people and devices is acknowledged as part of the framework. Farley et al (2015) acknowledge the usefulness of the framework but highlight that it was developed out of research conducted in primary and secondary schools and therefore application in a more complex higher education context may not be possible.

Huang and Chiu (2014) propose a Context Aware learning model (CAML) that can be used to assess mobile learning activities (Figure 11). A meaningful learning experience is defined as the *goal*, meaningful learning is framed in terms of it being active, authentic, constructive, cooperative and interactive and these are the *dimensions* of learning. The features of context aware learning are the *criteria*.

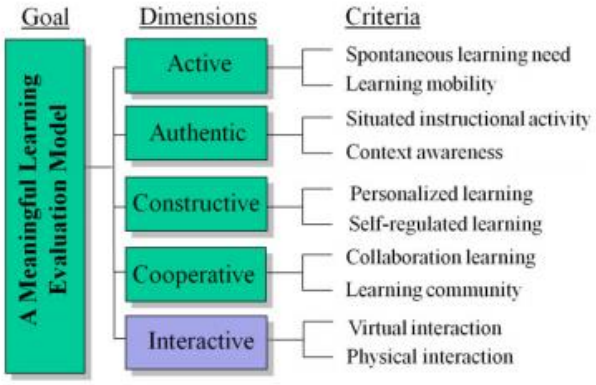

Figure 11: The framework for evaluating CAML based on meaningful learning. CAML, context-aware mobile learning, from Huang and Chiu (2014)

The suggestion is that the framework can be used to assess context aware mobile learning activities in terms of providing 'meaningful' learning. There are some issues in terms of validity; the framework was developed as a result of a review of the literature, not as a result of an application of the framework in a real-world context. Testing of the framework was conducted with a panel of experts, who applied it to three mobile learning activities drawn from the literature, but these experts are not identified. The activities selected from the literature were all conducted with schoolchildren, not students in higher education. Finally, students did not participate in the evaluation of the framework.

In order to provide a more universal and standardised model Farley and Murphy (2013) developed an assessment mechanism that can be used to evaluate mobile learning initiatives. They identified 3 distinct factors that need to be considered when assessing the sustainability of any technology: pedagogical, technical and organisational. Pedagogical factors are split into two themes: *teaching*, which reflects on the strengths and weaknesses of mobile learning practice as well as driving and limiting forces and *learning*, which examines expectations of mobile learning and identifies gaps in provision based on learner needs. Organisational aspects include practices and policies that support or inhibit the adoption of mobile learning initiatives. Technical factors include infrastructural issues and standards that may impact on mobile learning projects. Readiness is also identified as a significant factor i.e. the extent to which the institution is prepared to deliver and support mobile learning initiatives. This framework includes pedagogy as a significant foci and specifically identifies 'student perspective', 'social context', 'learning needs' and 'current and intended use' as issues to take into account when deploying mobile learning initiatives.

As has been discussed earlier in the literature review, these aspects are all culturally significant.

2.7.3 Frameworks for technology acceptance and mobile learning

Building on the Technology Acceptance model, which highlights aspects such as Perceived Usefulness, Perceived Ease of Use and Intention to Use, researchers have extended the TAM in relation to mobile learning to include other factors such as Perceived Convenience (Chang et al 2012), taking into account the affordances of mobile phones, as well as perceived mobility value and perceived enjoyment (Huang et al 2007), which are seen as useful predictors of using M-learning.

2.7.4 Frameworks for psychological factors of mobile learning

Terras and Ramsay (2012) suggest that a range of psychological attributes are important to consider in the context of mobile learning. They articulate five challenges that need to be overcome when designing mobile learning: the context dependent nature of memory; the finite nature of human cognition and it's susceptibility to interruption and distraction; distributed cognition and situated learning, such that knowledge is shared across individuals and learners have to negotiate these spaces in order to evaluate what is and isn't useful; metacognition i.e. the extent to which learners are able to self-manage their learning and finally individual differences and preferences for technology use.

Sha et al (2011) also consider the importance of self-regulated learning in their model (Figure 12), which they suggest is a framework that can be used to design and analyse mobile learning.

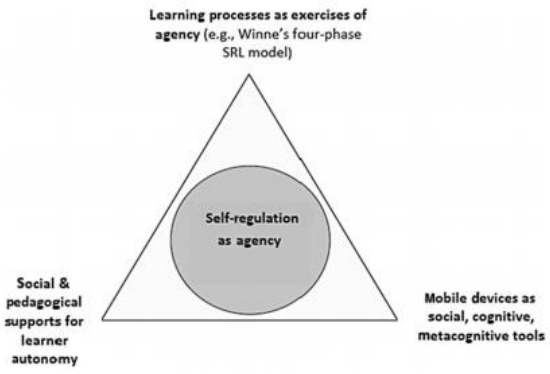

Figure 12: An analytic self-regulated learning (SRL) model of mobile learning, from Sha et al (2011)

At the centre of their model are characteristics that act as driving forces for self-regulated learning, such as motivation, prior experience and epistemological beliefs. Mobile technologies act as social, cognitive, and metacognitive tools and pedagogical design should allow learners some degree of autonomy in setting goals and selecting and assessing learning activities. Finally, links are made with Winne's four phase model (Winne, 1998, cited in Perry and Winne 2006), which suggests that self-regulated learning means learners engage in four sequenced and recursive phases of cognitive and behavioural activity: survey the task and the environment surrounding it; set goals and organise learning tactics to achieve them; work on the task and monitor goals and finally taking a holistic view of the first three phases, identifying learning problems and adjusting their strategies to achieve the task.

2.8 Mobile learning: an international perspective

UNESCO's 2012 report into the future of mobile learning highlights a number of advances that will impact on teaching and learning in a global context, namely that technology is becoming increasingly affordable and accessible driven in part by improved power capacities, that these devices will be able to collect and analyse large amounts of data and that issues such as screen size will not be a limitation in the future. Additionally, language barriers will disappear. (Winters et al 2013). The suggestion is that these advances will enable a global audience to tap into the potential of mobile learning.

However Traxler (2013b), reflecting on developments in mobile learning over the previous decade, suggests that the emergence of research into mobile learning, coming as it does from a particularly European perspective, carries with it a set of pedagogic assumptions about the relationships between institutions and learning that are not necessarily universal. He cautions that not all countries or cultures would share these assumptions and that there is a risk that mobile technologies "project the pedagogies, strictly speaking perhaps the epistemologies, of *outsiders* into communities that already have their own learning".

Tsinakos (2013) highlights a number of issues that may hamper mobile learning efforts in different countries:

- a lack of policies that can deal with or promote mobiles technologies in educational settings
- issues such as distraction, or concerns over possible health effects, which may hinder their use in a classroom setting.
- inequitable access to mobile technologies due to a lack of infrastructure or socio-economic issues.
- an inability to develop learning materials or resources due to a lack of qualified staff
- the limitations of the hardware, in terms of usability or screen size.

Tsinakos (ibid) reports that projects in mobile learning tend to be university or school based and follow one of three approaches, either using devices provided by the organisation, encouraging participants to bring their own devices or sharing the costs of the project between the organisation and the participant.

The remainder of this section will attempt to provide an overview of mobile learning research and initiatives across different regions and territories, with a particular emphasis on Europe, Asia and Africa as studies within these regions are of particular interest given the scope of the intended research. Rather than exhaustively capturing every mobile learning intervention that has ever been developed or undertaken this will be an attempt to highlight significant pieces of research or those that exemplify the types of interventions that have occurred.

2.8.1 Mobile learning in Europe

OECD figures for 2013 show that mobile device penetration in Europe is high and the diffusion of mobile technologies has been extremely rapid, though there are differences across countries. Texting and messaging are the main activities, followed by photography and video. The use of Internet connected phones, which brings with it access to social networks and applications, has increased, and features such as GPS are now routinely being built into phones allowing access to mapping and tagging features (OECD 2013).

Kukulska-Hulme et al (2009) lists a number of projects that have been influential in developing a European perspective on mobile learning, including HandLeR and MOBILearn.

Based on the theory of learning as conversation the HandLeR project, which started in 1998 at the University of Birmingham, investigated user interface issues in the design of a handheld device that could be used on an educational field trip. While technological issues meant the product performed poorly the project established the concept of contextual learning outside of classroom settings, as well as outlining requirements for contextual learning. These requirements include: portability; individual, adapting to learner abilities; unobtrusive; available anywhere; adaptable to the context of learning and the learner's evolving skills and knowledge; persistent; useful and easy to use. A number of these requirements have underpinned subsequent research projects in mobile learning but there acknowledgement that some have yet to be fully realised i.e. adaptability.

MobiLearn, a BYOD project which ran from 2002 to 2005, created a number of outputs. The aim was to create a set of pedagogically sound guidelines, drawn from mobile learning projects and theories of effective teaching and learning These guidelines encompassed infrastructural issues, usability requirements, assessment of devices for suitability, identification of suitable champions for mobile learning, management of resources, training and consideration of privacy issues (Vavloua et al 2004).

MoleNET was a project that ran from 2007 to 2010, worked with more than 100 projects across a variety of subject areas and used an SCPD approach. Among their key findings were that mobile learning can make learning more accessible, can encourage individual and collaborative learning and enables educators to provide differentiated learning activities to suite different learning styles and preferences. They highlighted the importance of staff training, the avoidance of a one-size-fits-all strategy and stressed that converting existing materials into a format suitable for mobile devices is not the best approach. Instead, learning objectives must be the starting point and mobile technologies should be considered in terms of enhancing the delivery.

Hylen (2012) in a report for UNESCO, identified a number of EU funded mobile learning projects including the UK M-Learning project and the GYPSY and Manolo projects in the Netherlands. Working with disaffected young people the M-Learning project offered learning opportunities outside of formal settings to those at risk from exclusion. The project focused on mobile technologies for delivering content as well as facilitating creativity, collaboration and communication in the learning process. It concluded that mobile learning functioned best as part of a 'blend' of learning activities. The Manolo project investigated how mobile technology affects teacher roles, what technologies are suitable for education and infrastructural requirements to support mobile learning. Researchers found that simply offering existing materials through mobile devices was not seen as adding value but that mobile tools can enhance collaboration and communication.

Cornelius and Marston (2009) used SMS text messaging in a flood disaster simulation, a BYOD project where students had to communicate decisions about how to deal with unfolding events, in real time, over a 72 hour period. There was a disruptive nature to the activity, students did not know when they would receive updates and had to respond within 2 hours. Some of these decisions led to negative consequences, in effect harming the people they were trying to help, but students responded positively to the exercise. This use of SMS was constructivist in its approach, as opposed to behaviourist, and the authors highlight the importance of 'cognitive engagement'. They also discuss the concept of a virtual context; in this case student location was not important to the activity, where a number of mobile learning interventions consider the location of the learner as an important aspect of the learning e.g. on a field trip.

France et al (2013) report on two field trips where mobile technologies were used by students. In the first University of Reading microbiology students went to Iceland to study

microbes in extreme environments. Using an OPD approach, students were provided with I-pads loaded with fieldwork related apps for gathering data such as GPS location, photos, videos and field notes. Materials were uploaded to cloud storage tools and a social networking site was used as a communication portal for staff and students before and during the trip. In the second Chester University Geography students used a mixture of university provided (OPD) and personally owned devices (BYOD) to capture fieldwork data, using a variety of social media and collaborative tools to collect, upload and share their findings. In both cases, mobile tools were seen as ideal facilitators of enquiry based learning which offers opportunities for team formation, collaboration and dissemination.

Wu et al (2013), used augmented reality tools on android tablets (OPD) to situate students in the context of an accident at a nuclear power plant. Students travelled round the school locating radiation 'hotspots' giving them the sense of being in a polluted area. These activities were supplemented with classroom and desktop computer based sessions in order to educate students about radiation, pollution and ecological issues.

Hylen (2012) found that outside of the UK, the Netherlands and Denmark mobile learning activity is scattered and small scale and that only these territories address mobile learning at a policy level, with the UK being the most developed. However, the economic downturn in the UK, along with policy changes, has had an impact on government led initiatives.

Primary drivers for mobile learning are low cost of devices, increased functionalities and the growing number of students who own devices, leading to an increase in BYOD approaches.

The main barriers are lack of policy support and negative attitudes from policy makers, teachers and parents towards the use of mobile technologies in education.

A survey of mobile learning initiatives reviewed in the report suggest that a blended approach, where mobile technologies are used with fixed technologies such as desktop computers, is the most effective.

2.8.2 Mobile learning in Africa

Mobile phone uptake in Africa has been rapid and widespread. The Mobile Africa report (Phllips and Lyons, 2011) reports that the number of mobile connections has increased by 30% a year, predicting that it would reach 735 million by the end of 2012. This has been fuelled by intense competition that has lowered prices and increased penetration.

Isaacs (2012) reports the following characteristics of mobile learning projects in Africa and the Middle East:

- The majority of projects focus on primary and secondary schools, with a high concentration in Kenya, South Africa and Uganda. Most projects use mobile phones to support the delivery of learning in classrooms, or to improve learner performance in formal and informal environments.
- A number of projects have emerged in higher education environments, these projects use mobile devices to provide access to learning materials, enable field research and facilitate collaboration and communication between staff and students.
- Projects are mostly initiated by private organisations rather than governments and tend to be small scale pilots.
- Projects tend to be based around the use of text based communication, on lower end handsets, in a BYOD context. As users are charged per megabyte initiatives tend to use text based methods to keep costs down.
- Projects are predominantly implemented in urban environments
- Projects do not consider implications for national policy

In a study of the opportunities and challenges of mobile learning among higher education students in Zanzibar, Haji et al (2013) identified found that most students responded positively to the notion of the use of mobile phones as part of their learning and agreed that use of mobile devices would lead to increased mobility. However, while most students owned mobile phones, only a minority owned smartphones. They also found that there were a number of technical obstacles to implementation of mobile learning including infrastructure limitations and issues around viewing existing content on small screens.

Thinyane (2010) reports on a comparative study into first year university students in South Africa and Australia. In terms of access to technologies 88.9% of students surveyed had access to a mobile phone and students used phones predominantly to make calls and send texts. The use of phones to send e-mails, pictures and for video calling was significantly lower. Compared to their Australian counterparts South African students used mobile technology far more extensively. In response to questions about the use of mobile technologies in education students responded positively across the majority of cases.

Drivers include the exponential growth of mobile devices, the positive attitudes of learners towards the technologies and the need to address deficiencies in existing educational provision i.e. a shortage of qualified teachers, lack of educational resources and lack of basic facilities in educational establishments. Barriers include lack of mobile optimised content, lack of awareness among decision makers and the technical limitations of basic mobile devices.

2.8.3 Mobile learning in Asia

Mobile penetration in Asia is high. As of the end of 2017, there were 2.7 billion unique mobile subscribers in Asia Pacific, accounting for two thirds of the region's population and more than half of the world's mobile subscribers live in India and China (GSMA 2018). The evidence suggests that many people are opting to buy a mobile phone before or instead of a computer, leapfrogging desktop technologies in favour of mobile. So (2012) reports on some of the key components of mobile education in Asia:

- Literacy education, where mobile technologies provide affordable, continuous and easy access to educational resources.
- Distance education, providing access to education where enrolment in education programmes are significantly lower than they are in areas such as Europe.
- Self-directed learning, promoting educational opportunities through informal learning.
- A movement toward designing future learning environments – educational settings enriched by technology, in which all or part of the learning experience takes place in a virtual environment.

Valk et al (2010) explore the results of six mobile learning projects in Asia. Five of the projects use SMS technology, the exception being a cellphone game. All but one of the SMS interventions simply used variations of quizzes. One project, a teacher training programme based in Bangladesh, in addition to SMS, used mobiles for conference calling, motivational messages, communication with the trainer and with fellow students and for dissemination of good practice. Participants experienced issues with conference calling due to limitations of the technology but responded positively to the situated learning opportunities afforded by the technology, where they could apply their training in the classroom, and the shared responsibility between the teacher and learner making the program more learner centred and participatory.

Mobile phone use in Asia has generated concerns about mobile technologies as distracting and disruptive but some studies suggest that disruption is a positive force if it forces schools to change their practice (So et al 2009). At a policy level, there are a number of initiatives at higher education level that promote research into the use of mobile devices in education, fuelled by the high levels of ownership amongst students.

In summary, much of the research in mobile learning has emerged from the work of practitioners in Europe, fuelled by a rapid increase in the number of mobile learning interventions that were underpinned by policy interventions. In countries outside of Europe mobile learning is less well developed and there are significant differences across regions. In Europe there have been a variety of projects that attempt to integrate different pedagogical approaches and learning theories, across both formal and informal contexts. Elsewhere, technological limitations are still a significant factor and have led to interventions that are constrained by technological, infrastructural and sociological boundaries. Developing countries focus on the use of SMS technologies as opposed to other features of mobile technologies.

2.9 Summary

This chapter has drawn upon a variety of literature in the fields of mobile learning and its definitions, the notion of context, theories and frameworks for learning and mobile learning and the concept of culture and its varying definitions. This summary will attempt to draw together the aspects uncovered in the literature and show how they underpin the conceptual framework proposed for the study.

The literature on mobile learning has identified a number of aspects that are important in the context of this study. The varying approaches taken to define mobile learning, which either examine it in terms of the technologies that are utilised when undertaking mobile learning, consider mobile learning as a subset of e-learning or frame mobile learning as an act of physical movement across formal and informal settings, indicate that there is not a definitive definition of mobile learning and that it is open to interpretation. If people are being asked to define what mobile learning is or means it may be described in terms of one of the definitions highlighted in the literature, or in some other way. It may be useful to establish how their ideas of what mobile learning *is* are constituted, for example are these definitions of mobile learning may be influenced by the *context* in which they occur?

Context was then discussed in the literature review. Again a number of definitions were identified, where context acts as a framing mechanism that may serve to explain, in one sense, how the varying definitions of mobile learning may be accommodated. Context is considered in the literature not as fixed but fluid and takes into account the characteristics of a learning situation, which may include information about the individual learners, interactions between learners, interactions with technology, the location in which the learning occurs, the time that it occurs and the type of activity being undertaken. As such, an examination of these aspects this may offer a lens through which mobile learning can be viewed, where the literature review identified aspects such as culture and cultural background are important elements of context that may impact on learning interactions (Wang and Wu, 2011; Sampson and Zervas, 2013) and potentially adaptation is required in order to deliver appropriate learning experiences that meet the needs of diverse learners.

Culture, as discussed in the literature review, is a broad term that can encompass a variety of factors including nationality, religion and shared beliefs and behaviours. Whilst a number of conceptualisations of culture are identified in the literature, some of which are highly cited, there are issues with the assumptions inherent in these conceptualisations and the extent to which they can be applied in different contexts. The literature highlights a number of aspects that are influenced by culture: cognition, such that cognitive styles, approaches to problem solving and learning processes and strategies are likely to be influenced by the cultural context of the learner; communication, where cultural differences in terms of preferences for synchronous and asynchronous modes and the tools used were identified; technology acceptance, where links were made with cultural influences and epistemology, such that expectations around knowledge construction are socially mediated.

Delving further into knowledge construction, the literature was examined in terms of the general theories related to learning, such as behaviourism, constructivism and connectivism as well as theories and frameworks specifically around mobile learning. Socialisation emerged as a key aspect, where learning occurs through socially mediated and technology mediated activities and these activities have cultural dimensions.

Finally, a survey of mobile learning literature across the globe highlights the Western focus of much of the research. It has highlighted that research into mobile learning tends to adopt a systematic, positivist stance and there is a lack of studies of mobile learning that examine the influence of culture or view mobile learning from an interpretivist stance. In

addition, there is a lack of literature that examines the influence of culture in terms of mobile learning. There are also technological and infrastructural issues that need to be overcome in terms of acceptance of mobile learning in education which, compared to e-learning, are a barrier to the use of mobile phones in formal educational settings.

The literature review highlights several important aspects that underpin this study, where the study seeks to expand on the literature by identifying and discussing how students in differing cultural contexts conceptualise mobile learning and use mobile devices as part of their learning.

The following chapter will provide an overview of the methodology employed in the study and attempt to explain how the chosen methodology is appropriate for investigating the above.

3 Methodology

The purpose of this study is to investigate the qualitatively different ways learners understand mobile learning. In conducting the literature review a primary research question was identified, namely how do learners from different cultural contexts understand and experience mobile learning? In addition two sub questions were identified:

- To what extent are there similarities and differences across differing cultural contexts in terms of students' experiences of using mobile phones for learning?
- To what extent do existing frameworks and theories for mobile learning address the cultural context of the learner?

This section discusses the research methodology employed for the study. Beginning with a discussion of the choices available a rationale will be given for the use of a phenomenographic research approach before delving into the philosophical foundations of phenomenography and the research design process. The data collection procedure will be presented. Towards the end of this chapter there will be a discussion of the process of analysis of phenomenographic data, the lack of consensus as to how to present the results of phenomenographic analysis will be examined and a suggested strategy for conducting the analysis will be presented. Finally, research validity and rigour will be discussed.

3.1 The development of a conceptual framework

As stated previously the focus of the study is on conceptions of mobile learning in an international context, in order to understand whether the cultural context of the learner impacts on how they use mobile technologies for learning. The study will also investigate the experiences of individual learners in order to understand their attitudes towards the use of mobile technologies in a learning context and the extent to which their cultural context impacts on these attitudes and approaches.

In reviewing the literature a range of academic databases were used across a range of disciplines, the criteria for inclusion being that they discussed mobile learning, factors that impact on learning, attitudes towards technology in general and mobile devices in particular and the notion of culture and its influence on individuals behaviours and beliefs when engaging in learning. The results identified a number of key aspects that informed the study going forward. The cultural context of a learner encompasses aspects such as

epistemologies, cognition, communication, attitudes towards technology and learning preferences and there is a need to consider that students who move from one context to another i.e. as international students are likely to bring elements of their cultural context with them and this will potentially impact on learning activities undertaken outside of their home country.

Following the literature review, and in order to proceed with the aims of the study, a conceptual framework was developed. Smyth (2004) considers a conceptual framework to be "a tool to scaffold research and, therefore, to assist a researcher to make meaning of subsequent findings" which can be used to link the literature to research goals, inform the research design and provide reference points for discussion of literature, methodology and analysis of data. Jabareen (2019) defines a conceptual framework as a set of interlinked concepts that allow for an understanding of a phenomenon where each concept has an ontological or epistemological role.

Merriam and Grennier (2019) consider the framework as deriving from the literature and is the lens through which the study questions are formed. Gaudet and Robert (2018) also see the conceptual framework as a step towards operationalisation of the research problem.

Development of the conceptual framework was done in parallel with the literature review. The starting point was the model proposed by Prasertsilp (2013), which was chosen because it combines elements from a number of theories emerging from the literature e.g. activity theory, social constructivism and the Technology Acceptance Model. This model also recognises the need for an understanding of cultural difference (Figure 13).

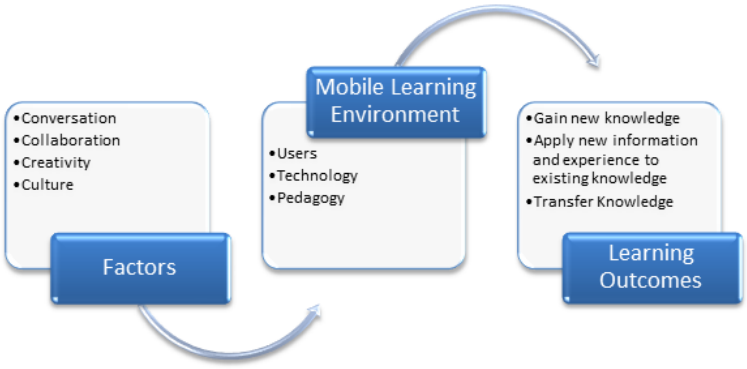

Figure 13. Mobile learning model, from Prasertsilp (2013)

Following the literature review, a modified conceptual framework was developed that built on the one proposed by Prasertsilp (Figure 14).

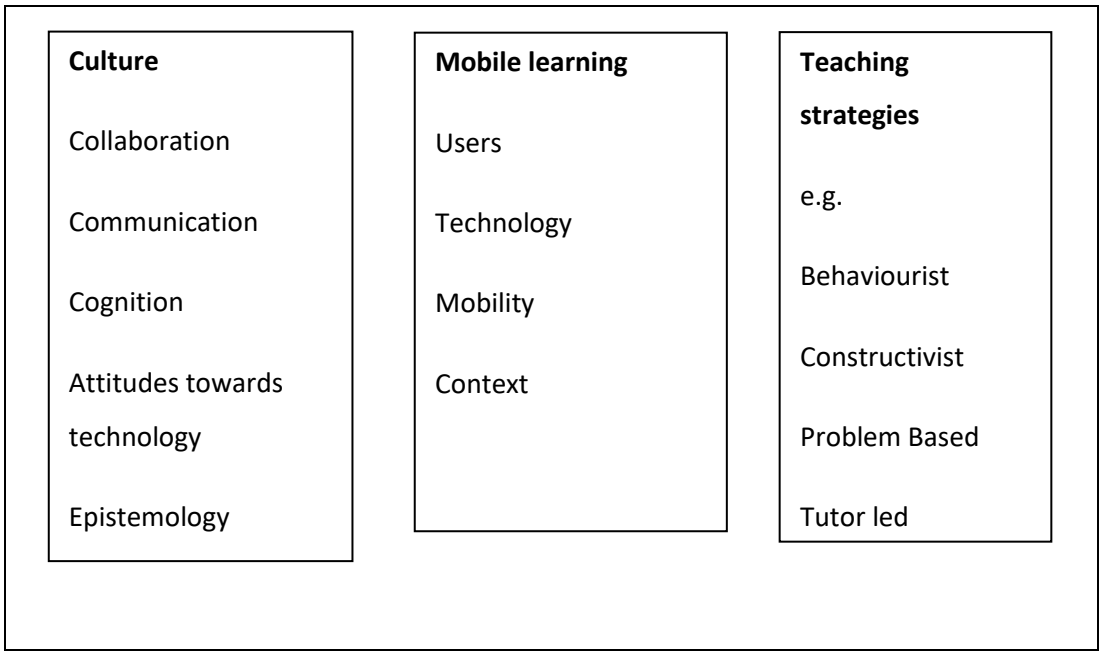

Figure 14: proposed conceptual framework

The conceptual framework was used in part as an attempt to organise the body of literature into a structure that could be then used as reference point for the investigation. Whilst these are organised under various headings, there is a recognition that these are not strict boundaries i.e. context could be placed under the heading of culture, since the literature has identified that cultural context is important or under context, such that the context of use governs the teaching strategy employed. As such, it was constructed as a way of thinking about the process of data collection and the questions that would be asked and would allow the subsequent discussion to examine the extent to which these concepts were evident.

Following the literature review, 'culture' was expanded into a number of factors that impact upon technology and learning interventions in a global context i.e. factors that are influenced by differences in culture. These were identified as: *cognition*; *attitudes towards technology*; *communication preferences*; *attitudes towards group work* and *epistemology*. Cognition, and the suggestion that cultural context influences how people process

information and undertake learning processes, merits further study in the context of this study, since it will potentially impact on learner attitudes mobile devices. Allied with this is the extent to which learners communicate and collaborate using mobile devices and whether these preferences are facilitated or inhibited by the use of mobile technologies. As such, these aspects are grouped with cognition. Since the literature review has highlighted that ways of knowing can be culturally mediated, epistemology is also considered in this grouping, such that assumptions about knowledge is acquired may result in certain attitudes towards the use of technology.

The concept of pedagogy from Prasertsilp's model was explored further in the literature, in order to identify theories relevant to mobile learning. Examples included Behaviourism, Constructivism, Situated Learning and Problem Based Learning. The teaching strategies grouping in the conceptual framework then highlights these different approaches to learning using mobile devices, which can be tutor or student led and may be classed as behaviourist, constructivist etc in nature. The influence of culture is identified in the literature review, which may impact on which of these approaches are used.

Finally, the mobile learning grouping considers that users are engaging with technology in a particular context, which may be influenced by the affordances of the technology and align with the concept of mobility, which can be the mobility of the learner or the mobility of the technology. Culture is again highlighted as significant, where conceptions of mobile learning may be influenced by where learning is considered to happen e.g. in a classroom, and whether the focus is on the technology or the goals of the user.

The remainder of this section discusses the selection of the research methodology that would enable exploration of the factors identified in the conceptual framework.

3.2 Methodological stance

3.2.1 Qualitative versus quantitative

The advantages and disadvantages of qualitative and quantitative research have been examined and presented extensively in other research so this chapter will not present these debates in detail. However, some discussion is required in order to define the scope of the research and the approach chosen.

Hartas (2010) discusses the major paradigms that underpin the qualitative and quantitative approaches: *empiricism*, *critical realism* and *positivism* in quantitative research and *critical theory*, *postmodernism* and *social constructivism* in qualitative research.

Where ontology is concerned with the nature of reality and epistemology is concerned with how knowledge can be created and communicated (Scotland, 2012), quantitative research assumes the ontological position that reality is objective and can be examined scientifically and therefore epistemological approaches are empirical and positivist in nature. Cohen et al (2011) outlines the stages of the 'scientific method' used in quantitative research, the process through which the researcher can collect and present their findings and set a path for others to follow. In this approach, a hypothesis is tested through experiments where variables are isolated and correlations and patterns are observed, resulting in either confirmation or rejection of the hypothesis.

Culture, as discussed earlier, has several definitions in the literature encompassing a variety of factors and as such a clear concept of culture as a whole can be difficult to identify and quantify. As such a positivist approach classifying 'culture' as an independent variable that influences aspects such as attitudes towards learning may experience difficulties. Williams-Green et al (1997) suggest that culture has several constituent *parts* or *dimensions* which could be considered variables and refer to Hofstede's dimensions of culture as an example. However Baskerville (2003), in discussing Hofstede, outlines the limitations of the research in terms of equating nationality with culture and a misleading dependence on cultural indices as an explanation of differences in behaviour.

Qualitative research, on the other hand, contends that reality is constructed by individuals who make sense of the world in an active way and it is therefore necessary to explore the meanings behind the actions of social actors when examining their reactions to social phenomena (Saunders et al 2007). Here the ontological position is subjective and

epistemological approaches are interpretivist, attempting to understand a phenomenon from the research subject's point of view.

Reed (2006) suggests that, for researchers who are investigating ways in which students experience *learning*, the objectivist approach is not appropriate since the object of study in such an approach is the phenomenon itself. Rather, the research would be more useful if it examined the construction of meaning that occurs through the interaction of students *with* the phenomenon i.e. adopting the perspective of the student. A qualitative approach would therefore seem be more appropriate for this study as one of the aims is to understand mobile learning from the perspective of the student. Cohen et al (2011) identify many characteristics of qualitative research that lend themselves to an understanding of the proposed conceptual framework, some of which are highly relevant to this study:

- humans construct their own meaning of situations
- meaning results from social situations
- behaviour is influenced by context and any data generated about behaviour is socially situated and context dependent
- data are analysed inductively with constructs arising from the data during the research
- research needs to examine situations from the viewpoint of the participants

Tesch (1990) frames qualitative research as research which predominantly or exclusively uses words as data. In her analysis of the terms used to describe types of qualitative research she presents a cognitive map that groups the objectives of qualitative research activities into four major types or categories: *the characteristics of language*; *the discovery of regularities*; *the comprehension of the meaning of text/action* and *reflection*. These four categories are arranged as a continuum which becomes less structured and more holistic. On the one side, research that investigates the *characteristics of language* is concerned with discrete parts of language such as words and phrases and tends to use orderly procedures, whereas at the other end of the continuum *reflection* tend to be intuitive and based on deep analysis of the data. Of particular interest in terms of the study is the category labelled *the discovery of regularities*, which is further sub divided into research

where data is analysed in order to either identify *connections between data items* **or** research that aims to identify *patterns that repeat across data*. This second type of research is further divided into research that identifies *patterns in conceptualisation*, *patterns as deficiencies*, *cultural patterns* and *patterns in the socialisation process*.

The concept map that expands on the discovery of regularities category is shown in Figure 15.

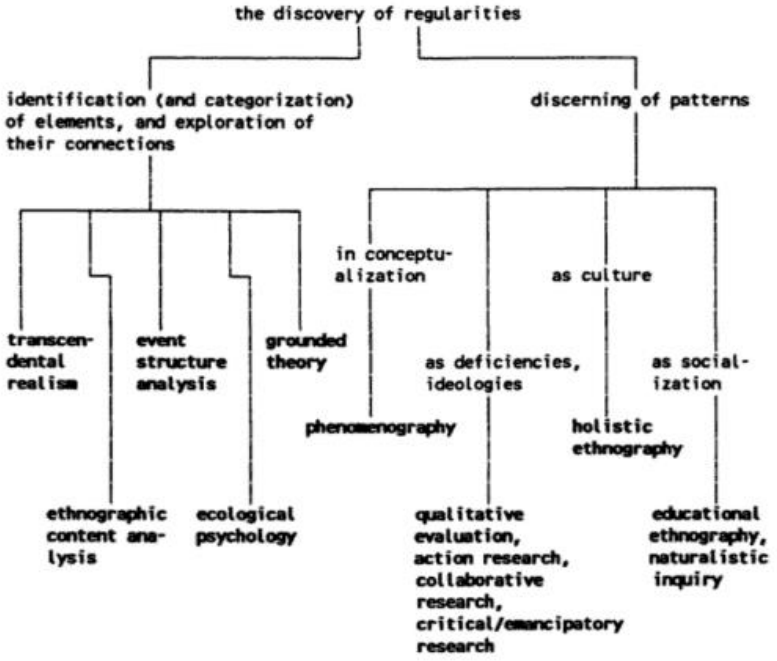

Figure 15: concept map of research that aims at the discovery of regularities, from Tesch (1990)

Ethnographic approaches would not be appropriate in the context of this study, as such approaches aim to describe or interpret a cultural group. Similarly, research approaches using action research, where practitioners question their current practice and work collaboratively with researchers to implement and assess changes, are also not relevant to this study. Given the research questions outlined earlier a research method that attempts to discern *patterns in conceptualisation* of mobile learning, based upon student experience, would seem to be the most relevant approach.

Conceptualisation is the "mental process whereby fuzzy and imprecise notions (concepts) are made more specific and precise" (Babbie, 2013). Sharifian (2011) contends that while conceptualisations may be initiated at an individual level, a large proportion of conceptualisations operate at a cultural level and arise from interactions between members of a cultural group. Drawing upon established theories of distributed cognition,

Sharifian (2011) proposes the notion of 'distributed representation', where cultural cognition is composed of schema and categories that lead to patterns of knowledge that is distributed across the cultural group. A number of characteristics of cultural conceptualisations are identified, which map to aspects of the conceptual framework outlined earlier in this section:

- Conceptualisations enable members of a group to think in a similar fashion and are developed through their interactions with each other.
- Conceptualisations can be perpetuated over time by communication between group members.
- Conceptualisations are not universally cohesive across all cultural groups

Cultural conceptualisations are broken down further by Sharifian (ibid) into a number of schema, which include:

- Event schema, which are developed through experience of certain events. Weddings and funerals are given as examples of events which are experienced similarly by a group of people from a similar cultural background and give rise to expectations of behaviour at such an event. It can be argued that the act of learning in a particular cultural context gives rise to an event schema amongst learners from that context.
- Role schema, which creates expectations around the characteristics associated with a particular role in society e.g. teacher (Sharifian 2011).

McCargar (1993) suggests that, while there may be regional variations, members of a culture share core expectations of events, objects and situations and that people rely on these cultural models when interacting with others, particularly when immersed in new cultural contexts.

Svensson (1989) attempts to clarify the distinction between the terms concept, conception and conceptualisation: a *concept* is a generalised or abstract meaning attributed to a phenomenon by an individual, a *conception* is the experienced meaning of a phenomenon and *conceptualisation* is the process of 'thinking' through which a conception is formed. This definition of the term 'conception' maps to the one used in phenomenography, where conceptions in phenomenographic research are the ways of experiencing something.

It is therefore proposed that for this study an investigation of the conceptions of mobile learning held by students, formed through the cognitive activity of conceptualisation, offers an opportunity to explore the influence of culture. Furthermore, following the concept map developed by Tesch (1990), phenomenography is an appropriate methodology to use to uncover these conceptions.

3.2.2 Phenomenography or phenomenology

Phenomenography is closely linked with phenomenology, another qualitative methodology. Both methods study the phenomena or object as they appear to people. However there are differences between these two approaches. Phenomenology is concerned with the phenomenon and its essence, whereas phenomenography investigates how a group of people view or *understand* the phenomenon and the variations in people's ways of understanding or conceptualising its various aspects (Larsson and Holmstrom 2007). Phenomenography is interested in *collective* meaning whereas phenomenology places an emphasis on *individual* experience (Zhao 2015). Finally, the phenomenographic approach adopts a second order perspective which describes how the phenomena is perceived whereas phenomenology uses a first order perspective to describe the world and the phenomena as it is rather than how it is understood.

This study is not attempting to define what mobile learning *is*. Rather, it is attempting to investigate how mobile learning is perceived by learners in differing cultural contexts. The next section will discuss phenomenography in more detail.

3.3 Phenomenography

Phenomenography originated in the 1970's, in an attempt to investigate learning through the eyes of the learner. Researchers at the University of Gothenberg, in Sweden, found that when students read a passage of text they understood it in a limited number of qualitatively ways and that this variation could be arranged into distinct categories. Based on their research they theorised that people hold a finite number of different understandings of all kinds of phenomena (Barnard et al 1999).

This approach to understanding learning is discussed by Kvale (1995) who considers that modern ideas of knowledge have moved away from a conception of knowledge as a mirror of reality towards one where knowledge is as a result of interpretation and negotiation of the meaning of the lived world, mediated in part by communication between people.

Cohen et al (2011) discuss how differing conceptions of social reality, and the assumptions that underpin them, influence the methods used to interpret such realities. They identify three sets of assumptions: ontological, epistemological and human nature (or more specifically, the relationship between humans and their environment).

Ontological assumptions are concerned with the extent to which 'reality' is objective and external to the individual or the product of individual cognition, description and interpretation. The interpretivist view of ontology is a fundamental aspect of phenomenography, where the nature of reality is seen as non-dualistic, as explained by Marton (2000, cited in Ireland et al 2009):

> "From a non-dualistic ontological perspective, there are not two worlds: a real world, objective world on the one hand, and a subjective world of mental representation on the other. There is only one world, a really existing world, which is expressed and understood in different ways by human beings. It is simultaneously objective and subjective. An experience is a relationship between objects and subjects encompassing both. The experience is as much an aspect of the object as it is of the subject".

Marton (1981) also discussed first order and second order perspectives, where first order perspectives orient themselves to the world and make statements about it whereas second order perspectives orient themselves towards, and make statements about, people's ideas and experiences of the world. Phenomenography uses a second order perspective where the researcher, rather than making statements about the phenomena is concerned with ideas *about* the phenomena (Reed 2006).

Epistemological assumptions of social reality are concerned with the nature and form of knowledge. Cohen et al (2011) frame views of knowledge as either *positivist*, where knowledge is objective and methods of enquiry are scientific in nature, or *anti-positivist*, where knowledge is personal and subjective and methods of enquiry require researchers to be involved with their subjects.

In phenomenography, *description* is the main emphasis, where the knowledge to be obtained about the phenomena can be described in terms of the similarity and variation in meaning the concept has for participants and participant groups (Forster, 2016).

Marton (1981) considers the *unit* of phenomenographic research to be the way of experiencing something and the object of the research is the *variation* in the ways of experiencing the phenomena. Within this framework, conceptions are the units, the ways in which participants in phenomenographic research make sense of the world. Variation in conceptions is then expressed through categories of description. Andretta (2006) considers that within the conception an internal relationship exists between the phenomena and the individual experiencing it, such that the ways of experiencing the phenomena (the object) reveals something about the person experiencing the phenomena (the subject).

In considering the nature of conceptions Svensson (1997) contends that assumptions about the nature of conceptions are closely linked to assumptions about the nature of knowledge. Knowledge is constructed through human thinking and human activity but is also dependent on the individual's external reality. Similarly, conceptions are dependent on human activity and the external world. He suggests the process of conceptualisation may lead to a variation in conceptions, due in part to influences of culture, language, social relations and social context and the relationship between conceptions and these influences is part of what can be investigated in phenomenographic research.

Harris (2011) discusses how earlier phenomenographic studies used conceptions as the smallest unit of analysis but subsequent researchers introduced frameworks that allowed for conceptions to be broken down further for analysis. These frameworks, known as the 'what/how' and 'structural/referential' frameworks, are based on research into intentionality and awareness and have been used in a number of phenomenographic studies in order to frame the research design and process of analysis. Both frameworks have their origins in studies of learning. Pramling (1986), in their study of children and their conceptions of learning, identified two related aspects in their framework: *what* to learn

and *how* to learn i.e. what the children perceived as learning and how this learning comes about. Marton (1988) subsequently developed a framework that mapped to aspects of this 'what/how' framework.

Marton and Booth (1997), in discussing what it means to experience something, suggest that the experience has a structure of awareness where you can discern entities and aspects and be aware of these aspects simultaneously. This awareness is layered and some aspects are at the core while others surround the core.

A basic unit of experience is said to have structural and referential aspects where the structural aspect is concerned with discernment of the phenomena and its constituent parts from its context and the referential aspect is concerned with the meaning of the experience. The structural aspect can be broken down further into an internal horizon and an external horizon, those aspects of the experience that surround the phenomenon are its external horizon, those which make up the phenomenon and its parts are its internal horizon. Using the example of a deer in the woods, the internal horizon describes the deer and its parts while the external horizon describes the contexts in which the deer can be found e.g. the forest, the zoo.

The structure of awareness framework builds on earlier work by Gurwitsch (1964, cited in Yoshimi and Vinson 2015) on the field of consciousness, where any field of consciousness can be structured into three domains: the theme, which is the focus of attention and the thematic field and the margin, which are at the periphery of attention. Cope (2004) highlights the relationship between the work of Gurwitsch and the later work of phenomenographers such as Marton and Booth:

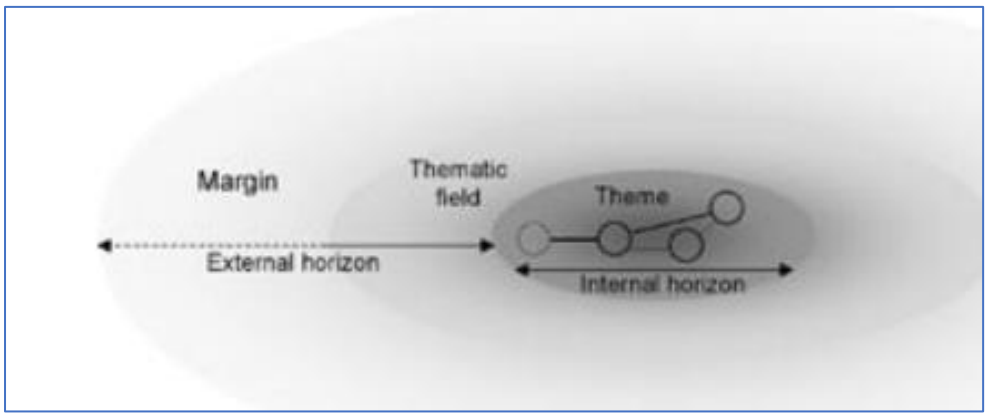

Figure 16: Structure of awareness framework, from Cope (2004)

The internal horizon is situated within the theme and the external horizon consists of the thematic field and the margin (Figure 16).

Building upon the idea that conceptions are units of experience and that these units have structural and referential aspects, categories of description are the qualitatively different ways a phenomenon may appear across a group. While conceptions refer to individual perceptions of a phenomena, categories of description represent multiple or collective conceptions (Yates et al 2012). Marton and Booth (1997) explain this distinction further:

> When we talk about 'a way of experiencing something' we usually do so in terms of individual awareness … When we talk about 'categories of description' we usually do so in terms of qualitatively different ways a phenomenon may appear to people of one kind or another. Thus categories of description refer to the collective level.
>
> (Marton and Booth, 1997, p128)

Categories of description are therefore labels given to sets of conceptions that convey some unique ways of experiencing a phenomenon that are distinct from each other and, collectively, present the qualitatively different ways the phenomenon is understood.

Reed (2006), in discussing the hierarchal nature of categories of description, highlights that each successive category should be a more complex way of experiencing the phenomenon.

The collection of categories of description forms the 'outcome space', a diagrammatic representation which attempts to document the logical relationship between conceptions.

The outcome space is an expression of the researched phenomenon, where the categories of description are related in a distinctive, often hierarchical way. Within each category of description are aspects of the phenomenon which are common across all categories but vary in some way in each category, known as the dimensions of variation (Ireland et al 2009).

Åkerlind (2005), considers that the outcomes of phenomenographic analysis are reported in 2 interrelated ways:

- The categories of description, which represent the collective meanings that make up the outcome space.
- The dimensions of variation, which highlight aspects of similarity and difference between the categories of description and allow for the development of

relationships between categories of description. These relationships then signify the structure of the outcome space.

Reed (2006) argues that in order for a phenomena to be experienced as a phenomena (its *structure*) it should be possible to distinguish it from its environment as well as being focally aware of its various aspects simultaneously and to give it *meaning* the phenomena is seen in the context of the situation in which it is found.

Pang and Marton (2003) suggests that dimensions of variation are part of the 'new phenomenography' which shifts in emphasis from describing *how* something is experienced to the *nature* of the different ways in which something is experienced and that while a phenomenon can be experienced in a particular way, with a focus on a particular aspect of the phenomenon, there must be also be an awareness of the other ways in which the phenomenon can be discerned.

In summary, phenomenography is therefore understood as a research approach that seeks to understand how research participants perceive a phenomenon, where these conceptions can be influenced by cultural context, are organised under categories of description that exhibit dimensions of variation and the categories of description are arranged in a hierarchical outcome space. Having established the essential elements of phenomenography, the next section will discuss the research design process.

3.4 Research design

In phenomenographic research the primary form of data collection is the interview. Researchers gather data through open ended interview questions, which are designed to orient the participant towards the phenomenon under investigation and to allow participants to select the dimensions of the question they wish to answer. A set number of open ended questions are supplemented with the use of unstructured probes or follow ups that delve deeper into participant responses. (Yates 2012). Open ended questions are exploratory, allowing participants to share their experiences of the phenomena and the meaning constructed from that experience. Probes are then used to bring participants to a deeper level of awareness and to uncover conceptions or ways of understanding the phenomenon (Rands and Gansemer-Topf 2016).

In this study, pilot interviews were conducted ahead of the main data collection in order to inform the study i.e. to test the conceptual framework and to field test the interview questions.

3.5 Ethical considerations

Cohen et al (2011) highlight a number of considerations with regards to the conduct of interviews and ethical issues that may arise and highlights the following important aspects:

- The gaining of informed consent
- Information provided to participants in advance of the study
- Confidentiality and non-traceability
- Who will see the results of the research and rights of participants to withdraw from the study.

An application was made to the Biomedical and Scientific Research Ethics Committee (REGO-2015-1398) at Warwick University for ethical approval, using guidance from the Research Code of Practice.

In line with the Code of Practice a Participant Information Leaflet was created, which advised participants as to the scope and nature of the research. Consent forms were also presented to participants and they signed to indicate that they agreed to participate in the study. Participants were also advised that they could end the interview at any time and

withdraw from the study. Interviews were recorded, the recording were stored on an usb device and locked in a filing cabinet to which only the researcher has access.

3.6 Pilot interviews

As suggested by Kim (2010) a pilot study can test a research protocol, the data collection method and a sample recruitment strategy. Seidman (2014) discusses the benefits of pilot studies for researchers:

> They will learn whether their research structure is appropriate for the study they envision. They will come to grips with some of the practical aspects of establishing access, making contact, and con- ducting the interview. The pilot can alert them to elements of their own interview techniques that support the objectives of the study and to those that detract from those objectives.

A decision was made to test the interview protocol prior to the main study. Partly, this was due to the researcher's lack of experience of conducting qualitative interviews. It was also to test proposed questions to see if they were effective in encouraging participants to describe their conceptions.

Pilot interviews were conducted with five participants in September 2015. Participants were undergraduate students on a Business degree at Newman University. Interviews lasted between forty five and ninety minutes. A set of questions, supplemented with probes and follow ups, was used to investigate students' understanding of mobile learning. Magnusson and Marecek (2015), in their discussion of the interview process and items to consider, provide a useful set of points that can be used to gauge the effectiveness of the interview:

- Did the researcher put the participant at ease and create a good working relationship e.g. through matching language style?
- Was the participant informed about privacy, anonymity and the right to withdraw from the study at any time?
- Did the researcher orient the participant as to the purpose of the interview?
- Are questions phrased appropriately?
- Are the participants responses oriented towards answering the research questions?

In addition, an important aspect of the phenomenographic interview is that the research sets aside any preconceptions or theories about aspects of the world under consideration. This is referred to as bracketing. Ashworth and Lucas (2002), stress that the categories of description must reflect the participants' description of the experience in order to be sound. They suggest that the research must bracket presuppositions. This includes the carry-over of earlier research findings, reaching premature conclusions as to theories or interpretations, adopting assumptions baked into research tools, for example ratings scales and making early connections between cause and effect based on participant descriptions of an experience.

These guidelines were used to assess the effectiveness of the interviews and what follows is a discussion of the process and lessons learned.

3.6.1 The interview process

Participants were recruited via email invitation, briefed as to the purpose and scope of the interview and were given a copy of the participation information leaflet if they indicated that they wished to participate. Interviews were held in the office of the researcher. All participants were asked to sign the consent form to indicate they were willing to proceed with the interview. Interviews were recorded using two recording devices for redundancy, this was indicated to participants at the outset and they were all happy to proceed. At the beginning of the interview participants were reassured that they were not being assessed and that there were no right or wrong answers. At the end of the interview participants were thanked for attending and invited to make comments about the interview process. All participants appeared comfortable with the interview process and did not raise any concerns.

3.6.2 Understanding and phrasing of questions

All interviews started with the same set of questions and were worked though in the same order, moving from an initial set of questions about what learning means to them to questions around the phrase *mobile learning*. Finally, in order to discuss aspects of how mobile devices are used in a learning context, scenarios involving the use of mobile were described and participants were asked how they felt about these scenarios. Probes were used to follow up on questions and ask students to reflect on their experiences.

3.6.3 Answering the research questions

On reflection, the number of questions was an issue. At the request of the ethics committee a set of generic questions were added to the interview schedule; these were questions oriented around learning in general as well as demographic questions. However, these questions were not *specifically* addressing the phenomenon under investigation i.e. mobile learning and meant that in the context of the study they added little value in terms of analysis but added significantly to the length of the interview. From a phenomenographic perspective, some conceptions of mobile learning were uncovered but not at the depth that would allow for development of categories of description and an outcome space. It was therefore decided that the general questions oriented around learning would be removed. The questions around mobile learning would be retained and would be the focus of the interviews. Where participants' experience of using mobile devices in learning was limited, the scenario-based questions allowed them to consider how they would react in such situations and articulate conceptions related to these scenarios. However, it was felt that for the main study it would be important to interview who had used mobile devices in some way as part of their learning to ground their conceptions in some experienced reality.

3.6.4 Bracketing of research assumptions

The researcher was aware of the need to avoid presuppositions. It was sometimes necessary to paraphrase what the participant had stated in order to assess whether it had been adequately captured. Overall, the researcher was aware of the need for constant monitoring in order to avoid bringing in the researcher's own assumptions.

The findings from the pilot interviews were used to adjust the questions used in the main study. In particular, the need to for participants to have used mobile devices as part of their learning, so as to relate their answers to an experienced reality as opposed to giving hypothetical responses to suggested situations.

3.7 Main study

The focus of the study is how the cultural context of the learner impacts on how they view the phenomenon of mobile learning. As identified in the literature review, much of the literature on mobile learning comes from a European perspective and the researcher is

keen to understand the extent to which these findings apply in a wider context. Ryan (2011), in discussing the internationalisation of university teaching, highlights the increased understanding of socio-cultural theories of learning that contend that learning is culturally mediated, but also is critical of the 'cultural boundedness' of educators who, whilst recognising the importance of social context in group work, collaborative learning and peer discussion, have not stepped out of their cultural 'contact zone'. For the researcher there were two choices: conduct the study with international students who had travelled to the UK to study or conduct interviews with students in their host country. The decision was made to identify students from differing cultural contexts and to interview these students *within* their cultural context i.e. *not* to interview international students studying in the UK but to travel to their host country and interview in situ. There are a number of justifications for this. Firstly, given the research approach of phenomenography, which is concerned with the lived experience of the phenomena under investigation and attempts to view it through the eyes of the research subject, it was felt that interviewing students in their host country would lead to a better understanding of their perceptions and experiences of mobile learning and how these have developed within the cultural context where the student normally resides. Within the scope of the study these conceptions of mobile learning would then be the focus of the discussion. Secondly, Irvine at al (2007), suggest that researchers should spend time in the cultural setting in order to understand social processes, systems and traditions that characterise the culture from which they are collecting data, citing the example of a study into nursing education in Japan where observation of teaching sessions and attendance at social events during the study oriented the researchers towards the cultural and social norms within the country.

Additionally Irvine et al (2007) highlight three important issues for selecting participants for inclusion: participants should share similar demographic characteristics across the cultural groups; the gap between data from the different settings is not too lengthy so that institutional or policy changes do not impact on comparisons between groups and researchers should ensure culturally sensitive access to research participants.

With this in mind, the researcher had to decide which cultural contexts would be included in the study, ensuring that the data was gathered in a manageable timeframe and that participants shared some characteristics across cultural groupings. Given that the researcher is a lecturer at a UK university, this was an obvious starting point in terms of identifying a group of students who could participate. Selection of additional students was

influenced by several factors, including timescales, resourcing and institutional relationships. The researcher's host institution has developed partnerships with other universities across the world; many of these are developed through the EU Erasmus programme which facilitates collaboration between European educational institutions. Additionally, outside of Europe the university has developed relationships with universities in China and Japan and schools in Africa. Given that the decision was made to work with university undergraduates this meant that the links with schools in Africa would not be beneficial in this instance. As discussed in the literature review, a number of studies have identified cultural groupings or clusters which exhibit significant differences in terms of cognition, epistemological beliefs and attitudes. The relationships with universities in China and Japan afforded the researcher access to undergraduates in two differing cultural contexts, outside of the European perspective where much of the literature on mobile learning is derived.

3.7.1 Sampling and sample size

Yates et al (2012) suggest that participants in a phenomenographic study should be selected because they have direct experience of the phenomenon, without any preconceptions about the views held by participants about the phenomenon under investigation. Furthermore, in the context of this study, this *purposive, non-random sampling* will use a *homogenous sampling* approach, where participants have similar characteristics to each other because they share a cultural context. Within the group itself, there may be variation in conceptions, which may be evident as dimensions of variation. However, if it is found to exist, it is the variation *between* groups that is of particular interest in this study, and the extent to which this variation is due to the cultural context of the group.

With regards to sample size, there is extensive and ongoing debate amongst practitioners as to the optimal number of interviews in qualitative research. Yates et al (2012) identify three factors that are highlighted by researchers who have undertaken phenomenographic studies and which are relevant in the context of this study when deciding on sample size: firstly, it should allow for finding variation in conceptions; secondly, the data collected should be manageable and finally sample size is determined by a saturation point, where additional interviews will not yield any new conceptions of the phenomenon. Ritchie and Lewis (2003) also identified factors that may influence the size of the sample: the heterogeneity of the population, where very diverse populations in relation to the

phenomenon being examined will require larger samples than relatively homogenous ones and the types of data collection methods, where single interviews will require fewer participants than focus groups and, lastly, budget/resource constraints issues.

Guest et al (2006) found numerous mentions of saturation in their review of literature as a background to their study. However, few studies actually provided guidelines for sample size using this metric. They describe seven sources that actually provided guidelines for samples sizes. Two of these sources discussed phenomenology, a research methodology that, like phenomenography, is concerned with investigation into a phenomenon, one suggested between five and twenty five participants and the other at least six. Guest (ibid) found that in their study of health care in women in Africa, where they interviewed 60 participants, the majority of codes resulting from their research were found in the first six interviews.

Mason (2010), in an examination of more than 500 PhD studies that used qualitative approaches, found that samples sizes varied from one to 95, across 26 distinct methodological approaches such as case study, action research and phenomenology. He presents a set of conclusions based on his research: students do not understand the concept of saturation and are doing more interviews than required to ensure that their sample sizes can be defended; students do understand saturation but use samples that are larger than required in anticipation of questions they may face in the viva voce examination and, finally, students are attempting to meet the requirements of quality and ethics processes which require them to state in advance the number of participants in their study.

In addition to the concept of saturation, Markauskaite and Wardak (2015) suggest that phenomenographic studies in newer areas tend to have smaller samples, citing studies of e-learning, information literacy and blended learning that draw upon three to seven participants.

Ritchie and Lewis (2003) contend that it is possible to supplement a sample by adding members to it if it is found that certain findings need more depth in order to attain validity. As such, this leaves open the possibility of conducting more interviews if the need arises.

3.7.2 Cross cultural interviewing

Schneider (2010) sees cross cultural interviews as those involving an interviewer and interviewee who have differing backgrounds and experiences, who may not share common

assumptions about meaning and must work towards establishing an understanding of the meaning of what each is saying.

Kvale (1996) suggest that culture creates boundaries between 'insiders' (the research participants) and 'outsiders' (the researcher) and that the researcher must therefore make attempts to cross this boundary. However, Widdicombe (2014) contends that the labels of insider and outsider between an interviewer and interviewee do not capture the multiple identities that may be utilised by the interviewer in order to establish a rapport.

A significant cultural boundary, one that must be crossed in the context of this study, is language. Bilingual and multilingual researchers, it is suggested, have a greater sensitivity to language and its meaning and structure (Irvine et al 2007). However, the researcher is monolingual, which means that the interviews have to be conducted in English or an interpreter would be required. The use of interpreters raises some methodological issues. Hennink (2008), uses the term 'cultural brokers' to describe translators who can identify meaning in the way language is used. Cultural brokers act not just as conveyors of information but significantly impact upon the data collection process. Bramberg and Dahlberg (2013), view the use of interpreters as a challenge to the immediacy and openness of the interview process where, in acting as a bridge between the researcher and the interview subject, the interpreter has to understand the context in which the question is asked, convey this to the interview subject and adequately translate the response. This co-construction of data has to negotiate the horizons of understandings of the various participants and Bramberg and Dahlberg (2013) suggest that the interpreter should therefore be an active participant in the research process. Within the context of this study, it was felt that the use of an interpreter would be impractical, as it would necessitate the identification, recruitment, training and presence of interpreters in the differing cultural contexts for potentially extended periods of time.

Recruiting and interviewing English speaking participants would eliminate the need for interpreters, but raises the question as to whether the use of a language that is a *second* language for research participants impacts upon the data that is collected. However, a number of studies have discussed the effectiveness of English as a bridge between researchers and research participants in cross cultural research. Robinson-Pant (2005) states that English can be considered a neutral language that is not associated with a particular ethnic group. Crystal (2003) considers English to be a global language, driven by its prominent use in global media, communications and technological innovations. In

examining English as a *lingua franca* Ishikawa (2016) discusses the *world English* paradigm where localised and indigenised varieties of English, which have predominantly evolved out of educational institutions and may have their own linguistic norms, *do* allow for communication across geographical boundaries whilst *also* allowing socio-cultural identities to be projected.

3.7.3 Study sample and interview process

The population of interest was undergraduate students who had used mobile devices as part of their learning. The sample was drawn from educational institutions in China, Japan and the UK.

In the UK, students from two courses were identified. The first course was an undergraduate Business Management programme at a post-1992 UK university; the second was an undergraduate course in Business Systems and Technology run by a FE college. Initial contact with the UK students was made via email in the case of the Business Management students and through the course leader for the Business Systems course.

In Japan, interviews were held at a private university in the Aichi prefecture of Japan. The institution is a liberal arts institution, established in the 1940's. It consists of seven faculties and offers undergraduate and postgraduate programs in a number of subject areas. Contact was made with a lecturer in the English subject area through the international office of the researcher's host institution. This lecturer visited the UK a number of times in 2015 and arrangements were made to travel to Japan in January 2016 and interview students on campus. As part of the week spent in Japan the researcher met and socialised with lecturers in the subject area. This included presenting details of the study as part of a departmental seminar, presenting a talk about the researcher's host institution to students interested in studying abroad and joining with academics for an evening meal. The researcher also toured the campus and met with students. Interviews were conducted in an office on campus and scheduled over a number of days. Participants at the Japanese university were undertaking an English degree, with a view to training as English teachers.

The Chinese undergraduate students were identified through a partnership programme developed by the host institution of the researcher. The university, which is not one of the C9 league schools, is located in the city of Guangzhou, the capital of Guangdong Province in southern China. It is a multi-disciplinary university and its 26 schools offer 66 undergraduate programs, 42 master's degree programs, 2 doctoral programs and various

other courses across its two campuses. The agent responsible for the administering the programme, who is based at the Chinese university, identified participants and arranged for them to be available during the visit to China in May 2016. These students were undertaking the final year of an undergraduate Business Management degree prior to attending an MBA at a UK university.

All interviews were conducted in the period between January and May 2016. Interviews were conducted individually. In total, 33 interviews were conducted, varying in length between 30 minutes and 75 minutes. 15 interviews were conducted in Japan, 8 in the UK and 8 in China. 23 of these interviews were used in the study, 8 from China, 8 in the Uk and 7 from Japan. Not all the interviews in Japan were used in the final study for a number of reasons. Opportunities arose in Japan to interview international students from South Korea, Indonesia and Germany but these were not included in the final study. The researcher was interested in the extent to which the cultural 'baggage' of the learner accompanied them when moving to a different cultural context, hence the reason for conducting the additional interviews. However, in each case the sample size (n=1) for each of these cultural contexts precluded them from being used in the study. Where phenomenography is concerned with the collective understanding of a phenomenon rather than at the individual level it was felt that more students from these countries would have been required in order to gain an understanding of conceptions emerging from these cultural contexts. In addition, the study aimed to interview students 'in situ' i.e. within their normal cultural context. The additional interviews were still useful, first as a further test as a test of the interview protocol and second as a means of testing the extent to which international students retain aspects of their cultural context as they move across cultural boundaries.

At the beginning of the interview participants were given a participant information leaflet which explained the nature of the study and its purpose. Students were reassured that they could withdraw from the process at any time and that there were no right or wrong answers. If students were willing to take part, having been advised of the process and taken through the information leaflet, they were asked to sign the consent form to indicate consent. Interviews were audio recorded and participants were made aware of this before the recording began.

Bruce (1994) outlines some of the distinct features of the phenomenographic interview that differentiate it from other forms of interview:

- The aim is to identify variation in peoples understanding or experience of the phenomenon
- The focus is not on the person or the phenomenon but how the phenomenon is perceived or experienced by the person
- The interviewers role is to try to see the phenomenon from the perspective of the person being interviewed

Open questions were developed to assist with the process of exploration; these questions were centred on the following research objectives:

- What 'mobile learning' meant to participants
- How and where they used mobile devices as part of their learning
- How the use of mobile devices impacted on relationships with students and staff

Follow up questions are extracted from what the interview subject has said so far and ask them to expand on their description of experiences or the meaning of certain concepts, rather than being based on pre-determined questions and ideas (Mann et al, 2007). As such, it was anticipated that follow up questions would be used, over and above the set of exploratory questions, but these would emerge out of the dialogue between researcher and participant.

3.7.4 Transcription

Following the interviews the audio files were transferred to a computer and given a de-identifying number. The transcription process was conducted by the researcher, not by a transcription service. One issue was cost. In addition, Widodo (2014) sees data transcription as a first step in data analysis and organisation, where the researcher can reflect on the data and the context in which it was captured and also critique the interview process and their technique. He outlines a number of steps in the active listening process:

- an initial 'warm-up' listen to reacquaint the researcher with the interview
- follow up listening to identify the main points of the data
- close up listening to find links between responses and the research question
- repeated and selective listening, conducted while transcribing, which enables the researcher to focus on the data and reflect on what has been captured
- analytical listening, which examines how the data is conceptualised.

Repeated and selective listening was a significant factor in the transcription process, particularly when transcribing the interviews with the Chinese and Japanese students. Issues with accents meant that segments of the interviews had to be replayed a few times to capture what was being said. Even with repeated listening, some words were unintelligible. This was highlighted in the transcription where it occurred.

Having transcribed the interviews from the various cultural contexts, the next step was to conduct an analysis of the texts and to present the results. The next section will examine the ways in which researchers use the identified elements of the phenomenographic research approach when analysing and presenting their data.

3.8 Variation in phenomenographic data analysis

3.8.1 Introduction

Having collected the data the next stage was hampered by this researchers' attempts to make sense of the literature around phenomenographic data analysis. As well as reviewing many academic articles on phenomenography there were a number of attempts to engage with academics who have used the phenomenographic method, through online and telephone conversations, in order to ascertain why they adopted a particular approach in their analysis. Attendance at a seminar on phenomenography and conversations with attendees, continued after the seminar in an online phenomenography forum, confirmed what I was finding across numerous studies and theses: there was no agreed process for phenomenographic data analysis, the use of phenomenographic components and the presentation of results. Different approaches are evident in terms of analysing transcripts, use of categories of description, use of dimensions of variation, use of a structure of awareness and construction of the outcome space, with no clear 'roadmap' to follow.

An email discussion with Professor Ference Marton confirmed the lack of a definitive method for presenting the results of a phenomenographic analysis. Professor Marton suggested that this is partly because phenomenography is a 'young' research approach that is still evolving. As a researcher attempting to apply this approach this is obviously a source of frustration.

To understand why there is such variance and to identify a way forward in the context of this study I examined recent PhD studies that used the phenomenographic approach in order to identify variations and commonalties in practice. The decision to examine PhD studies, rather than journal articles, was made for several reasons:

- As a novice researcher I was interested to see how other researchers at the same stage of their academic journey made sense of the phenomenographic landscape and the differing approaches to phenomenographic analysis.
- I felt that the longer form of a PhD study would perhaps contain more reflection and evaluation than a journal article, which is typically limited to a more descriptive outline of the research approach rather than a critical discussion of phenomenography.

- I was interested to see how other researchers interpreted some of the elements of phenomenography, as put forward by academics such as Marton, Åkerlind and Booth, to see whether these interpretations matched my own.

A search was conducted on the British Library Ethos service for studies in a higher education setting, limiting the search to dissertations published between 2014 and 2018. In part this was in order to find more recent examples of PhD students undertaking phenomenographic analysis that perhaps faced the same issues and had identified a suitable approach. A summary of the studies selected for analysis is shown in Table 3, identifying variance in use of aspects of phenomenography.

Author	**Transcript analysis method**	**Framework used?**	**Categories of description presented?**	**Dimensions of variation presented?**	**Outcome space presented?**
O' Brien (2015)	Marton	None identified	No (thematic analysis)	No	No
Casey (2016)	Åkerlind	Structural/referential	Yes	No	Yes (multiple)
Weston (2018)	Marton	None identified	Yes	No	Yes
McGuigan (2017)	Not identifiable	None identified	No (thematic analysis)	No	No
Mpofu-Currie (2015)	Åkerlind	None identified	Yes	No	Yes
Pitt (2014)	Marton	What/how	Yes	Yes	Yes
Nguyen (2016)	Marton	Structural/referential	Yes	Yes	Yes
Iyer (2018)	Marton	Structural/referential	Yes	No	Yes (multiple)

Table 3: **PhD thesis selected for analysis**

Studies were examined for articulation of the method used to analyse transcripts, evidence of either the what/how or structural /referential frameworks, the use of categories of description, the use of dimensions of variation and the development of an outcome space. As previously discussed phenomenography is concerned with ways of experiencing a phenomenon and these ways of experiencing are when some aspect of the phenomenon is discerned from its context, giving it meaning and context. It is suggested that conceptions of the phenomenon are related and structured in some way (Marton 1997). It would be logical to assume that studies that use the phenomenographic approach map to these characteristics of phenomenography but analysis of the chosen studies shows a wide variation in terms of data analysis and presentation of findings. The following sections will outline these variations in more detail.

3.8.2 Variation when analysing interview transcripts

In broad terms Kettunen and Tynjälä (2017) identify variation in practice in several areas, namely the extent to which the whole transcript, or parts of it, are analysed and whether this analysis is conducted by an individual or groups.

In terms of phenomenographic transcript analysis, Forster (2016) discusses two schools of thought which are labelled the *Marton* and *Åkerlind* methods. In the Åkerlind method researchers analyse the whole transcript and examine extracts, in the form of quotes, in the context of the larger whole, whereas with Marton's approach researchers extract quotes from the transcript and add them to a decontextualized 'pool of meanings' from which the analysis is conducted.

Åkerlind method

In the initial analysis transcripts are read multiple times and key themes are identified. Similar transcripts are grouped together and after further readings the focus is on searching for differences and similarities in the overall meaning of the transcript and dimensions of variation across the transcripts, which are developed into categories of description. Themes of expanding awareness, which are discerned as running through the set of transcripts as a whole, are identified and linked to different dimensions of variation (Forster 2016). A key aspect of the Åkerlind approach is the consideration of the extracts 'in-situ', where a given utterance in considered in relation to the parts of the transcript that surround it.

Marton method

Aflague and Ferszt (2010) outline a protocol that follows the seven steps of analysis in the Marton method: *familiarisation*, where the audio is transcribed and read a number of times; *condensation*, where similar occurrences of the same phrase are reduced to a representative version; *comparison*, which involves comparison of excerpts to find sources of agreement or variation; *grouping* of similar quotes; *articulating* to capture the essence of the similarity within the groups of answers; *labelling*, with a suitable expression and *contrasting* of similarities and differences.

In describing Marton's approach, having identified the parts of the transcript that relate to the phenomenon, (Collier-Reed and Ingerman, 2013, p 6) outline that the next step, condensation, involves physically cutting out these extracts and placing them in a pile as part of a 'pool of meaning'.

Expanding on the concept of the whole, Dortins (2002) identifies two types of 'whole' in the context of analysis, where each transcript is one whole and the group of transcripts is another. She suggests that considering the group of transcripts as the 'whole' enables the construction of groupings of consistent meanings into conceptions, where inconsistencies of meaning leads to the development of a set of qualitatively *different* categories of description, whereas considering the individual transcript as the 'whole' is more problematic because the inconsistencies at the single transcript level i.e. the individual do not need to be comprehended since phenomenography is concerned with the collective rather than the individual.

Åkerlind (2005) summarises the debates around the two methods, highlighting that proponents of the Marton approach argue that it removes irrelevant or redundant data and focuses on the aspects that relate more directly to the research theme, as well as enabling, through the decontextualised extracts, a focus on the collective rather than individual, as well as the opposing argument that decontextualization may reduce consideration of the context in which the quotes are made and this could impact on the meaning. Marton himself defends against the criticisms of decontextualization with regards to context, suggesting that analysis of transcripts *must* take into account the collective and individual context (Marton, 1994 cited in Collier-Reed and Ingerman, 2013). Proponents of the Åkerlind method also argue that it increases accuracy in interpreting answers but that

researchers need to be aware of the need to focus on collective rather than individual meaning (Forster 2016, Paakkari et al 2010).

In terms of the PhD studies chosen for analysis, a number of studies surveyed use the Marton method for analysing transcripts (Pitt 2014, Iyer 2018, O' Brien 2015, Weston 2018). Some stated this explicitly whilst for others this was inferred from their description of the transcript analysis process.

Nguyen (2016) outlines an analysis protocol that follows the Marton method but in the 'condensation stage' talks about how specific utterances are highlighted in context i.e. using the Åkerlind method, before being extracted into a table representing the whole transcript thus switching back to the Marton approach. Additionally they create a table of utterances representing a single transcript, which is then compared against other tables, and do not create the decontextualized pool of meanings articulated in the Marton approach, which does seem to diverge from the protocol.

Casey (2016) explicitly uses the Åkerlind method, iteratively re-examining the highlighted quotes in the context of the interview as a whole. Mpofu-Currie (2015) describes a two stage process where utterances are first highlighted in the context of the interview and then later extracted into separate groups of meanings i.e. using a mixture of the Åkerlind and Marton approaches. Casey (2016) reiterates Åkerlind's (2005) assertion that decontextualization can lead to a loss of the underlying meaning and therefore considering utterances in the context of the whole transcript is preferable, whereas Mpofu-Currie (2015) provides no justification for the choice of method.

McGuigan (2017), does not explicitly use either the Marton or Åkerlind methods and reports that he spent more than two years immersing himself in the 'lifeworld' of participants following the data gathering phase. Participants were encouraged to keep reflective diaries, create collages and take photographs, which were then discussed in multiple interviews varying between 45 minutes and three hours. As part of the analysis phase McGuigan creates individual profiles of participants and specifically states "individual profiles provide a creative means by which the individual remains present throughout the analysis process". This does seem particularly at odds with the focus of phenomenography, where it seems an inordinate amount of time has been spent on understanding the participants themselves rather than their collective understanding of the phenomenon in question.

Analysing the transcript analysis process across these studies has been useful in identifying the available options and how they are applied. The question is then *which* method to apply.

In the context of this study, interviews were conducted across three *cultural* contexts. Since cultural context was identified as a factor in the conceptual framework it may be appropriate to consider each grouping of transcripts as a 'whole' and undertake three sets of analysis that represent these three cultural contexts, rather than one grouping comprising all of the transcripts.

A search for cross cultural phenomenographic studies yielded few results that could serve as a guide. For example, a study by Dupin et al (2015) of French and Swedish nurses' conceptions of learning research conducted interviews with nurses from the two countries and used Marton's approach to analyse interviews. All of the interview transcripts were considered as one whole and a single set of categories of description developed within a single outcome space. Cultural context is not mentioned in the study though very briefly mentioned in the abstract. The authors acknowledge that the development of research capacity is similar irrespective of the country and whilst they highlight some differences in conceptions between the two contexts it could be argued that the issue of culture was irrelevant considering the two countries from where participants were selected, hence its exclusion from the discussion.

A more useful study was conducted by Dahlin and Watkins (2000) who examined student conceptions of the role of repetition in memorisation and understanding, conducting interviews with German and Chinese secondary students in Hong Kong. In this study, extracts were considered in *three* contexts, the context of the individual interview, the context of the group in which the interview belonged and the context of the entire set of transcripts across the two groups. Categories of description were created for each grouping in order to 'discover the variation of experiences within that groups cultural context' and then comparisons were made between groups in order to discover cultural differences. This study is helpful because it recognises the need to consider the transcripts within each cultural context as separate groups, but there are some issues in how the results from these groupings are subsequently dealt with. After creating categories of description for each context a set of categories of description across the entire set of transcripts is developed and percentages indicating how many students in each grouping expressed these conceptions is presented. This seems to be more of a qualitative measure, as well as

potentially removing categories of description that are present in one context but not the other and cannot therefore be used across both sets of students. The study does not use a structural/referential or what/how framework, dimensions of variation or present an outcome space, all of which could be used to perhaps provide a greater depth of analysis and reveal differences, if they are found to exist, across the cultural groupings without necessarily removing categories of description because they do not 'fit' the data when considering the entire set of transcripts as a whole.

The choice is then either to adopt Åkerlind's approach, to see how utterances relate to the transcript or group of transcripts as a whole, or Marton's approach where utterances are decontextualised into pools of meanings for that particular context. There are two questions that need to be answered: to what extent is the context in which these interviews occurred retained depending on the method used and which of these methods leads to a more complex understanding of the phenomenon?

Using Åkerlind's approach the three sets of interview transcripts are each considered a 'whole', would mean analysis of the transcripts within the three cultural groupings in order to identify meanings within each cultural context as well as qualitative difference within each context. This would lead to a construction of three outcome spaces, one for each context, which could then be compared and contrasted to see if there are any differences across the cultural groupings. Using Marton's approach would result in three pools of meanings, each representing the differing cultural contexts, which would again lead to three outcome spaces.

Construction of a single pool of meanings encompassing all of the transcripts or considering all of the transcripts as a whole may, in both approaches, lead to an obfuscation of the cultural context of each group of transcripts.

Since the output in both approaches would yield the same number of outcome spaces, if we follow the approach used by Dahlin and Watkins (2000), what would differentiate the outcome spaces developed in either approach? This is where the second question could be considered, in terms of the complexity of the outcome space generated. Forster (2016), in describing the Åkerlind method, suggests that it is a more recent approach and produces a more meaningful and complex result, including as it does a consideration of dimensions of variation and theme of expanding awareness. Thus, the Åkerlind method would seem to be the best approach to take as it encompasses these additional aspects, offers an opportunity

to conduct a more detailed analysis of differences across the cultural contexts and does not attempt to simply count the number of participants that express a particular conception, as in Dahlin and Watkin's study.

The group versus individual approach is also a source of variation in phenomenographic data analysis. Bowden (2005) advocates a team approach to data analysis, where someone takes on the role of 'devil's advocate' and questions the categories of description generated by the researcher. However, Åkerlind (2010) suggests that an individual researcher *can* undertake a meaningful analysis of transcript data in order to reach an understanding of a phenomenon and that this is evident in the number of doctoral thesis surveyed where the researcher was working individually. All the studies surveyed analysed the data as solo researchers, as would be expected from PhD studies. However, McGuigan mentions discussion with 'critical friends' as part of his analysis without identifying who they are and what they contributed.

3.8.3 Variation in use of frameworks

In an extensive review of studies that used the what/how and structural/referential frameworks Harris (2011) found considerable variation in how these frameworks were defined and utilised and identified several issues:

- Inconsistent labelling of parts of conceptions as either referential and structural and inconsistent use of these labels, sometimes within the same paper.
- Differing interpretations of the underlying theories.
- Differing understandings of what constitutes the internal and external horizons and where they map to the model developed by Gurwitsch (1964).

Where Cope (2004) argues that the use of a structure of awareness can increase the validity of a phenomenographic study Harris (2011) contends that using a framework may increase the depth of analysis but this does not necessarily heighten its validity.

Harris (2011) suggests that researchers need to justify their use of a framework and how they conceptualised it as well as showing their analytical process.

It was found that a number of the studies surveyed do not use the what/how or structural/referential framework (O' Brien, 2015; Hope, 2014; Weston, 2018, McGuigan, 2017; Reeves, 2018; Mpofu-Currie, 2015). As highlighted previously, Harris (2011) suggests that the absence of a framework does not mean the work lacks validity, but studies that do

use a framework offer an additional layer of complexity in terms of analysis. For example Weston (2018), who does not use a framework, recognises that categories of description should be linked in some way but in their investigation of final year midwifery students presents categories of description as a linear journey rather than a hierarchical inclusive structure. Meaning units are identified, which could map to the referential/structural framework, but this is not discussed and there is no attempt to identify variation in meaning units across categories of description, which would potentially map to the dimensions of variation. As such, the study is not as complex as those that use a framework and could be considered more of a thematic analysis than a phenomenographic one.

Pitt (2014) uses the what/how framework in their study of students' perception of feedback. The study maps the 'what' to the feedback the students receive but the 'how' is mapped to subsequent behaviours following feedback. This appears to be a different interpretation of the 'how' as described in the literature. Irvin (2006), in considering that the 'what' and 'how' aspects of phenomenography are underpinned by understandings of intentionality, sees the 'what' as being a person's understanding of a phenomenon and the 'how' is their conceptualisations of acts that facilitate this meaning. In Pitt's study, describing the 'how' as actions following feedback does not seem to offer insight as to how students facilitate their *understanding* of the feedback.

The structural/referential framework is used by three of the studies (Nguyen, 2016; Casey, 2016; Iyer, 2018). Casey (2016) presents a tabular structure (Table 4) with categories of description and associated structural and referential aspects. There is also a structure of awareness, with aspects of the phenomenon being foregrounded across the different categories of description and an inclusive hierarchy increasing in complexity. In this study, the referential aspects i.e. meaning are associated with a set of structural aspects of the phenomenon. For example, the meaning of Master's level learning being about the 'production of appropriate academic texts' is associated with aspects such as assignment requirements, reading and writing and searching skills, which are less complex aspects of the phenomenon. This can be compared with the more complex meaning of 'creation of new ideas', where aspects of the phenomenon include those at the lower level but now also include critical thinking and theory building. It is unclear what the distinction is between the wording in the first column, related to the categories of description, and those of the third column relating to the referential aspects, where in one sense they seem interchangeable.

Category	Structural Aspects What's in the foreground? Features?	Referential Aspects Master's level learning is about (means)….
1. Master's level learning as a broad set of academic skills	• Assignment requirements • Searching skills • Reading and writing a lot • Reading and writing well in English	Production of appropriate academic texts
2. Master's level learning as a critical, investigative mind-set	**As in Category 1 and:** • Critical reading, writing, thinking: synthesising, evaluating, applying	Engaging with existing ideas
3. Master's level learning as innovative thinking	**As in Category 2 and:** • Needing own opinion and ideas • Adapting exiting theories and frameworks • Critical thinking: theory building	Creation of new ideas

Table 4: Categories of description and associated structural and referential aspects, from Casey (2016)

Nguyen (2018) uses the structure of awareness framework to identify aspects that are in the theme, the thematic field and the margin. Iyer (2018) in studying approaches to learning of architectural students, presents a set of structural and referential aspects where referential aspects are described as surface or deep approaches to learning and structural facets are mapped to the pedagogical focus of the courses e.g. technical or craft based.

3.8.4 Variation in use of categories of description

Two of these studies (McGuigan, 2017; O' Brien 2015) reject the use of categories of description, one of the central tenets of the phenomenographic approach. Both cite Ashworth and Lucas (2000) who suggest that an 'orthodox' phenomenographic analysis, using categories of description, may not be the best way to capture student experience, but provide little justification as to why the production of categories of description is not appropriate in the context of their studies. It was therefore difficult to see the value in continuing to use the phenomenographic approach if it was being argued that it does not provide a suitable mechanism for revealing the essence of the issue being investigated.

Studies that present categories of description vary somewhat in their approach. Marton (1997) suggests that categories of description should be limited in number. Nguyen (2016) presents three categories of description. Iyer (2018) presents 6 categories of description but these are also referred to as approaches to learning. Weston (2018) outlines 4 categories of description related to midwifery students' views on practice and learning. There is no preconceived notion of the number of categories of description that will

emerge from this study, but attempts will be made to represent the phenomenon in as few categories of description as possible.

3.8.5 Variation in use of dimensions of variation

Marton (1997) originally discussed the term dimensions of variation in the context of a structure of awareness, where aspects of a phenomenon are recognised as having the potential for variation and what is discerned, in a particular context, is a *value* of the dimension whilst simultaneously being aware that other values may exist. As an example, Marton uses the example of something that is moving, where the dimension of variation is its two possible states, rest and motion, and therefore there is simultaneous awareness of these two states but one of these is held in focus i.e. foregrounded, whilst the other is in the background. Pang (2003) also considers dimensions of variation to be ways of experiencing a phenomenon where critical aspects of the phenomenon are discerned and focused on simultaneously and every aspect can be a dimension of variation. Åkerlind (2005) suggests that Marton's description of dimensions of variation was ambiguous and led to differing interpretations of what constitutes a dimension. She uses the phrase *themes of expanding awareness*, groupings of related dimensions of variation which are inclusive and hierarchical and increase in complexity but concedes that these may simply be regarded as more complex dimensions of variation.

An example of the use of themes of expanding awareness is shown by Åkerlind (2004), who presents dimensions of variation as existing across categories of description in an outcome space, where aspects of the phenomenon (role of student, benefits for students, benefits for teacher and breadth of benefit) are seen across all the categories of description but different elements are in focus under each category of description (Table 5). Examining the 'teacher transmission focussed' category of description, the teacher would be aware that a student can be a passive recipient, a responsive recipient, an active recipient and an active creator and these are aspects of this dimension of variation but the focus of conceptions in this category of description is on students as passive recipients, which is foregrounded, while the other aspects are in the background. These dimensions also increase in complexity from category 1 to category 4, where for example the student is a passive recipient in category 1 but an active creator in category 4.

Key themes	Categories			
	1 Teacher transmission focused	2 Student-relations focused	3 Student engagement focused	4 Student learning focused
Role of student	Passive recipients	Responsive recipients	Active recipients	Active creator
Benefits for students	Knowledge as facts	Knowledge and Skills	Knowledge, skills and enjoyment	Knowledge, skills, enjoyment and development
Benefits for teacher	Nothing or new content knowledge	New content and teaching enjoyment	New content and teaching enjoyment	New content, enojoyment and understanding
Breadth of benefit	Student only or student and teacher	Student and teacher	Student and teacher	Student, teacher and field, etc.

Table 5: Key aspects of the variation in ways of experiencing being a university teacher, from Åkerlind (2004)

In the PhD studies chosen for examination, dimensions of variation are presented by two researchers. Åkerlind's conception of dimensions of variation is evident in Nguyen (2018), who identifies factors that are present in all categories, such as role of technology or role of students, but are qualitatively different *across* categories of description. However, these dimensions were identified as part of the conceptual framework and used to inform the questions asked of participants as opposed to emerging from the data. Walsh (1994) identifies discussion amongst phenomenographers as to whether the outcome space should emerge from the data or reflects the judgement of the researcher and suggests that an emphasis on creating structural relationships may ignore aspects of the data. In the context of Ngyuen's study, the question is whether the researcher has effectively bracketed their own assumptions prior to data collection or is seeking to reinforce a structural relationship already established in the mind of the researcher.

Pitt (2014) uses the term 'structure' rather than dimensions and presents 5 types or variation organised in themes affecting feedback use (Table 6).

Themes affecting Feedback use	1 Broken relationship	2 Needy student	3 Low achiever	4 Emotionally charged	5 High achiever
Predisposition	High effort = reward False conception of ability	High effort = reward Low conception of ability	Low effort = poor grade Low conception of ability	Ability fixed Fragile confidence	High effort = reward High conception of ability
Emotion	Positive & sustained	Positive & sustained	Positive & sustained	Positive & sustained	Positive & sustained
Reaction	Maintain performance & motivation increased	Aim higher next time & motivation increased	Aim higher next time & motivation increased	Disbelief at achievement & motivation increased	Increase performance level next time & motivation increased
Feedback cognitions	Language not understood	Language understood but message not retained	Language understood but message not retained	Grade dominant Written comments useful	Feedback important Language understood
Feedback use	Not utilised	Not utilised Not transferable	Utilised only in same module	Used on next assessment	Used on next assessment

Table 6: Structure of variation in feedback use, from Pitt (2014)

Casey (2016) does not use the term dimensions of variation, stating that it is not well defined in the literature but does describe some qualitative differences across categories of description and this could be analogous to dimensions of variation.

It is clear that the studies that include dimensions of variation offer a more complex analysis of the relationships between categories of description, using a structure of awareness in order to highlight aspects of the phenomenon and what is foregrounded in the minds of participants when thinking about their experience. In the context of this study, this may provide an opportunity to identify where differences across the cultural contexts studied, where aspects of the phenomenon are identified across all contexts but different aspects are foregrounded because of the cultural context of the participant.

4.4.2 Variation in use and presentation of an outcome space

In a study of student understandings of a given text and how they went about learning the text, Marton (1994) organises the results of interview transcript analysis into a limited set of categories of description and highlighted relationships between the categories. These categories were arranged in a hierarchical structure termed the outcome space, a diagrammatic representation of the different ways in which the text had been understood.

Marton and Booth (1997) outline three criteria that can be used to define the quality of an outcome space:

- Each category in the outcome space is distinct in describing a particular way of experiencing a phenomenon

- The categories should have a logical relationship with each other, usually in the form of a hierarchy
- A minimal number of categories should be produced i.e. the aim is to capture variation in the data as efficiently as possible

Recognising that the same data may be interpreted differently by another researcher and therefore it may not be possible to replicate the outcome space, Cope (2004) argues that when researchers are attempting to justify their outcome space they should strive to communicate the process of checks and balances undertaken by the researcher as part of the analysis. In addition, categories of description should be explained in detail and supported by appropriate extracts from the transcripts.

An outcome space is present in all but two of the studies however the way in which the outcome space is presented varies across studies, predominantly shown as either a diagram or a tabular structure.

Baughan (2017) states that many phenomenographic studies will yield a single outcome space but acknowledges some will yield more than one depending on the research question and the nature of the data collected.

Two types of outcome space are created by Pitt (2014), one which presents emotional and behavioural responses to different types of feedback, which is acknowledged by the author as a divergence from the phenomenographic approach, and one which attempts to represent the variation in meanings in a hierarchically organised manner. This second type of outcome space is actually presented as two outcome spaces depicting conceptions related to good and poor grades. A singular outcome space, with dimensions of variation related to good and poor grades, may have been a more useful approach.

Iyer (2018), in considering approaches to learning of architecture students, conducted interviews at four institutions and presents four outcome spaces, one for each institutional context. This seems logical, given the earlier discussion about context and consideration of the 'whole'. In this case the whole would be the institution, hence the separation of transcripts into four sets of data and the construction of four outcome space. Casey (2016), adopts a different perspective. In relation to the research questions posed in the study two sets of outcome spaces are developed: one outcome space examining the understanding of

Masters level learning and two outcome spaces examining conceptions of processes of learning in a networked learning environment.

Overall, analysis of these studies has confirmed the wider lack of consistency in how researchers have interpreted phenomenography and presented their results. In that respect the analysis was useful, in that it demonstrated that I was not alone in questioning what constitutes a 'valid' approach.

Having surveyed the literature on phenomenography and how researchers have employed it an approach to the use of phenomenography is proposed as follows:

- Transcript analysis will follow the Akerlind method, examining utterances in context, rather than creating a decontextualized pool of meanings.
- Since there are examples of studies that present multiple outcome spaces, justified in terms of the context in which interviews were conducted, an outcome space for each cultural context may be the most appropriate approach.
- Categories of description will be generated for each context. Additionally, attempts will be made to identify dimensions of variation and referential and structural aspects which will be used to provide a more complex analysis.

Comparison of these outcome spaces will subsequently allow for an analysis of differences across the cultural contexts, if they are found.

3.9 Quality of the study

Traditionally, the words *validity* and *reliability* are used by researchers in discussing the issue of quality. Some qualitative researchers have rejected these terms on the basis that they stem from positivist epistemologies that do not correspond to qualitative approaches and instead prefer to use terms such as *trustworthiness*, *credibility* and *confirmability* (Kvale and Brinkmann 2009). The issue of quality, including the ways in which could considered in the context of this study, will be discussed further in this section.

Flick (2007) distinguishes between internal validity (the extent to which the observed effects are due to the manipulation of an independent variable and are not influenced by other factors) and external validity (the generalisation of results to other situations). Reliability is framed as the trustworthiness and consistency of the research findings, such that the findings are reproducible at other times by other researchers.

3.9.1 Validity

Validity is considered in terms of quality of craftsmanship and validation is seen as a quality control mechanism that permeates the entire research process. Kvale and Brinkmann (2009) suggest that validity can be applied at various stages of the research process: thematising, designing, interviewing, transcribing, analysing, validating and reporting.

Åkerlind (2012) contends that the view of validity as the extent to which it investigates what it sets out to investigate, or that the findings reflect the phenomenon being studied, is not appropriate in the context of phenomenography. Instead, the researcher should consider how well the research outcomes correspond to how the participants experienced or understood the phenomenon.

Two types of validity are identified by Kvale and Brinkman (2009): pragmatic and communicative, where communicative validity is concerned with the researcher's ability to argue for a particular interpretation of the data and pragmatic validity is the extent to which the research outcomes are considered useful and provide value to the research community. Pragmatic validity in the context of this study could be achieved through presentation at conferences and publication in peer reviewed journals. Communicative validity could be achieved through the viva-voce process, in discussing the study with the examiners.

3.9.2 Reliability

Cope (2004), in discussing the concept of reliability and the replicability of results, suggests that replicability is not a useful measure in the context of a phenomenographic study, where the researcher's relationship with the data may be unique and the outcome space constructed by other researchers examining the same data may not be the same. Instead, the phrases *interjudge reliability* and *interjudge communicability* are proposed, where the researcher clearly communicates the process of interpretation.

3.10 Summary

In this chapter, the rationale for an interpretivist stance was presented and specifically the phenomenographic approach was presented and discussed. The differences between phenomenology and phenomenography were discussed. The core elements of phenomenography, namely conceptions, categories of description and the outcome space, were discussed. The various approaches to data analysis were examined, in order to identify the approach taken for analysis of interview transcripts in this study. Limitations of the research approach were also discussed.

4 Findings

4.1 Introduction

The previous chapters discussed my understanding of the phenomenographic process and my attempts to make sense of the multiple approaches to presenting the outputs of phenomenographic studies.

My research question was concerned with student understandings of mobile learning across differing cultural contexts. Having analysed the three sets of interviews that represent each cultural context I will present three outcome spaces that describe conceptions of mobile learning for each group of transcripts. A description of the categories of description generated for each set of interviews will be presented, supported with extracts from the transcripts that highlight the structural and referential aspects of each category of description. Each outcome space will attempt to highlight how the categories of description follow an inclusive hierarchy within each context. Where variation occurs across the categories of description this will be described using Åkerlind's concept of themes of expanding awareness.

4.2 Findings from analysis of interviews transcripts from the UK context

Three categories of description related to conceptions of mobile learning emerged from the data analysis process.

These categories of description, from category 1 to category 3, present the increasingly complex ways in which mobile learning is experienced. Table 7, below, is a graphical representation of the relationship between these categories of description.

Category 1: Experiencing mobile learning as creating and accessing learning resources.

Category 2: Experiencing mobile learning as learning related communications using mobile devices.

Category 3: Experiencing mobile learning as learning related collaboration using mobile devices.

Table 7: Hierarchically related categories of description of mobile learning, UK context

What follows is a more detailed analysis of the utterances that relate to these categories of description, the structural and referential relationships identified in these utterances and the expanding theme of awareness that describes the increasing complexity of these categories of description.

4.2.1 Category 1: Experiencing mobile learning as creating and accessing learning resources using mobile devices

The key focus in this category is on the ability to access and create learning related resources and information, in a variety of formats, at differing locations. These settings are both inside and outside of what is considered the 'formal' class or lecture. The structural aspects of this category focus on convenience and accessibility in terms of looking up course related information and capturing or creating course related notes and material, where students describe the affordance of mobile devices in relation to other technologies that can be used for learning. Referentially, the act of accessing course material or

searching for information is seen as self-directed and individual as opposed to tutor led or as part of a group.

Mobility is a key aspect of this category of description, where mobile devices are used across a variety of contexts, for different purposes and at different times. A number of participants described accessing resources whilst on the move:

> If you're travelling by public transport in the train or the bus you can look through your notes on the phone and your tablets and stuff like that so you can do it a variation of everywhere you can go out (UKP7, page 2)

> If you're outside of a session, you've got your phone, you're by yourself especially if you're waiting for a bus or something, convenience, and it breaks down the time between leaving somewhere and going somewhere else (UKP4, page 8)

> I do a lot of my mobile learning on the bus, so between home and college I read a pdf or newspaper (UKP5, page 3).

> Cos I have children, a lot of my free time is the journey between, so between dropping them off and picking them up or between college and home I tend to do reading pdf's or newspapers, so that is obviously kind of my mobile time (UKP5, page 4)

Other students describe mobile learning as accessing resources and information at locations outside of the classroom though this is qualified by the availability of associated infrastructure i.e. connectivity that enables such access:

> I'd say, have you seen like the student area where all the tables are? Doing it in there, doing it in different places around the college. Like, outside, wherever there's free wifi, in the libraries, anywhere there's free wifi. Like, you may do it like in the shopping centre or something, in your break, where they got free wifi (UKP2, page 3).

Portability is seen as the primary characteristic of mobile devices that enables access at different locations, particularly when compared to other technologies that can be used for learning. Laptops were also considered to be portable, but differences were identified between laptops, tablets and mobile devices that were either drivers for, or barriers against, using them in certain contexts.

When comparing mobile phones to other devices, students identified several factors that impacted on the decision to use a mobile phone over a desktop pc or tablet, including the availability of laptops and pc's at different locations, the need for additional space as well

as charging points when using laptops and the time taken to get the laptop to a working state or connected to the network, compared to the 'always connected' functionality provided by a mobile phone:

> The laptop doesn't come out with me because, it's the places…it's like if I'm coming to uni, there's.. to carry the laptop I feel there's no need because all my work is shared in the cloud and dropbox and stuff so whenever I come to uni I can just use the computers we have on site.

> …just generally on the motorway journey, three hour journey or if you're on a train I think it's more convenient as well and it's easier, you can take your phone out straight away and it's quick, only takes a couple of seconds and you're where you're at, where you want to be where a laptop, getting it out and starting it and stuff then looking for a space in front of you really to use it, on a laptop you need to sit down and use it whereas a mobile you can walk around and use it, that's probably why you use a mobile a lot more (UKP7, page3)

> I mean it is mobile in the sense that I take it everywhere with me, I can just pick up, say if I do my work on my laptop rather than my computer I can just pick it up and bring it to the lecture like I did the other day and it's all there but it's a bit…I find it harder to carry, you need a charge all the time in the bag for it. Phone I just put in my normal bag, in my pocket (UKP8, page 6)

> I would say a laptop's very stationary, regardless of where you are you still need something solid to put it down on, whereas I do a lot of my mobile learning on the bus (UKP5, page 3)

> I mean if my laptop is in front of me and it's just something quick, if I have to connect to wifi or something and my phone's just there I just use my phone (UKP3, page 5)

> Yeah, places where you couldn't really learn because it required like the pc or laptop, you could…like waiting in a doctor's office for appointment, relative's house and you ain't got access to a pc, you could use your phone (UKP6, page 3)

Conversely, a distinction is made between mobile devices and desktops/laptops, where the physical characteristics of the mobile devices e.g. the smaller screen and lack of keyboard, are such that prolonged work activities, such as writing assignments are more likely to be conducted on desktops and laptops:

> I use my laptop more for university, although I can work off my phone it's very… it takes up a lot of power and doesn't look the same, Microsoft Word doesn't, so it's much easier to format the document on the computer (UKP2, page 2)

> I'd go to my pc. Personally my pc's set up as dual monitors so I can like, be… have the information on one screen and be actually doing the work on one screen. It makes work a lot easier and again my phone, me being big handed, it's a lot harder. I use it for about ten minutes and then I get a bit bored (UKP6, page 5)

> What I mainly use my laptop for is work, so I'll get my uni work up on my laptop. I can't do it on my phone cos with this phone I haven't got notes or anything… I mean I've tried it, I think it's cos the layout on a phone's so different to on a laptop. On a laptop I can see , like, the title and the paragraph how much I'm writing, like how it looks. On a phone it's just a big block of text and it kind of puts me off a bit (UKP8, page 4).

> I definitely research more things on the laptop, I think it's because it's bigger as well. Some websites, they're a lot easier to look at when you're online. Yeah and because, say if I'm doing work, I do that on a laptop as well. I wouldn't do work on a phone…too small, haven't got the Word document things on the phone that are as good as the computer (UKP1, page 2).

Participants also made a distinction between planned and unplanned activities, where mobile devices would be used for ad-hoc activities and alternative technologies, such as laptops, are not available or convenient to use, or their use has not been anticipated in advance:

> …my laptop only comes with me when I know I'm going somewhere to sit down and do work that's not at home. So if I know I'm going to uni and I'm going to end up doing work then I'll bring it (UKP8, page 6)

> …if I am going to do something on Moodle it tends to be planned. So like this afternoon I'm gonna go on Moodle and I'm going to look at what I'm doing and write the assignment. If it's already planned then I've already got preparation for it, I've got my laptop or my friend's computer. So that's more a planned thing, whereas doing things on my phone is more 'I can do that quickly now, I've got thirty minutes' (UKP3, page 4)

Where mobile devices are used for creating material, it is predominantly to create short notes, capture material generated in teaching sessions or to use features of the phone for creating resources for use in assignments, which are subsequently transferred to a desktop computer or laptop for further development:

> I've done research as well. A couple of weeks ago, every week we used to have a presentation give to Alex and on the way home on the bus, this is before I had my car, I'd search online for articles about that sort of thing. Say I was doing something on Steam, I'd

search for Steam and then I'd see the information that was on the page and then I'd copy the link and I'd actually send it to myself or email it to myself so when I get home I could look at it on the pc (UKP6, page 4)

I use it to take notes, for my assignment, start writing my assignment (UKP1, page 2)

Previous phone I used or work a little bit, it had like Microsoft Word on, it was a blackberry. So I was allowed to do little bits, like notes in class. Instead of like writing it down because I don't like writing it down. Plus typing it was gonna be a bit of a hassle to log on so I just quickly whipped out my phone and just types in the notes that we needed, that was a lot easier (UKP6, page 2)

You know, we had a teacher who showed us a piece of work that was on the board, that a lot of people took pictures of to keep in their phones, cos it would have been a lot easier. We do that a lot. With my phone I've got loads of pictures of just the board, cos it's a lot easier than taking the notes down, we can just take a picture of it (UKP6, page 5).

I used it last year because we had to make an animation. So I'd use my phone to record, like record us building the stuff and I'd put it on the computer then (UKP2, page 4)

We was told to record ourselves doing like certain projects. So, instead of having like, to get a screen capture or a record just simply get my phone out, record on that, especially with the resolution and the…it captures your voice really well.

Mobile devices are seen as providing immediate access to information. Participants talked about accessing course information, such as schedules and timetables, as well as results and feedback. Participants also described accessing course related resources through the Virtual Learning Environment associated with their course e.g. Moodle.

I'd be looking at the course. I've read things on Moodle actually, so opening pdf's, reading those articles, that sort of thing. Um, looked at what we do next week…I've checked my grades, did that on the phone (UKP3, page 5).

Yeah I've used my phone for Moodle and I've looked at assignment feedback using my phone as well and assignment briefs and journal articles on the phone, of Moodle (UKP1, Page 5)

The home page, going into the actual course itself. Just looking at assignments, checking on hand in dates for assignments (UKP4, page 4)

Additionally, students described searching for information via their mobile phones, for example where a conversation with students or a topic raised in class would prompt them to search for additional resources or to look up definitions of terms:

> Like obviously if I need to for some reason look up the definition of something and I'm out somewhere I'll use my phone if it's quick (UKP8, page 5)

> Probably talking to somebody more than somebody talking to me in a lecture. Me talking to somebody and them saying something to me, what does that mean? I'm not really sure, I'll just Google it. It's quick, easy, already in your pocket rather than going to find a computer and also it's got 3G, 4G (UKP3, page 4).

Students described themselves as the primary instigators of mobile device use, as opposed to being directed to use their devices by the teacher. Examples include students using the calculator facility or creating content for an assignment and using mobile devices when classroom-based resources were unavailable e.g. for viewing lecture slides and using mobile devices to follow up topics discussed in sessions e.g. searching for definitions.

> No we wasn't told by our tutor. It was more something that we learnt to use (UKP7, page 4).

> It wasn't the teacher teaching me stuff. It was sort of like general things that you don't really need somebody there to tell you to do (UKP2, page 4)

> In a session. Actually, in this situation the projector didn't work in the classroom and one of the students suggested oh if the projector's not working you could just look at the Powerpoint on your phones.

> I would say if we were working on a calculation the tutor would say then oh somebody have a look, what's this times this on your phones, that's been said before (UKP1, page 7)

However, students rejected the use of more formalised uses of mobile devices, viewing them as supplemental to the teaching not a replacement for the teacher. Students also cited concerns around mobile devices being a distraction, students not focussing on class activities and the extent to which students would be able to engage in formalised activities because of the diversity of devices and their capabilities:

> I think it would be OK if it wasn't essential to the lesson cos say, someone, people probably wouldn't have an Internet, the wi-fi's not very good…you don't know whether people are actually learning on their phone, perhaps the tutor would know that's what they are doing (UKP1, page 7)

That would probably seem negative to me. It feels to me too many opportunities for immature students to not participate. Such that you'd then have a reason to look at your phone if it went off, which during the time of the lecture for me I'd expect the majority of the attention to be on the class. When we first started we had a lot of students who would just sit on their phone and not work and then they would come ask me, what was this, what do I have to do, what's this model and it would end up wasting my time (UKP5, page 12)

In the session we have like the teacher there, whereas out of the session we could use our phones to message the teacher but inside the session we already have the option of the teacher there plus in the session you don't really need your phone to communicate with other peers as well, cos they're actually in the session and also the fact that everything you need software wise would be in the college on the pc's in session, so I think you'd use your phone outside the session when you don't really have access to those things (UKP6, page 10).

Cos I like being…if I'm sitting down in a lecture and I'm learning something new I like being focused and just engaged in that. I don't wanna go on my phone. I prefer everyone learning together sort of thing and a powerpoint or like, I don't know, I prefer one to one learning with like, actually being spoken to me. If I knew we were going to be learning through my phone I'd probably get really bored and I'd get unmotivated to do my work (UKP8, page 8).

I would definitely say use your phones outside the session unless the tutor says to you OK I need you to take out your phones to do this particular bit. I feel once the teacher's teaching all the focus should be on what they are saying, then the mobile should only be taken out outside of the session because that's when, you know, should be time to interact. When you're in the session you're all in there, everyone's there you're all face to face there's no need to communicate over the phone. To do your work you've got your computers there so using your mobiles is like a distraction in the session then, it can be considered (UKP7, page 10).

I think it would be a struggle to use phones as part of learning in lectures and things. I mean of course everyone has one but they're all different, people have different abilities on their phones. Some people are never on their phone, some people are always on their phone. I think they'd have to be prepared for some people to be limited as to how good their work, the standard of their work's going to be if they are using a phone. There's people like me who will have to learn to do something before they do it, I'd have to learn how to do the thing on my phone and then do the work (UKP8, page 9)

I don't think the phone could replace the tutor. I think if the tutor was not in that location and the phone was the medium of them kind of expressing the seminar or whatever they

> discussed that's fine but while we're in person I think the mobile phone is still a rude version (UKP5, page 13)

4.2.2 Category 2: Experiencing mobile learning as learning related communications using mobile devices

The key focus in this category is on facilitating learning related communications via mobile devices. Communications are either student to student or student to teacher. Participants outlined aspects such as synchronous versus asynchronous communication, formal and informal communications (and the tools used to facilitate them) and issues in terms of meanings and intents when engaging in face to face or technology mediated communications. Referentially, the students position themselves as individual learners consulting with peers and tutors as part of a process of engaging with learning tasks and task requirements and using mobile phones to schedule learning interactions.

Communication is described as a key feature of mobile devices, across a range of tools and features available on mobile devices including SMS, group chat, video calling, email and voice calls:

> Talk to my friends, probably using whatsapp, that's probably the most. Social media websites next…Instagram, least probably shopping…I'd feel lost without it, I don't know what other people are doing otherwise. The other ways of contacting people would be on a computer, laptop maybe, it's convenient to use your phone (UKP1, page1).

> Yeah, usually communication. I get emails from lecturers straight through on the phone (UKP5, page 1)

> I use it for three things. I use it to communicate with my family, one, I use it for social media as well – Instagram, Facebook, Snapchat, I also use it for emails as well. Emails from college, finance, work (UKP6, page 1)

> Phone calls. When me and the students can't talk about assignments or work in a group we tend to use the whatsapp or Facebook (UKP5, page 1)

Mobile devices were described as enablers of synchronous and asynchronous communication. Students described using whatsapp, a tool for synchronous

communication as well as email, which is described as asynchronous. Synchronous communication is favoured over asynchronous communication in terms of the immediacy of response, messages sent through SMS or apps such as whatsapp are seen as requiring immediate attention. The ubiquity of the device and it's 'always on and always connected' nature was seen as advantageous in terms of facilitating communication. Being able to ascertain if other students are active i.e. available for synchronous communication is highlighted as another feature of some of the tools used on mobile devices:

> …with messaging say if they used whatsapp I could know if they read my message or not. When you send a message, say if I sent a message to you if you do view it, it will show two blue ticks and if you haven't viewed it, it will show two white ticks. I'd like to think that I'd respond straight away and I like to think the person I'm talking to would respond straight away, that would be the reason why you're using the messaging system instead of email. The whole point of messaging is fairly instant, whereas email is like I could email Alex and he would read it tomorrow and reply to me another day (UKP6, page 8).

> If I'm stuck I'd always talk to my friends about it or if they're not there I'd text em (UKP2, page 5)

> …we were talking about what was the best way to communicate, cos obviously emails are great but you don't know if other people have seen it, not everyone sees the email straight away, whereas we all downloaded the whatsapp application and you can literally see who's seen it, who's replying to it, you can track the message backwards (UKP5, page 5)

> …when you see a text message appear on your phone you instantly go ok, let me read this or let's see what this says. When you see an email you tend to leave it, some people can leave it for a few days, weeks even months. People don't check their emails (UKP7, page 8).

> If they don't answer my text I usually go on Facebook messenger and I'm a bit of a stalker and I see when they were last active. If it's been hours I'm like 'they won't see it so no point' but if they are active now I message them then (UKP8, page1)

> It's easy, I can send a message and whoever I'm sending it to can pick it up when they're ready, whereas a phone [call] they've got to be there ready to answer my phone call, it's not always practical. Something like whatsapp also tells me who's seen the message and when they saw it (UKP5, page 1).

> Communication wise with students we're…in my class we're quite good we've all got ourselves in a little group, a whatsapp group, so we're always communicating with each other. So we're actually quite close in the class in terms of each other (UKP7, page3)

In this category of description communications include clarifying assignment requirements, communicating either one to one or in a group with other students, communicating with the tutor, sending notifications, checking on availability of students or teachers and making arrangements to meet either the tutor or other students.

> The thing I do most is probably texting, cos I'm quite busy in the day and I usually see people in the day and I have to schedule my day so I end up texting people and seeing if they are still free to do whatever…(UKP8, page 1)

> I've used it to communicate with my friends about assignments, if they're stuck or I'm stuck we'll text each other (UKP2, page 4)

> …like this morning I used it to check my webmail to see if you'd emailed me back. I check it regularly to see if [tutor name] has emailed me back about some work. I'll usually email him about something (UKP8, page 7)

> Yeah, it'd be like '[student name] can you come on the Skype in ten minutes so we can talk about the work'. My phone is solely like communication, not work based (UKP6, page 11).

> …they set up forums for us to use in our own Moodle accounts for us to communicate but we felt as students, maybe…what's the term, if we could exchange all the numbers and make a group it could be easier. We're all in one group and then we've also got subgroups, little ones where we're in little teams for like group projects and stuff like that. You can communicate and it makes it easier and quick to say we've got this deadline to do this, you need to get this done so I can do this part of the coursework and then in terms of that way, it does help (UKP7, page 4)

When considering synchronous and asynchronous modes of communication asynchronous communication is described as requiring more planning and preparation in terms of creating messages and responses. A distinction is also made between the informal language used on tools which are synchronous, such as SMS and whatsapp versus the more formal language used in asynchronous tools such as email. Participants described drivers for moving from formal to informal modes of communication, where increased levels of interaction and trust and perception of a lack of hierarchy between participants enable the transition into less formal modes. Where students communicate with each other using a variety of tools, with a preference for asynchronous communications and less formal language, students use more formal approaches with their tutors even if given the choice to use less formal methods of communication, thus maintaining a hierarchical relationship

with their tutors when using these tools. The tutor is positioned as someone who exists outside of the informal spaces in which students interact with each other using their mobile devices, partly in deference to their position as teacher but also because they have not crossed the social boundaries that separate staff and students.

> Yeah, text is more personal. It's for…you know, text language, like shortening words. I wouldn't do that on an email, I'd always keep it like formal. Yeah, sort of like post really. You wouldn't write a letter to somebody like really shorthand, you'd have to lay it out properly and things. (UKP2, page 10)

> In college, or the first two years of when I was in uni, because I was friendly with people, I probably would use it for that, because rather than emailing and stuff we would text, whatsapp, that sort of thing so we had a whatsapp group. Whereas here, I'm only here part time. The people who I am in groups with I'm not, I wouldn't say I'm friendly with, I don't have their number they don't have my number so it's more of a professional computer, laptop, email system rather than friendship, social thing which it was in college because I was there full time, we spent more time together. If it was Abbie I would text her, I wouldn't email her because she's my friend, whereas everybody else I only see them two hours a week it's more for a professional thing so it's email which for me is a laptop (UKP3, page 4).

> The tutor isn't more your friend, like. (UKP4, page 7).

> I think it's a bit of respect to be honest, email seems to be the formal medium. I see email as kind of like the evolution of a letter, that seems to be the formal option to me. Because I have respect for my tutors I would send them an email, whereas text message or whatsapp seems to be something I do with my peers or my family (UKP5, page 11).

> I think it's awkward. Cos he's a lecturer, there's like a barrier. I don't know, cos he's not my friend that I see outside of uni. So I'd email first and then I'd get a response and then, or if I didn't get a response and I needed to know I'd text, or whatsapp or ring (UKP1, page 12).

> It just seems, how can you put it? The tutor isn't more your friend, like. When you're friends with people you've got more of a tight bond, so to say. You'll be fine with texting them because they'll have your number. It's more unformal. So it's more, you want it formal sometimes it is the person you're also looking up to, a role model sometimes (UKP4, page 7).

> I mean there's boundaries, like for example when I scheduled for my work placement I got [lecturer name]'s number so it would be easier to see when he's outside the store so I could got and get him to bring him in the back when I was doing my placement and stuff. I didn't

> know what to do, sort of thing. Is it weird to text your lecturer? It's not weird it's just not something people are used to now. I mean in like 10 years it'll probably be a normal thing. I think it's just because students are so used to seeing their lecturers on a professional level, phones aren't really professional usually. The numbers you have are family and friends, you don't really have anyone else's number…It's just knowing that boundary, you don't wanna cross a line you're not supposed to. Like, texting them too late or something, and then it's like the fear of making things weird in the lecture I think. (UKP8, page 13).

Students highlighted issues arising from technology mediated communications, in particular the preference for face to face communications because it is easier to discern the meaning of what is being conveyed through the use of visual cues such as facial expressions and body language. This covers both student-student and student-teacher interactions.

> The only thing with having phones, a lot of the arguments I have with my wife is because we misread. So you've got, you can't come across sarcastically or jokingly on a phone, it's the plain text. So what you think may be acceptable because the person knows what you mean, that you give over by the tone of your voice or even by your language you don't get with the phone (UKP5, page 9)

> You can't always express what you mean on text, sometimes it comes out all wrong and you can probably be judgemental and not mean it and then it comes out a bit nastier than it sounds. You have to be careful how you type things, where if you're seeing face to face it's easier (UKP1, page 10)

> …me personally I tend to go on emotion as well, how the teacher is saying it like 'Oh [name redacted] that was really good', you can't really convey emotions through an app or online. It allow me to assess the situation, like say if I'm asking the teacher 'how do I do this, how do I do that', if they're a bit snappy with me or like if they're a lot more lenient with me I'll understand the severity of the situation. Whereas if someone was texting me, like 'you've got an assignment tomorrow', but someone saying 'dude, you've got an assignment tomorrow' there's a sense of urgency there, you wouldn't get that through an email (UKP6, page 6)

> Yeah, because I'm, like I said before, I'm quite an honest person. Sometimes if I write something you won't hear how I say it, how I'm putting it across and it'll come across wrong to people (UKP8, page 13)

> Cos when you post it people can read it a few times before they decide to plan on what they are going to say, whereas if you're sitting, if someone's there can you just have a quick look at this, you can see their facial expressions. I think it depends on what it is. If it's group

> work I prefer face to face, 100%. If it's asking me a question about my assignment or me asking them a question, like you know just 'I'm a bit confused on this, what have you done' I'm alright on that with whatsapp or facebook, cos it's brief. Obviously face to face is gonna be easier because it's quicker responses, you can get what you need, but I would have issues with…if there is none (UKP3, page 10)

> If it's face to face you'll know exactly what they mean and they'll probably go into it, if you ask them what they mean, you'll get that understanding straight away but if you try and email them back you'll be waiting another hour or two before you get a reply (UKP4, page 7)

Mobile phones are viewed as personal devices where certain characteristics, such as the phone number, are linked to a student's identity such that sharing these details can lead to an increase in perceptions of closeness amongst the cohort, though some participants expressed reservations about sharing their phone number with others:

> …in the first year after a couple of months in, we all, everyone exchanged numbers and put into a group and our group was really good, you didn't feel it was just you in a group but you felt you was actually in a group. My bond now with classmates I've got is very, we've got a very strong group, we all know each other, you can speak to them all the time..(UKP7, page 10).

> It was a little weird last year when I met my classmates for the first time. Because we were doing group work, making a film together, we needed a way to contact each other if we needed to so we all exchanged numbers. I mean it's a bit weird, like I didn't use…if I wasn't personal friends with them I wouldn't use their number, I literally text them every now and then, if they're running late 'are you coming in' or 'are you coming on set to do this thing'. I don't think I had them on Facebook or anything I thought it was a bit weird (UKP8, page 14).

> It depends on the kind of information they want you to share because I wouldn't go round the class and give everybody my number because I wouldn't want to. Whereas I wouldn't mind if he [the tutor] said add each other on Facebook. I'd be alright with that. Though I don't know why because you can get more information from a Facebook account than a mobile number (UKP3, page 13).

4.2.3 Category 3: Experiencing mobile learning as learning related collaboration using mobile devices

Students aligning with this category of description see mobile devices as offering opportunities for a collaborative approach to learning. The focus in this category is on sharing resources, comparing and contrasting work and offering feedback and motivation to each other. Referential aspects focus on collaborating with others, when undertaking group tasks, in order to enhance the collective understanding and attainment of the group and using mobile devices to organise and allocate tasks associated with learning.

Whilst working on individual assessments some participants described the sharing of resources related to learning, such as articles and research, with the intention of creating a shared knowledge base. Students described how they would discuss their interpretations of assignment tasks, use tools such as Whatsapp to clarify understandings amongst the group about aspects of the learning and use their phones to capture, share and discuss screenshots of work in progress. Whilst some students described comparing their work with others, others expressed reservations about sharing extended extracts of individualised assignments due to concerns over ownership and plagiarism:

> …what I tend to do as well is when assignments released for our course I tend to text our friends on what they're gathered, like references wise and I'll check it out and they'll send it to my phone…Yeah we tend to look at each other's work just to have a reference point (UKP6, page 4)

> On the phone as well you have a group chat so I can talk to like 6 people at once in the same chat and send photos between each other…(UKP1, page 3)

> We might have discussed the work, but not physically done it on the phone. Yeah, what do you think we should do for this, I am doing this way, do you think this is going to work? (UKP1, page 9)

> You could send across your code but some students prefer, because it's your work, to send that to everybody you don't want it to become, where it could become risk of being plagiarised (UKP7, page 6)

> …a lot of the coursework we tend to, not share as in depth because we don't want to be caught in plagiarism and be too similar to other people, but we do share a bit of content if we've found a good source or if I'm doing my research and found a source that might

> benefit someone else we'll share that. Yeah it would generally be the plagiarism, also not every student puts the same amount of work into the reports as I do and I would rather not have something I've worked with four or five days on, giving them the answer… (UKP5, page 7)

Group tasks and assessments are where students use mobile phones to work collaboratively and develop a collective construction of meaning, where synchronous tools, such as group chat, are preferred over asynchronous tools such as email. However, as with the previous category of description students expressed a preference for face to face interactions over technology mediated, citing the ability to motivate each other and focus on the task:

> When we have group projects I tend to use Whatsapp to discuss or pass ideas through…We talked about the learning. We weren't always clear on some points but we weren't together to talk about it so we were using each other as sounding boards, do you think this is right, is this right…Say we've got the work on screen and it was a diagram, we take a photograph and say, is this right, has someone got something similar or am I going completely off? (UKP5, page 5)

> I'm more of a fan of in-person sort of thing. If someone's talking to me in person versus like on a phone and on a phone they get distracted. You'll be talking to someone about something important and they just forget and you won't get a reply for like ten minutes and it's 'oh, it's fine it's only on my phone anyway'. If you're there physically with someone, you like make a meeting, then it'll take priority over the phone, sort of thing (UKP8, page 11)

> I'd do face to face cos I can always trust my group members and they're actually doing something. If it was over the mobile device I think everybody would leave it until the last second to do their bit and I think face to face you can encourage each other 'oh I've done my bit, how much have you done' (UKP2, page 9)

Students describe using mobile phones as tools for planning and allocating tasks and monitoring progress of group members, before arranging to meet to complete the assembly of the final submission. Again, face to face interactions are preferred in the final stages of group tasks in order to assemble the final piece and act as an incentive to complete the work:

> Everybody would just choose which [unintelligible] they're gonna use and then discuss it over, through the group chat., which is easier then co you don't have to meet up with people from five places, plus sometimes with group work it doesn't always get done so then when you bring it all together there's, think a bit less maybe, so it does work all meet up

together you're more inclined to do it than if you're texting somebody yeah I'll do it (UKP1, page 8)

More of the time it's like chatting about OK, we've got this to do, we all have to do it by this day and just general like we've got this plan then this meeting, we've got a review meeting at this time we need everyone to turn up on this time, on this day we'll need your piece of work submitted to know, like, say you've done procurement, we need your procurement done, we need your risk analysis done, we need your quantity report done, we need all that back, so I can look through let's say the scope and see if it's correct (UKP7, page 4).

I think it would be difficult to do something like a presentation on your phone. Purely because for me it hasn't got the same…It would be a different format to what we're used to so I don't know. Maybe just planning rather than actually doing the project so rather than actually create the presentation on there more of a planning mechanism, you do this I'll do this, go away and do it, come back and say right I've done it shall we meet up to show (UKP3, page 8)

For me personally meeting face to face is a good way of seeing how people actually feel on what we've produced on the presentation and it gives people more of a chance to put more into it because sometimes I feel over the phone and over the Internet people can be quite reserved in what they want to say and in person they might be more open minded, more open to giving out their ideas and stuff. So when we're all there it kind of makes…everyone's working as one unit, whereas on their phones some people might be working at this time and others might come in the night and some in the day. It's all spread out so it's not really too much linked, we're not always at the same time on the phone.

Whilst expressing a preference for a face to face session to complete the group tasks, students described using mobile devices to provide feedback to each other on work in progress:

Yeah, what do you think we should do for this, I am doing this way, do you think this is going to work? (UKP1, page 9)

Yeah, like a mate of mine, he sent me a piece of work and I realised something was missing on his. Instead of just leaving it I actually told him where he could have lost marks. It was a genuine mistake, he genuinely forgot it. Having me look at it made it so he got those marks instead, it was like two diagrams missing (UKP6, page 7)

> We talked about the learning. We weren't always clear on some points but we weren't together to talk about it we were using each other as sounding boards, do you think this is right, is this right? (UKP5, page 5)

> We did a…one of our first projects we did a PESTLE analysis and one of the guys had over simplified a process and then to combat that he'd on the next thing gone too far into the process. It was a case of this one's too shallow and this one's miles too deep (UKP5, page 6)

4.2.4 Structural and referential relationships and expanding awareness

Table 8 shows how there is increasing complexity moving from category 1 to category 3. Referentially, whilst retaining the concept that the mobile device is a supplemental to traditional i.e. class based face to face learning, variation in meaning moves from the student experiencing mobile learning as an individualised activity, where mobile devices are used to assist with learning separate from other learners, to mobile learning as learning that happens through connecting and collaborating with other learners.

Structurally, there is increasing complexity from a focus on device aspects, mobility and technical competence at the lower level, to a focus on the various modes of communication available and how meanings associated with communication are expressed, to a focus on how students work collaboratively towards group tasks whilst being mindful of ownership over aspects of their own work.

Category	Structural (aspects of phenomenon)	Referential (mobile learning is about)
Category 1: Experiencing mobile learning as creating and accessing learning resources using mobile devices.	• Aspects/features of device : battery; screen size; apps e.g. notes, camera; portability; connectivity; ease of use • Time • Location • Formal versus informal (location) • Availability of alternatives • Technical competence	Facilitating individual knowledge creation and access to information

	• Planned versus unplanned • Student led versus tutor led • Distraction	
Category 2: Experiencing mobile learning as learning related communications using mobile devices.	**As in Category 1 and includes:** • Meaning/emotion • Tools used for communication (SMS, email, chat) • Synchronous vs asynchronous • Face to face versus technology mediated • Focus of assignments • Formal versus informal (communication)	Facilitating connecting with others in order to develop their individual understanding.
Category 3: Experiencing mobile learning as learning related collaboration using mobile devices.	**As in Category 2 and includes:** • Plagiarism/ownership • Group versus individual tasks • Feedback • Motivation	Facilitating collaboration with others in order to share resources for individual and group tasks

Table 8: Structural and referential relationships, UK context

Using the framework of a theme of expanding awareness, as described by Åkerlind (2005), there are distinct themes that emerge from the students understanding of mobile learning, which are evident across all categories of description and show how they are interrelated. Table 9 elaborates how variation occurs across the categories of dimensions in five themes: learner positioning; context of use (location); task focus; learning interactions and tutor role, with variation in these themes demonstrating an increasing level of complexity moving from category 1 to category 3, with one exception which will be discussed later in this section.

Themes of awareness	**Category 1**	**Category 2**	**Category 3**
Learner positioning (relative to cohort)	Individual	Individual	Part of collective
Context of use (location)	Formal and informal	Informal	Informal

Task focus	Individual, knowledge enhancement	Individual, clarification of understanding, scheduling	Shared knowledge base, planning
Learning interactions	One way Tutor – Student Student – Resources	Two way Student – Student Student – Tutor	Two way Student – Student
Teacher role	Signposting (of resources), notifications	Answering queries	None

Table 9: Expanding themes of awareness, UK context

In category 1, Learning interactions are one-way, either signposting of relevant resources by the tutor, course related notifications sent by the tutor or institution or students accessing materials through their mobile devices. Students position themselves as individual learners in relation to the other members of the cohort and the context in which they use mobile devices is across formal and informal locations i.e. in class and outside of class. The focus of tasks, when using mobile devices, is on enhancing their individual knowledge and aspects of the devices that are focussed on are those that enable access or capture of course related information or resources. Learning interactions are focused on either the resources made available by the tutor or those located by the student.

In category 2, two-way learning interactions occur between students and teachers, where both are seen as sources of clarification in terms of developing their understanding, but these interactions are aimed at enhancing an individual's understanding as opposed to that of the entire cohort. These communications occur outside of the formal context of the classroom, where the classroom is seen as the point at which staff and students are simultaneously 'present', without the potential for distraction that students see as an inherent characteristic of mobile devices. The focus of the device is on facilitating communication with teachers and peers in order to consult on aspects of their learning and

to *schedule* learning interactions i.e. discussing *when* they happen. Students, as well as the teacher, are seen as valid sources of clarification in this process.

In category 3, a two-way dialogue occurs between students. Students view themselves as part of collective contributing to the development of a pooled knowledge base that benefits all participants and devices are used outside of the formal classroom to *plan* learning interactions i.e. *what* will happen and *how* it will happen. This is distinct and more complex than the previous category where the focus is on *when* these interactions happen. The device focus is on two-way dialogue and tools that facilitate this. Learning interactions are between students, the tutor is absent from these discussions.

The absence of the teacher in the most complex category of description is significant. Where students may be guided by the teacher in terms of course material or use the teacher to clarify aspects of their learning in the first two categories, the tools and spaces used to construct their collective knowledge base in response to group tasks are used and inhabited exclusively by students. Some of the student utterances reflect on this positioning of the teacher outside of the spaces used for dialogue, where the teacher facilitates and guides the activity but is not providing the 'answer':

> It depends what it is, if it's a group task that we'll be presenting to him the following week I wouldn't expect him to be in it whereas if it was a task where they said i'm gonna put some stuff on there that I'd like you to read, give me feedback on, maybe we can have some sort of forum, conversation on there and then we'll discuss it further next week', then they'd be involved because they'd be mainly the one we'd be asking the questions to (UKPX, page Y).

> **In these discussions a tutor is not involved?**
>
> No.
>
> **Would you want them to be involved?**
>
> Yes and no sometimes. It's good to know we've got the right answer but in the journey in getting to the answer is part of your education. I would rather get it wrong five or six times that get it right first-time cos I've not learnt anything.
>
> **As part of that journey you wouldn't want the tutor to be involved because you want to work it out for yourself?**

> Yeah, part of the fun of education is working out the problems; I don't want the answer on day one, give me the answer on day 20 and I'll be happy, but there's the 19 days on what I've learned.

In summary, the outcome space for the interviews conducted in the UK shows that students have a tool-based view of the use of mobile devices in learning. Face to face interactions between students and teachers are prioritised over technology mediated ones and students see a distinction between learning and attainment at individual and group levels. The technology is not transparent and students foreground a number of aspects of the technology which influence how they are used. The tutor exists outside of the spaces that students inhabit when discussing their learning.

Having presented the outcome space for the UK context, what follows is the outcome space and categories of description for the Chinese context.

4.3 Findings from analysis of Chinese student interview transcripts

Analysis of the transcripts from the Chinese context reveals the same set of categories of description as with the UK context.

As with the previous outcome space, these categories of descriptions are related in an inclusive hierarchy, moving from less complex to more complex, as shown in Table 10.

Category 1: Mobile learning is experiencing mobile learning as creating and accessing learning resources using mobile devices.
Category 2: Mobile learning is experiencing mobile learning as learning related communications using mobile devices.
Category 3: Mobile learning is experiencing mobile learning as learning related collaboration using mobile devices.

Table 10: Hierarchically related categories of description of mobile learning, Chinese context

This presents an interesting correlation with the UK students' conceptions of mobile learning. However, further examination of the structural and referential aspects of these categories of descriptions highlights some variations between the two sets of students, which will be discussed in more detail.

4.3.1 Category 1: Experiencing mobile learning as creating and accessing learning resources using mobile devices

The focus in the category is on accessing information related to learning, but this is limited in scope. Students highlight the portability aspect of mobile devices that lends itself to use

across a variety of contexts. To a limited extent, students describe using their mobile devices to create resources related to learning, for example taking notes. Referentially, students are positioning themselves as individual learners and accessing learning material via mobile devices is a tutor directed process, whereas students are self-directed in terms of capturing notes or searching for information.

When undertaking learning activities such as searching for information mobile devices are seen as useful in the absence of other devices but are also seen as inferior to laptops and tablets, which have the same affordance of portability but have the advantage of larger screen size which is conducive to longer periods of working.

> Sometimes I need to search some information and I can write it in my paper or assignment, if I study in the library then I can use my phone to search the knowledge but if I stayed at dormitory I can use the computer, so it depends where I am (CHP8, page 2)

> I often use my phone to take notes in the classes, because I often forget to carry my notebooks. If having classes, I should …I just can carry my phone to the classes, not so many things such as books, notebooks or pencil I just can carry one thing. (CHP1, page 4)

> Laptop I think is very convenient so you can take it anywhere and I most of the times use the laptop for doing homework, especially when I am doing presentations. Both things, iphone maybe smaller than the laptop and I can take it, very convenient. The laptop is most for the work and iphone to be leisure. (CHP2, page 1).

> Yes, I will use every device that I can get the information, not just the phone. If I can use the ipad, laptop and phone I think the main point is to find the answer (CHP5, page 4).

> Most of the time laptop used to surf Internet or finish homework. If I want to contact with friends I always use the phone and then the ipad maybe for when I want to watch the video or use it to study….The laptop is to search for information from the Internet or to finish my assignment or presentation but my mobile phone I download many learning apps so overnight staying outside I can use it, not just in my dormitory or in home (CHP4, page 2 and 3)

> Most of the time I use my mobile phone and if I need to finish my essay or assignment I will use my laptop, do some research (CHP3, page 1)

> I will take the laptop to the university because it is the main way to study and do some work like writing the paper (CHP7, page 2)

Students describe using their mobile devices during sessions to access learning materials, under direction from the tutor. Students commented that this is primarily how learning materials, such as Powerpoints, are distributed by the tutor. Apps such as wechat, a group chat tool, are used as a repository for distributing teaching materials and are used by both staff and students.

> The teacher will use the mobile phone to teach us. She will use the wechat, she will write down some information and make the handout, take a picture of the handout and download on the wechat. We have a group, our class have a group and my teacher will send some documents and tell us how to study, writing and listening in this group. Just in the classroom, we can, this sentence how to write and we will write down on the book. When we are in the class the teacher just send the note on the class in the group. (CHP6, page 6).

> My tutor often send Powerpoint to our chat application then I can download it to se the knowledge in my phone (CHP1, page 4)

> Put it on a stick and sometimes they will put it on our chatting group (CHP3, page 5)

> Yeah, sometimes they will give me the materials after the class, we will also use the usb storage to collect the material. Sometimes they call us to download an app, in that app it have some materials which is he or she upload (CHP7, page 7)

Students use mobile devices inside and outside of the formal learning context of the classroom. Students describe this as either being directed by the tutor, in terms of viewing resources in concert with other students and instead of viewing it projected onto a screen in the class, or student led, for example when students use the device to take notes. The potential for distraction when using mobile devices in sessions is highlighted, as well as the need to show the tutor respect in how devices are used.

> **Did the teacher tell you to use your phones?**

> Yes, and then before the class they will send PowerPoint or some words before the class so we can read it in advance.

> **So in the class you don't get your phone out?**

> Yeah, at the same time in the class the teacher will ask us to look at the phone (CHP4, page 4).

One day we asked the teacher what we should take in the class, the teacher said you just take yourself and your mobile phone. It's OK. We take our mobile phone and she said I will use a mobile phone in the class. I will write down all the notes on this group to study.

Do you think if the teacher hadn't directed you, you would have decided for yourself to use mobiles?

Maybe, I don't know. I wouldn't have this idea (CHP6, page 3)

Sometimes in the classroom we need to listen to the teacher and I think it's…we need to respect our teacher and we don't use the phone in the class. Maybe also searching the information in the class it's not respect of him (CHP5, page 4).

Maybe they will, sometimes they will think about I was playing the phone's games but after he looked my phone he know that I was taking the notes (CHP1, page 4)

Would you like the teacher to tell you to use mobile phones or wechat, or is that not the teacher's job?

I think that is not the teacher's job, it is the students to choose… I think every student has their own learning method, teacher should encourage students can use this way but I think teacher not right to let their students, must use this. Encourage is OK (CHP2, page 4)

4.3.2 Category 2: Experiencing mobile learning as learning related communications using mobile devices

In this category of description students describe using communication tools on mobile devices in order to discuss aspects of their learning. The focus is on formal and informal tools, face to face versus technology mediated interactions and the extent to which meaning can be expressed through these interactions and the emphasis on 'knowledge experts' when interacting with the tutor and peers. Referentially, students are positioning themselves as individual learners connecting with others to enhance their individual understanding.

Chinese students describe communication in terms of synchronous tools only, where email is used for submitting material for assignments. A key difference between the Chinese and UK contexts is that the tutor uses the same communications tools as students i.e. tutors are

available in group chat tools such as wechat and QQ, whereas in the UK context email was the mechanism used by students to communicate with tutors and synchronous tools were used for student to student communications. The Chinese students describe the synchronous tools as informal but unlike the UK context the tutor is present in these informal spaces. Students cite convenience and immediacy, as well as lack of availability of tutors for face to face meetings, as drivers for using synchronous tools.

> We often use the chat application to…like QQ to send files or chat with each other so we often use the chat application to talk about the teaching (CHP, page 5)
>
> All most we will use wechat but if I need to hand in my papers we will use the email (CHP5, page 7)
>
> I think this is very different in China to Britain. In China we maybe chat with my tutor if I have a question. I will chat in callings, text messages or leave messages. Sometimes we will use the wechat or QQ. In Britain most things use the email, I think it is very different system (CHP2, page 5)
>
> **In terms of communication with your tutor, do you sometimes email them?**
>
> If I need to, if it's not very necessary I will use some apps like wechat.
>
> **What's the difference between wechat and email if you're communicating with the tutor?**
>
> Email is something very official, wechat is more casual (CHP3, page 6)
>
> **Which would you say you use more when communicating with your teacher?**
>
> The email we use to send homework but most of the time we communicate with others using wechat.
>
> **Why do you think you don't use email?**
>
> Because the wechat be more convenient, because we can't reply immediately but if the email maybe not convenient like wechat (CHP4, page 6)

> The email, sometimes we send the email other people will receive after hours or some days. When I use the wechat, everyone in China will use the wechat. If I find somebody in the wechat they can find out they have some message immediately (CHP7, page 1).

> China is usually to use the wechat to communicate with each other, they have no custom to use the email in their daily life so if I need to use the apps to communicate with classmates I will use the wechat because I think it is the best way, because it is immediately and it can receive immediately and feedback me immediately (CHP7, page 5).

> I would like to use wechat, or send message or use QQ to connect. Because I feel if I call them they are busy with their own things so I will disturb them so I just like to text a message. I will also use email but seldom because they need to, only they have time they will check the email but when we use the wechat we can [makes beeping noise] then you can find it and look the information (CHP8, page 8).

As with the UK context, students express a preference for face to face interactions, where meaning can be expressed more fully than in technology mediated interactions.

> Communicate with people face to face it can help to comprehend the…our friend's emotion. We can see their face to comprehend what they think about the things we discuss (CHP1, page 12)

> I think if you face to face you see clear to other's faces, express our body languages, but if you group chat you may not see these things (CHP2, page 5)

> Because when I talk to my teacher I have to care about her feeling. I have to care about…maybe if they agree with my idea then I can face to face communicate with her I can see her face. Through the face I can see if I did a good job or not enough. So, maybe face to face communicate would be more clear for me and I could know the tutor's feeling, but if I communicate with my friends I don't need to think about many things so I just express myself and then I get the information from them, that's enough (CHP4, page 6).

Students describe communicating with the tutor and each other in group chats, in order to clarify aspects of their learning. This is different to the UK context, where the tutor is absent from the group chats on mobile devices. Whilst students accept answers to questions from both staff and students the tutor is considered the more knowledgeable source compared to their peers.

> Sometimes we will chat about our homework in the chat group.

> **What would you talk about…what sort of things would you do?**

It's the problem we face in the homework.

So, the areas you don't understand?

Yes.

OK, so for example you might post something saying, 'I don't understand this, can someone explain?'

Yes…Someone will explain it with me and sometimes the tutor will answer my question.

If you post up a question who would you prefer answered the question, the tutor or the classmates?

I would focus more on my tutor's answer but if some classmates answer me, I will discuss about the work with them.

Why would you prefer the answer from the tutor?

Because the tutor's answer is more correct, right. Their answer is I think most right (CHP1, page 8)

So when you are using the phone to communicate with the teacher or classmates, if you have a question who would you contact, the teacher or your classmates?

I would ask the teacher because they have more experience and the knowledge. I can learn from he or she, him or her. Teacher will also, from the computer or mobile phone, tell me how to do this the best and collect the data (CHP7, page 6)

For me, I would find the teacher, I won't ask the question on the group I just ask teacher. Maybe this is a little bit shy. I don't want the people to know what I don't know…When I am in the classroom I will ask the teacher but when I am in my home I will use the wechat (CHP6, page 4).

4.3.3 Category 3: Experiencing mobile learning as learning related collaboration using mobile devices

As with the UK context, students aligning with this category of description are describing using mobile devices to facilitate collaboration, where mobile devices offer opportunities for comparing work, offering feedback and managing group work activities. Referential aspects focus on collective understanding and enhancement which encompasses both group work and individual assignments.

Students describe using mobile devices for collaboration in two different contexts: working on individual assignments or tasks, using the group chat to improve their own understanding and attainment and working on group tasks, where group members aim to improve outcomes for all students involved in the task. When working on individual assignments, students describe using group tools to facilitate their understanding and to engage in dialogue with other students. Unlike the UK context, where students positioned themselves as individual learners unless working on group projects and would therefore be unwilling to share their individual work with others, Chinese students are more willing to upload their individual assignment work to the group to serve as a model for others and students appear to defer to students who they consider more 'academic' than themselves. The Chinese students do acknowledge issues around plagiarism and ownership in their descriptions. There is a recognition of the need to be self managed learners i.e. to solve problems without relying on others but also acceptance that 'learned' others can contribute to their own self development.

> **You mention feedback. Do you give each other feedback, would you put up your work and ask for feedback?**
>
> Yeah, they will see the assignment and say where it can be improved and where it is the good point (CHP7, page 5)

> **Have you ever put some work in chat, have you ever worked on an assignment and put the work in the chat?**
>
> No I haven't, but sometimes who study better they will put their homework in the group.
>
> **You mean someone who spends more time studying?**
>
> They are, maybe they have talent about the work.

Why do you think they do that?

They want to make their homework to be a model, then the people can use his homework to comprehend the things we should do.

Would you use that work?

Yes, I often do it.

But you wouldn't put up your own work as a model?

If I study better in some subjects I will do it (CHP1, page 9)

If I have a problem and maybe ask my partners or my teammates, we make discussions not at once to ask someone for help especially teacher because they also very busy. For students we have the problems, we should no to ask for help, we should solve the problem by myself. If I can't solve it I will ask my classmates or roommates for some advice, ideas, but I will solve it by myself (CHP2, page 5)

Do you put up part of your work and say 'I've done some work on the assignment, here it is can somebody have a look'?

Most of time I won't put up what I've written on my assignment, just a point of view.

So not the actual work?

Yes.

Is there a reason why you don't put up the actual work in the chat?

If I put words, what I've written in my assignment other people may use.

Do you provide guidance to each other as to how to tackle the work?

Sometimes I don't know how to start with it and they will give me some advice on what I can write on my assignment. If I have some confused they will point it out (CHP3, page 4)

In terms of group work, there are similarities with the UK context, where students will plan group activities using mobile devices and offer feedback on group member contributions. As with the UK students, face to face interactions are favoured over technology mediated ones.

> When we do our report and presentation we need to do the teamwork and we need to talk our minds to this topic and we need to discuss in person. I think it is good to our presentation and topic, but when we do the papers we can just discuss in the wechat. This is think is the difference, the teamwork. The paper is our personal things, for the presentation we need to work together and face to face is the good way (CHP5, page 5)

> In the group project I always be the leader so maybe I will start a discussion and then ask them to give me some information about something, they will do that and send me the information I need through wechat and then I will just try to make the information in the group project…Using the phone, before we do the face to face communication I will tell them that this time when we discuss with others what kind of content we need to prepare then I will tell them in advance through the phone, that will save time in communication (CHP4, page 5)

> If I do the presentations, if we do the discussion with my teamworkers we can talk with each other and we can express and argue and I think this process is very inspirations. But if I with my teamworkers not in same place maybe we should use the phone to chat (CHP2, page 4)

> Actually, in each group, I mean about the assignment we will liaise with the teacher in the group. The teacher can assign the homework or the assignment in the group so we can know it easily. Sometimes because our team, we need the teamwork so I need to share my ideas with you and you also ned ti share the ideas with me then we can use wechat to share all our ideas and we can know each other easily (CHP8, page 7)

Compared with face to face interactions, permanence is described as a useful feature of technology mediated dialogues, where a record of the conversation can be reviewed at a later date.

> I think using the mobile, it's like record on it, when we finished talking even I forget my opinion I can look back (CHP3, page 4).

> Sometimes I have some questions and confused at home. I don't need to go back to the campus to find them. Just like, I can look back to what they have talked about if I miss (CHP3, page5)

> …we talk to our papers on the wechat and we saw the chatting record. That's very small but we have a record and that's where we have many papers and we can get more feedback on the face to face meeting (CHP5, page 5).

The tutor has access to the group chat in order to set tasks and assignments. Students may consult with the tutor in terms of approaching the task but they do not show the work to the tutor as it is developed, citing tutor workload.

> **Do you ever in group chat say you've done something on the assignment and ask the teacher for feedback?**
>
> No.
>
> **Why not?**
>
> No, because actually I don't know why. I know my teacher is very busy and I don't want to disturb him or her. Because when we get our score at the end of the terms when we can know the feedback (CHP8, page 8)

4.3.4 Structural and referential relationships and expanding awareness

Table 11 shows the structural and referential relationships between categories, highlighting what is in focus in each of the categories of description. Again there is increasing complexity in structural and referential aspects moving from category 1 to category 3, with a focus on accessing resources as an individual learner to working towards collective understanding and attainment with a focus on dialogue and sharing and comparing work.

In category one, concerns around technical competence are absent from student descriptions, suggesting a different attitude towards the technology compared to the UK students. As with the UK students the affordances of mobile devices are described, in comparison with larger devices and the distinction between work and study is highlighted, where devices such as laptops are preferred for writing assignments and searching for information and mobile devices are seen as a secondary option.

In category two, the focus is on synchronous communications, compared to a mixture of synchronous and asynchronous in the UK context where different tools are used according to who the communication is with. Communication using mobile devices is seen as informal and is used by both students and tutors, in part because of the lack of availability of tutors due to workload and perceived time pressures on tutors by students. Knowledge experts are prioritised in communications, where students are cognisant of their ability in relation to peers and tutors and either defer to those they consider more knowledgeable.

In category three, students collaborate on both individual and group tasks and feedback is obtained from peers on aspects of their individual assignments as well as organising and planning group activities. As with the previous category of description, students defer to those they consider more knowledgeable and are willing to share their work, as knowledge experts, or utilise the work of others who are recognised as more knowledgeable. These 'models' of work are made available in group chat tools.

Category	Structural (aspects of phenomenon)	Referential (mobile learning is about)
Category 1: Experiencing mobile learning as creating and accessing learning resources using mobile devices.	• Aspects/features of device: screen size; apps e.g. notes, camera; portability; connectivity. • Location • Formal and informal (location) • Work versus study • Student led versus tutor led	Facilitating individual knowledge and access to information
Category 2: Experiencing mobile learning as learning related communications using mobile devices.	**As in Category 1 and includes:** • Meaning/emotion • Time • Synchronous • Informal (communication) • Face to face versus technology mediated • Knowledge experts	Facilitating connecting with others in order to develop their individual understanding.
Category 3: Experiencing mobile learning as a learning related collaboration using mobile devices.	**As in Category 2 and includes:** • Plagiarism/ownership • Sharing of exemplars • Learning tasks/assignments • Feedback • Individual and group	Using mobile devices to engage in dialogue with others in order to develop individual and group learning and attainment

Table 11: Structural and referential aspects, Chinese context

In terms of themes of expanding awareness, the themes identified in the UK context are evident, but there are differences in terms of the structural aspects that are in focus in each of the categories of description (Table 12).

Themes of awareness	**Category 1**	**Category 2**	**Category 3**
Learner positioning (relative to cohort)	Individual	Individual	Collective
Context of use (location)	Formal and informal	Informal	Informal
Task focus	Individual, knowledge enhancement,	Individual and group, clarify understanding	Individual and group, planning
Learning interactions	One-way Tutor – Student Student – Resources	Two-way Student – Student Student – Tutor	Two way Student – Student
Teacher role	Sharing resources	Answering queries	Present but non participatory

Table 12: Expanding themes of awareness, Chinese context

As with the previous contexts, there is an expanding focus on the learner moving from learning as an individual to learning as being part of a collective, encompassing both individual and group tasks. The content of use moves from the formal setting of the classroom to informal spaces outside of the classroom and learning interactions move from one-way tutor directed activities in the classroom to two-way interactions between students that involve consultation through to dialogue. Even though the teacher in present in the spaces used by students, across all categories of description, they do not participate in dialogue, instead they are making resources available in category 1 and answering student queries in category 2.

4.4 Findings from analysis of Japanese student interviews

Finally, the findings from analysis of the Japanese interview transcripts is presented. The same three categories of description, which follow the inclusive hierarchy highlighted previously, are evident in the utterances of Japanese students (Table 13). Category 1 has been modified slightly, as students did not describe using their mobile devices to create learning materials, such as notes:

Category 1: Experiencing mobile learning as accessing learning resources using mobile devices
Category 2: Experiencing mobile learning as learning related communications using mobile devices
Category 3: Experiencing mobile learning as learning related collaboration using mobile devices.

Table 13: Hierarchically related categories of description of mobile learning, Japanese context

4.4.1 Experiencing mobile learning as accessing learning resources using mobile devices

Students aligning with this category of description describe using mobile devices to access learning resources that supplement face to face classroom-based teaching. Structural aspects focus on device capabilities, formal versus informal settings, apps for learning and tutor versus student recommendations. Referential aspects focus on the student as a self-directed learner and positions them as individual learners but competing and measuring themselves against other learners as a means of motivation. Use of mobile devices takes place outside of formal sessions. Free resources are prioritised over those that require a

fee. Mobile devices are used for searching for information and accessing course resources, but 'work' is done on larger devices.

In the Japanese context, as the students are studying English as their major, their use of mobile devices is focussed on activities that help them learn and practice the English language. Students describe using mobile devices to search for information, access videos, read articles and use apps that allow them to practice pronunciation. Whilst apps are recommended by peers and by tutors students report that they are mainly self-directed in locating resources. Apps and learning resources are accessed in various locations outside of the classroom and students describe using apps, reading articles and watching videos whilst travelling to and from the formal setting of the classroom. Portability and the 'always on' nature of mobile devices are aspects that lend them to being used in a variety of locations.

> For me mobile just means mobile phone not laptop or tablet…It's hassle to turn on laptop (JPP1, page 2)

> Mobile phone is really easy to bring and laptop is not. So that's one reason. That's why I use mobile phone to search something, because it's too easy to bring it (JPP4, page 2)

> For me, mobile learning is learning on trains. If I'm not in front of a desk I can learn through mobile learning. So learn anywhere is an important aspect of mobile learning (JPP6, page 3).

> Mobile learning is convenient. But last year Mr [tutor name] gave us mobile learning. It's called English Central and we had to do that every week and we warched short videos for about 3-5 minutes and we listening to video and typing what they said and finally we were speaking (JPP1, page 3).

> So, if I have a app for learning it's easier to like, get the information from that…Yeah, I have some dictionaries and I used to have some help reading app so just one sentence in two or three seconds and go to other sentences for rapid reading…So, like I used it for my listening English and also memorising words… On the way to University, so on the train. So partly it's related to University? (JPP5, page 4)

> English Central, I use mobile phone to do that. Watch a movie and fill in the blank and read it and if my pronunciation is not good it says bad and then if I say good it says move on (JPP4, page 3)

When I learn something from mobile phone I usually use free application apps, for English words or English expressions. I see English, sometimes I check what tha means in Japanese and sometimes I take a note of it and see it again, again, again and gradually I memorise it and yes (JPP3, page 4)

Students identified a distinction between tutors recommending and enforcing use of tools such as mobile devices or apps but would use them if directed, even if they weren't happy to do so. A tutor enforcing the use of mobile devices is seen as outside of the norm or raises issues such as potential conflict of interest.

They didn't direct you to an app?

No

How did you feel about that, do you think they should?

No, I don't think so. I think teacher's jobs are to do something. Teachers should focus on their jobs in teaching something. This is not their job.

Why do you say that?

I think if they told us these applications it can be like commercialisation (JPP3, page 5)

My university teacher recommended me application. She is quite a good English speaker and she told me it is quite good for English learning. I tried it and then oh, that good thing so I keep doing.

Would you want your tutor to do more of that, use applications or use mobile devices?

No, they just recommend me for that application so they didn't enforced me to use the application, they gave me the information.

You are happy for the tutor to recommend but you are not happy for the tutor to say you must?

Usually in Japan in the school or something there are many homework to do and we have many thing that you have to do in the school days, so they get used to that kind of thing 'the teacher told me to do that' or 'the professor told to do that so I have to do'. It's quite usually but they don't like it, so I think if they told me to do that maybe I will do that but I don't like it (JPP2, page 4)

Maybe it's not good idea but I hear foreign country people, teachers use mobile for task. They are familiar with mobile since they young child, they get opportunity to educate mobile learning so if some teacher say you use mobile learning I think they are foreign country people or they like foreign country education (JPP6, page 6)

As with the UK and Chinese contexts, students make distinctions between mobile devices and laptops, where laptops are used for writing assignments and for longer periods compared to mobile devices.

I don't use it, when I write a report I mostly use laptop

You say mostly, what else do you use?

Sometimes I use ipad, but just once. When I bought it I was just curious about how to use Word so that's why I used it

Why do you use the laptop for assignment then?

I think it's the easiest way to write a report so that's why (JPP3, page 2)

Laptop is for the business, study or business. I use Word, Powerpoint and such kind of applications for study.

Have you ever used a mobile phone for writing a report or assignment?

No. I think I did once. I didn't have the connection for my laptop and I had to do the…I don't usually do that.

Why don't you normally do that? You did it once?

Because smartphone is quite small and it's difficult to see the whole document in the same thing, same time. Putting the text is very different and it takes time than the laptop so it's not effective (JPP2, page 2).

I use pc for homework because it is easy to copy but mobile phone is not (JPP4, page 2)

If I write an assignment I mostly use my laptop…Cos it's like the proper app for that. Word or Excel or Powerpoint. I download it for my tablet but it's not so useful as the laptop so I use a Bluetooth keyboard but mainly I do it on the laptop so it's easy and useful (JPP5, page 3)

Laptop has I think different features, they have another application. It doesn't share the applications in all honesty, some of the applications the feature is different. Laptop is a bit difficult to carry on and in honesty I can't say that many people carry laptop all the time. But if you think about the smartphone you can carry that almost all the time, I think that is the most different thing (JPP2, page 3)

Cost is identified as a factor when using mobile devices. In the absence of connectivity such as wifi students incur costs when using their data plans and this may deter their use, however students also highlight aspects of the device that facilitate their learning without incurring additional costs if connectivity is available:

Mobile phone there is risk, not risk, If I use there is a limit?

In terms of data you have an allowance?

Yes

Is cost an issue, is it expensive to use your phone?

Yes (JPP4, page 2)

Skype. I take speaking lessons in Skype. But only that.

What is good about that as part of your learning?

I can communicate people all over the world for free and it is good connection so we can listen clearly, more clear than other applications for example Line and Facebook.

Is free important?

Yes, very important because for free makes us to join learning more easy. Of course I don't want to pay money for learning.

Why not?

Because I'm not rich people. I don't have much money of course. I don't need to pay money for learning it's very useful for me.

So, in terms of accessing learning on your phone, it needs to be free?

Yes, I hope. Also, to pay money, for example my speaking lesson I pay several thousand yen every month. I feel to pay money makes this possibility to attend the study. It is sometimes good thing but sometimes bad thing because money gives me a pressure (JPP6, page 8)

When I learn something from mobile phone I usually use free application apps, for English words or English expressions (JPP3, page 4).

Whilst considering themselves as individual learners, students describe an element of competition when using apps in terms of comparing scores against other students, this is seen as a motivating tool:

You mentioned before that you used it with your friends, how did that work?

It was good, because we can, what's the word? Like, I said I did this and she said oh, I did more. Oh really, so I'll do more.

So you would compare?

Yes, compare.

How did that work? Did you get a score and compare the score?

That pronunciation, if I said it good it says 'good' but like that. SO try, try and try.

So you would compete?

Yes, compete!

Is that important. Why?

Yes, it leads to motivation. If I do alone by myself I can like [makes sighing noise] and then maybe later (JPP4, page 5)

In terms of the mobile learning situation you were involved in, were your classmates involved?

Yes, sort of like competing with each other.

How did that work?

So, like for example the other guy had a higher score than me I'd be like kind of not good feeling so I'd do more work (JPP5, page 7)

As with the other contexts, students expressed reservations about use of mobile devices in formal classroom settings, citing the potential for distraction:

I prefer to use it in my room, at home because it's actually, I don't use it at University, we doesn't use it in the lecture. Sometimes the professor told me not using the mobile phone during the lecture, so actually doesn't use at University so often (JPP2, page 8)

I think nowadays a student at the University don't usually use it for learning. So, when I use it for learning many people see me just using mobile phone, not learning. So for some people think as the person addicted to mobile phone, it can happen (JPP3, page 6)

So you wouldn't want to do a session where mobiles are used the majority of the time?

No

What do you think the problem would be?

Students get bored or checking the email or like texting or searching web or doing the other game apps could be the problem. If I like stop them to doing what happen is student get angry or get bored. One of my teachers say 'hey hide your phone or put it into the bottom of bag then don't see it in my class'. It works well, I like that class.

Mobile use is not encouraged in class?

No

Why do you think that is?

Cos like, I see my friend just checking, or texting, or gaming all the time. Even though it's really interesting class, so just waste for me (JPP5, page 10)

I don't know students abroad but Japanese students here tend to use phones all the time. If it is the sessions, if you use the mobile phones the teachers have to pay attention to what they are doing because someone doing…

So they might be doing something not related to the learning?

Yes (JPP1, page 8)

4.4.2 Experiencing mobile learning as facilitating learning related communications

Students aligning with this category of description are using mobile devices to communicate with peers and tutors. The focus is formal versus informal communications, face to face versus technology mediated interactions and the importance of meaning. Referentially, students are positioning themselves as individual learners connecting with others in order to develop their individual understanding.

As with the UK context, students use synchronous tools, such as the group chat application Line, as well as asynchronous tools such as email depending on who they are communicating with, thus the communications are either considered formal or informal depending on the context. Unlike the Chinese context, students report that tutors are readily available, so technology mediated conversations are considered less effective and less important. Where technology mediated communications with tutors occur, these are achieved using formal tools such as email, denoting respect for the tutor, but students describe these as more difficult to compose compared to less formal methods such as Line:

Have you ever used the mobile phone to communicate with your tutor?

If you mean the email yeah, I used email to send the email to professor.

Why only email, not Line?

My professor doesn't use, I think, doesn't use the smartphone for receiving the student email. I think this is a private issue, private thing. I think that we can use to contact the professor is only the email…I think email looks like, it's organised as very polite way, official way to send text. I think it's quite different from Line or Facebook because in Japan they doesn't recognise the official text. So if you want to send the assignment or ask about lecture we should use email (JPP2, page 7).

I've never talked with my professors on apps or mobile phones.

What's the reason you've never done that?

Because it is not necessary.

What about email?

I don't like emailing because I need to care about what kind of language I should use.

What kind of language?

Polite language. It's so difficult, mostly for students (JPP3, page 9)

It's difficult to meet friends in university because as I told you they're busy. But some teachers are always here so anytime I can visit them to ask questions (JPP7, page 6)

Do you think there is a difference between how you communicate with classmates and how you communicate with a teacher using a mobile?

I feel it's an optional thing. Email is more formal.

In terms of methods, you would prefer email if you are communicating with a tutor?

Yes.

Text if you are communicating with a classmate?

Yes.

How would you feel if a tutor starts text messaging you or the class?

Between the tutor and I just fine. Some young tutors are using text message. Teachers or tutors I respect I send them an email (JPP5, page 11).

Email is formal, so think about like, here I have to use dot or comma but in Line I don't care I just put in what I think. It's really easy to write (JPP4, page 8)

As with the UK and Chinese contexts, students expressed a preference for face to face communication versus technology mediated ones, citing meaning and the amount of information that can be shared as aspects that are diminished when using technology.

Students see synchronous communications mediated through mobile devices as more difficult to organise than face to face communications.

What would be your preference, face to face or another way?

Face to face.

Why face to face?

I don't understand English well. If you ask in the session you can hear more details.

What sort of things would you get from face to face that you don't get from a mobile device?

For example gesture. Or, conversation face to face…Because I'm not good at English, so if you gesture I can understand that more easily (JPP1, page 6)

So, like if people more there it will be more ideas, important information there so like facing each other is important for me…Like I think it's going to be longer. The period I need to spend cos like texting or like just phone call is not enough to share the information but like if we face each other I think I can you know if I text in 30 minutes but like also I can talk to him in 30 seconds, it's same for me (JPP5, page 8).

Through mobile I can only understand through text or through picture but face to face I can see the face so I can feel the thinking or how him thinking, it's easy to communicate directly (JPP6, page 5)

I think group work in face to face is quite easier, because of you get together just do the conversation, making share the information quite easily but if it comes to mobile that's gonna be quite difficult to share the information in the same time because you have to Skype or call Line phone in the same time, you have to use the smartphone in the same time. Sounds like easy but it's gonna be difficult to use smartphones in the same time. So if you want to share the information fastly that's gonna be, face to face is quite better (JPP2, page 7)

Face to face is good, only letter or character sometimes people take the wrong meaning so face to face is easy to explain and also we can see the face and he looks angry or looks happy (JPP4, page 7)

4.4.3 Experiencing mobile learning as facilitating learning related collaboration

Students aligning with this category of description, similar to the UK context, are using mobile devices to plan and organise face to face activities and collaborate on group work. Structural aspects are focused on honesty of feedback, permanence and group tasks. Referentially, students are positioning themselves as part of a collective aiming to enhance the quality of group tasks.

As with the UK context, Japanese students describe using mobile devices primarily to plan face to face interactions rather than discussing the assignments within the group chat:

> In this university sometimes I wish to do English class with my friends as a teacher. So this is good task for us, also we don't have enough time together for planning the class so we use mobile device to discuss what we do in that class. But I don't want to discuss only mobile device, also I'd like to meet. Through mobile device we can't confirm everything so if we meet we can bring something which we used in that class and also we talked everyone, so five, six people at one time and also I did ask to confirm that face to face class (JPP6, page 6)

> …like you know my friends and me or like my family want to confirm where I am or what time I will go back to my house so like ask me, text me, ask me some help or something.

> **So, you use it for confirming schedules, is it mostly for arranging things?**

> Yes.

> So why is it mostly that you use it for arranging meetings and confirming appointments?

> Cos, how do I say, it's way too easier. Before we like saying OK this time we are going to talk about this and then prepare for it, then start the topic. SO it's way easier I think (JPP5, page 2).

> Just for arranging the thing, by texting

> **So you would communicate with each other for a face to face?**

> Yes…We can divide the thing we do till the meeting and then like ready for that and then get together but we normally don't do it because we cannot share the information enough if we are using the mobile…So like, if people more there it will be more ideas, important information there so like facing each other is important for me(JPP5, page 8)

Mostly in Line app, we can make group with some students. So if five people group, we make a group of five. We can send document in there. Mostly we share the thinking, I mean thinking about how shall we work, when we shall get together for the conversation (JPP2, page 6)

Sometimes we talk about the assignment in Line.

Do you give each other feedback?

Sometimes we do that.

Do you get negative feedback? Has anyone ever said this is bad?

Using Line?

Yes.

I think it's no different from when you pass it in person. It depends on the assignment (JPP2, page 6)

For example I finish the task, so you can check it. I upload the file for that, then add some comments on it.

So you would be communicating with somebody else and asking for feedback?

Yes

You would be happy for them to be positive or negative?

Both…For my case I normally get positive comments but for me it's more important to get the negative thing because it develops me so much. So like, but for my case if I add some comment or feedback for other student or friend I put like two positives then one negative (JPP5, page 9)

Unlike the Chinese context, where students found a record of the group chat conversation a useful reference tool, students in the Japanese context expressed concerns about the permanence of student to student technology mediated conversations.

I think it's more dangerous for us to comment on there. If I say that at one time, I can recast the thing, what I said, but if I comment it will remain forever. If I write that thing, but like the day after that oh I shouldn't have written that thing, sometimes I feel like that.

Why would that be a problem?

It's because we like see, through Internet

So the fact that it's visible to others?

So visible, like if I comment on her, it's not good, so face to face is more important for me (JPP5, page 9)

Mobile communication remains forever but face to face it doesn't remain so I talk some detail bad point because it doesn't remain. I fear remain or bad point because sometimes it leads to broke friendship or something so I am careful for writing in mobile device (JPP6, page 7)

So if the tutor said I want you to communicate with each other using your mobile phones how would you feel about that?

It's OK. I think I will feel embarrassed because when I was in the UK the teacher used ipad for taking a video. I was really embarrassed the reason, I had two reasons. One, simply because taking a video of me is embarrassing and the other is if you take a video it has a record, a memory so I didn't like it.

So the reason you wouldn't want to communicate using mobile phones is because there is a permanent record?

Yes (JPP3, page 7)

Whilst highlighting concerns around permanence, students expressed the view that technology mediated feedback is more honest than that given face to face:

By using mobile phone I can talk with a friend who I rarely speak. So, in class I am not always talking to friends but in text message I can be frank

You can be honest?

Yes.

If you were meeting face to face you would be less frank? If you were using text messages you would be more honest?

Yes (JPP7, page 6).

I think that's gonna be much more honest than in person, because I can't see the face of others in Line application and I can only see the assignment in there and I think it will be honest feedback.

Do you think that's different from what would happen face to face?

I think unconsciously that's going to be different.

Which do you prefer, face to face or via mobile devices?

For me I like the honest feedback so I prefer the feedback from mobile phone or Line JPP2, page 6).

4.4.4 Structural and referential aspects and expanding awareness

Table 14 shows the structural and referential aspects for this outcome space, showing the relationships between categories. As with the previous outcome spaces there is increasing complexity moving from category 1 to category 3. There is a focus on device characteristics in category 1, where these devices are used in informal contexts and with a focus on apps and comparing performance against peers. In category 2 there is a focus on communication tools which are classed as formal or informal depending on who is being consulted and face to face communications are prioritised over technology mediated ones. In category 3 students are using mobile devices to engage in group tasks and to provide feedback to each other, where the technology enables them to be more honest in their feedback compared to face to face interactions.

Category	Structural (aspects of phenomenon)	Referential (mobile learning is about)
Category 1: Experiencing mobile learning as accessing learning resources.	• Aspects/features of device: screen size; apps e.g. portability; connectivity. • Cost • Formal and informal (location) • Work versus study • Student led • Competition/motivation	Facilitating individual knowledge and access to information

	• Distraction	
Category 2: Experiencing mobile learning as a tool that facilitates communication.	**As in Category 1 and includes:** • Meaning/emotion • Permanence • Synchronous and asynchronous • Formal and Informal (communication) • Face to face versus technology mediated	Facilitating connecting with others in order to develop their individual understanding.
Category 3: Experiencing mobile learning as a tool that facilitates collaboration.	**As in Category 2 and includes:** • Honesty • Group tasks/assignments • Feedback	Using mobile devices to engage in dialogue with others in order to enhance group learning and attainment

Table 14: Structural and referential aspects, Japanese context

As with the previous contexts, there is evidence of themes of expanding awareness moving from category 1 to category 3, as shown in table 15.

Themes of awareness	**Category 1**	**Category 2**	**Category 3**
Learner positioning (relative to cohort)	Individual	Individual	Collective
Context of use (location)	Informal	Informal	Informal
Task focus	Individual, knowledge enhancement, assignment	Individual, clarify understanding (of task/assignment)	Group, planning

Learning interactions	One-way Tutor – Student Student – Resources	Two-way Student – Student Student – Tutor	Two way Student – Student
Teacher role	Notifications, signposting	Answering queries	None

Table 15: Themes of expanding awareness, Japanese context

In category 1, mobile devices are used for one-way interactions, either signposting of relevant resources by the tutor, course related notifications sent by the tutor or institution or students accessing materials through their mobile devices. Students position themselves as individual learners in relation to the other members of the cohort and the context in which they use mobile devices is primarily informal i.e. outside of the classroom. The focus of tasks, when using mobile devices, is on enhancing their individual knowledge and aspects of the devices that are focussed on are those that enable access to course related information or resources. Students are primarily self-directed in locating resources but are also open to recommendations from their peers.

In category 2, students enhance their individual understanding through two way interactions between students and tutors. As with the UK context, these interactions occur outside of the formal classroom setting, where use of mobile devices is seen as a distraction. Students are using mobile devices to consult with others in order develop their individual understanding

In category 3, the focus is on group rather than individual tasks and mobile devices are used outside of the formal context to plan learning interactions. As with the UK context, the tutor is absent in the spaces used for these interactions.

Comparison of the three outcome spaces

Having created an outcome space for each context, which presents structural and referential aspects and themes of expanding awareness, this section will consolidate these findings in order to highlight where conceptions of mobile learning across the three contexts, in particular the aspects of the phenomenon that are in focus when participants describe their use of mobile phones for learning, can be attributed to the cultural context

of the learner. Commonalities as well as differences across the three contexts will be highlighted in an attempt to identify not only where differences could be due to cultural context but also where aspects that are evident across all contexts may have a greater or lesser impact on the use of mobile phones in a particular context due to cultural issues.

4.4.5 Differences and commonalities in categories of description across the 3 contexts

Table 16 shows how there is a slight change to the wording of the categories of description of the Japanese context compared to the UK and Chinese contexts. Whereas categories 2 and 3, concerned with communication and collaboration, are able to be described using the same wording for the category of description Japanese students described using mobile phones for accessing information but *not* for creating learning related resources e.g. taking notes or creating material for tasks such as video, audio etc.

Category of description	**Japanese context**	**Chinese context**	**UK context**
Experiencing mobile learning as creating and accessing learning resources using mobile devices.		✓	✓
Experiencing mobile learning as accessing learning resources.	✓		
Experiencing mobile learning as learning related communications using mobile devices.	✓	✓	✓
Experiencing mobile learning as a learning related collaboration using mobile devices.	✓	✓	✓

Table 16: comparing categories of description of mobile learning across all contexts

4.4.6 Differences and commonalities across category 1 of the outcome space

When comparing the structural aspects of category 1 in each outcome space i.e. the aspects of the phenomenon that are focussed on in this category, there are commonalities

as well as variations in parts of the phenomenon that are foregrounded in each context, as show in table 17:

	Category 1 Structural aspects
UK context	• Aspects/features of device: battery; screen size; apps e.g. notes, camera; portability; connectivity; ease of use • Time • Location • Formal versus informal (location) • Availability of alternatives • Technical competence • Planned versus unplanned • Student led versus tutor led • Distraction
Chinese context	• Aspects/features of device: screen size; apps e.g. notes, camera; portability; connectivity. • Location • Formal versus informal (location) • Work versus study • Student led versus tutor led • Distraction
Japanese context	• Aspects/features of device: screen size; apps e.g. portability; connectivity. • Cost (connectivity) • Formal versus informal (location) • Work versus study • Student led • Competition/motivation • Distraction • Student led versus tutor led

Table 17: comparing Category 1 structural and referential aspects across the three contexts

The key commonalities and differences across the contexts can be summarised as follows:

- In all contexts, students describe aspects of mobile phones that either facilitate or limit their use in engaging with learning resources however the Japanese students do not describe creating resources such as notes. The portability of the device, compared to laptops and tablets, is seen as a key aspect of the device such that they are ubiquitous across the physical spaces that students move through on a daily basis. However, other aspects of the device are also highlighted when considering *how* they are used. Some of these are technological, in terms of connectivity, screen size and battery life, as well as the extent to which alternative devices are also considered portable. Screen size is a common limitation of mobile phones that limit prolonged use, as well as connectivity i.e. the availability of a wi-fi connection.
- From a technical perspective, the UK students foreground aspects of technical competence in using mobile phones, whereas the Chinese and Japanese students do not.
- Across all contexts, distraction is highlighted as a concern amongst students. The potential for mobile use to be distracting to other students, or not meeting the approval of tutors, is seen as a barrier to their use in a formal setting. As such, use of mobile phones in the Japanese context occurs *outside* of the formal session, whereas in the other two contexts mobiles are used *during* formal teaching sessions.
- Whereas both the UK and Chinese contexts describe instances of use of mobile devices that are either student led or tutor led, the Japanese context describes only student led use of mobile devices, where tutors may recommend apps but do not enforce the use of phones.
- The Japanese students describe aspects of competition, where comparing scores gained in apps may encourage their peers to perform better.

4.4.7 Differences and commonalities across category 2 of the outcome space

When comparing category 2 of the outcome space, there are again differences and commonalities in terms of aspects of the phenomenon that are focused on in each of the contexts, as shown in Table 18:

	Category 2 Structural aspects
UK context	• Meaning/emotion • Tools used for communication (SMS, email, chat) • Synchronous vs asynchronous • Face to face versus technology mediated • Focus of assignments • Formal and informal (communication)
Chinese context	• Meaning/emotion • Time • Synchronous • Informal (communication) • Face to face versus technology mediated • Knowledge experts
Japanese context	• Meaning/emotion • Synchronous and asynchronous • Formal and Informal (communication) • Face to face versus technology mediated

Table 18: comparing Category 2 structural and referential aspects across the three contexts

These differences and commonalities can be summarised as follows:

- Meaning and emotion are highlighted as important across all three contexts, particularly with regards to communications with tutors.
- The UK and Japanese students use different tools to communicate with tutors or peers, where communications with tutors uses email, which is considered more formal that chat or text tools, whereas Chinese students and tutors use informal tools to communicate with each other. Additionally, UK and Japanese use a mixture of synchronous and synchronous tools whereas Chinese students use predominantly synchronous.
- The UK and Japanese contexts position the tutor outside of the informal spaces used by students to communicate with each other, whereas in the Chinese context the tutor is present in the same informal spaces that students use.

- UK and Japanese students describe tutors as being readily available for face to face communications, whereas in the Chinese context face to face communications are limited due to tutor workload and availability, hence communications using mobile devices are described as the best way to communicate outside of formal sessions.
- When consulting with others about aspects of the learning Chinese students foreground knowledge experts in communications, in terms of who is approached.

4.4.8 Differences and commonalities across category 3 of the outcome space

Table 19 shows the structural aspects of category 3 across the three contexts.

	Category 3 Structural aspects
UK context	• Plagiarism/ownership • Group versus individual tasks/assignments • Feedback • Motivation
Chinese context	• Plagiarism/ownership • Sharing of exemplars • Feedback • Individual and group tasks • Permanence
Japanese context	• Honesty • Group tasks/assignments • Feedback • Permanence

Table 19: comparing Category 3 structural and referential aspects across the three contexts

The key differences and commonalities that emerge can be summarised as follows:

- When describing using mobile phones for collaboration UK and Japanese students are focused on group tasks rather than individual ones, using mobile devices to organise group activities and contributions. Chinese students use mobile phones to collaborate on both group and individual tasks.
- Plagiarism and ownership is foregrounded in UK and Chinese descriptions of collaboration. However, whilst students in both contexts are aware of issues

around plagiarism, such that UK students do not tend to share work for individual assessment, Chinese students *are* prepared to share individual as well as group work, positioning themselves or others as 'knowledge experts' who share exemplars of the work for others to learn from.

- Feedback is seen as an important aspect of collaboration across all three contexts but this is described as student to student rather than tutor to student, where UK students express the desire to work out problems for themselves and Chinese students cite tutor workload as the reason to not ask for feedback, instead seeing the comments made after the work is submitted as the point at which they can expect feedback.
- The UK students describe using dialogue on mobile devices as a means of motivating other group members through feedback and reminders. Japanese students discussed motivation in the context of category 1, where they compared their scores on apps as a way of motivating each other.
- The Chinese students see the permanence of dialogue conducted via mobile phones as a positive aspect of technology mediated dialogue in order to look back at the record of interactions, whereas Japanese students viewed a permanent record of interactions as a barrier to dialogue conducted via mobile phones, in terms of the impact negative feedback or comments may have on others or embarrassment in terms of their comments being visible to others.
- Japanese students described being more honest in technology mediated interactions compared to face to face interactions.

4.4.9 Differences and commonalities in expanding themes of awareness

When comparing the themes of awareness across the three contexts there are similarities and differences in terms of the themes that emerged from the analysis. These are presented in Table 20. As can be seen in the table, there are differences and commonalities across the categories of description, in terms of learner positioning, use across formal and informal contexts, task focus, learning interactions and the role of the tutor.

Themes of awareness		**Category 1**	**Category 2**	**Category 3**
Learner positioning	UK	Individual	Individual	Individual and Collective

(relative to cohort)	China	Individual	Individual	Individual and Collective
	Japan	Individual	Individual	Collective
Location	UK	Formal and informal	Informal	Informal
	China	Formal and informal	Informal	Informal
	Japan	Informal	Informal	Informal
Task focus	UK	Individual, knowledge enhancement	Individual, clarification of understanding, scheduling	Individual and group, planning
	China	Individual, knowledge enhancement,	Individual and group, clarify understanding	Individual and group, planning
	Japan	Individual, knowledge enhancement, assignment	Individual, clarify understanding (of task/assignment)	Group, planning
Learning interactions	UK	One way Tutor – Student Student – Resources	Two way Student – Student Student – Tutor	Two way Student – Student
	China	One-way Tutor – Student Student – Resources	Two-way Student – Student Student – Tutor	Two way Student – Student
	Japan	One-way Tutor – Student Student – Resources	Two-way Student – Student Student – Tutor	Two way Student – Student

Teacher role	UK	Signposting (of resources), notifications	Answering queries	None
	China	Directing, sharing resources	Answering queries	Present but non participatory
	Japan	Signposting (of resources), notifications.	Answering queries	None

Table 20: comparing themes of awareness across the three contexts

What emerges from the analysis of the transcripts and construction and analysis of the outcomes spaces for each context is that there are aspects of the phenomenon, as described by students, that are either present across all contexts or can vary across cultural contexts and that these aspects merit further discussion. These aspects can be summarised as:

- The complexity of use of mobile phones in learning i.e. whether mobile devices are used in a simplistic way to access information or more complex ways such as for communication or collaboration.
- The positioning of the learner in the tools and spaces used on mobile phones i.e. as an individual or as part of a collective.
- The positioning and presence of the tutor in the tools and spaces used on mobile phones.
- The location of use i.e. the formal and informal spaces in which mobile phones are used and the potential for distraction.
- How mobile phones are used for feedback and issues around motivation, meanings, expression and honesty when communicating using mobile phones.
- Issues around permanence and visibility.
- Tutor directed and student led use of mobile phones.
- Issues around ownership and plagiarism.

The question arises as to whether those aspects that are present across all contexts are given the same priority or whether they are considered more or less important as you move across the different contexts. In addition, where students describe an aspect of the phenomenon in one context and it is not described in others, is that because of the cultural context of the learner that this aspect is foregrounded and present in their conceptions?

4.5 Summary

Outcome spaces for the three cultural contexts were presented, showing a hierarchically related set of categories of description that increase in complexity. Themes of expanding awareness were also described across the three cultural contexts. Students described using mobile phones for accessing resources, communicating with tutors and peers and collaborating. There were differences across the three contexts in aspects of the phenomenon that were foregrounded in the descriptions of mobile learning. Students described culturally mediated influences in terms of deferring to the tutor, communicating using formal or informal methods depending on whether communication is with tutors of peers, the language used in communications and preferences for synchronous and synchronous tools. Students described collaboration in terms of individual goals or working as a collective and students described how they positioned their tutors and themselves in relation to communication and collaboration. Mobile phones are seen as offering convenience and flexibility but their use across formal and informal settings takes into account technological affordance as well as issues of distraction.

5 Discussion and conclusions

5.1 Answering the research questions

The study focussed on conceptions of mobile learning international contexts, with the primary research question being: how do learners from different cultural contexts understand and experience mobile learning?

Two related sub questions were identified:

- To what extent are there similarities and differences across differing cultural contexts in terms of students' experiences of using mobile phones for learning?
- To what extent do existing frameworks and theories for mobile learning address the cultural context of the learner?

In this chapter, the findings from the previous chapter will be discussed and, where appropriate, links made with the literature discussed in Chapter 2 and other relevant literature. I will attempt to highlight what the findings contribute to current knowledge and discuss the implications of the findings in relation to strategies for mobile learning that encompass culturally diverse learners. Finally, I will reflect on the use of phenomenography as the methodological approach for my study.

5.1.1 The core elements of mobile learning in international contexts

In the previous chapter the findings from the analysis were presented and three outcomes spaces, one for each cultural context, were created. The categories of description showed an inclusive hierarchy in each outcome space, where conceptions of mobile learning move from less complex to more complex. Structural and referential aspects of each outcome space were highlighted, as well as expanding themes of awareness. Comparison of the three outcome spaces showed commonalities and differences across the three contexts.

The following aspects emerged from analysis of transcripts as being foregrounded in descriptions of using mobile phones for learning:

- The complexity of use of mobile phones in learning i.e. whether mobile devices are used in a simplistic way to access information or more complex ways such as for communication or collaboration.

- The positioning of the learner in the tools and spaces used on mobile phones i.e. as an individual or as part of a collective.
- The positioning and presence of the tutor in the tools and spaces used on mobile phones.
- The context of use i.e. the formal and informal spaces in which mobile phones are used and the potential for distraction.
- How mobile phones are used for feedback and issues around motivation, meanings, expression and honesty when communicating using mobile phones.
- Issues around permanence and visibility.
- Tutor directed and student led use of mobile phones.
- Concerns around ownership and plagiarism.

As discussed in the previous chapter, areas of commonality as well as difference across the three contexts were identified. Partly, this was to identify those aspects that were considered important by students regardless of cultural context. Additionally, it identified aspects of the phenomenon that are present across all three contexts but are potentially impacted by cultural factors, such that participants assigned different priorities to these aspects of the phenomenon. Thus, the primary research question, how learners across different cultural contexts understand mobile learning, is presented in the findings of this study. The first sub question, what are the commonalities and differences across the cultural context, is also examined in the findings. The remaining sub question, the extent to which existing frameworks and theories for mobile learning address the cultural context of the learning, is discussed in the following sections.

5.1.2 Findings in relation to context

Context has emerged as a key aspect of conceptions of mobile learning, such that students described mobile learning in terms of their lived experience of using mobile phones within the constraints and opportunities afforded within their cultural context. The five aspects of context as described by Zimmermann (2002) in chapter 2, specifically: individuality; time; location; activity and relations are evident in descriptions of mobile learning across the three contexts. Students described using mobile phones in formal and informal locations, at different times and adopting various workflows, as well as describing the differing activities undertaken on mobile phones, such as capturing information and accessing

resources. They also describe using mobile phones for forming relations with others, both staff and students.

What is also evident is the concept of 'cultural appropriation' (Pachler et al, 2010), discussed in the literature review, where outside of the formal setting of the classroom students are self-directed in exploiting the technological capabilities of mobile phones and these choices are framed within their socio-cultural context, as well as the concept of 'reflective adaptation' (Lin 2001) where an individual reflects on their existing practice and goals, chooses aspects of an artefact for adaption and reflects on their choices.

Students in the three contexts describe how they make decisions about where and when to use mobile phones compared to other technologies. This is variously related to the features of the mobile phone, psychological aspects, institutional issues and learner preferences. For example, students describe using a mobile phone because of the features of portability and always on connectivity but prefer laptops because of the larger screen, particularly for reading activities. Students also make a distinction between 'work' and study, such that laptops are used for assignments, which are planned activities, and mobile devices are used for ad-hoc activities such as searching for a definition. Context determines when phones are used as opposed to laptops.

Students describe using different tools to communicate with staff and students. Again, context is the underlying factor determining how communication occurs, in this case notions of respect and the hierarchical nature of the tutor-student relationship in some cultures.

Context, therefore, is posited as the underlying thread that connects how students describe mobile learning. The following sections will expand on the notion of context in relation to aspects such as complexity of use, distraction, permanence, learning activities and learner identity.

5.1.3 Findings in relation to complexity of use of mobile phones

The literature review highlighted varying definitions of mobile learning. These definitions were either technology focused, considered mobile learning as a subset of e-learning, viewed mobile learning as augmenting face to face teaching or framed mobile learning in terms of mobility. Mobility was considered to have a number of aspects:

- interactions with different groups across formal and informal spaces, dispersed over time.
- students carrying around the technologies they use for learning and switching between devices according to their technological affordances
- the behaviours undertaken by learners as part of their learning

In terms of describing mobile learning, students across the three contexts saw mobile learning in a variety of ways: mobile learning as using mobile phones for learning; mobile learning as using a range of devices including laptops, tablets and mobile phones; mobile learning as learning on the move and mobile learning as learning in locations other than the classroom. Many of the UK students described mobile learning as learning on the move, for example, where mobile phones were used when travelling to and from the formal classroom setting. Japanese and Chinese students described mobile learning in terms of devices or portability, or as analogous to e-learning where students who engaged in mobile learning were not able to attend formal classroom sessions. These definitions of mobile learning were identified in the literature, particularly Winter's (2007) grouping of perspectives of mobile learning into four categories: technocentric; mobile learning as a subset of e-learning; augmenting formal face to face teaching and considering mobile learning from the perspective of the mobility of the learner. However, it is difficult to ascribe one view of mobile learning to a particular context. For example, UK students, as well as describing mobile learning in terms of mobility, also described using mobile devices in terms of the technology. What is perhaps interesting to note is that all three contexts viewed mobile learning as supplementing, not replacing, formal face to face teaching such that institutional, class-based teaching is still prioritised over other forms of learning.

In terms of technological affordances, and the complexity of use associated with these affordances, what is evident across all three contexts is the mobility hierarchy highlighted in the study by Gay, Rieger, and Bennington (2002), where use of mobile devices moves from a content focus and individualised activity at the lower level to a communication and collaborative focus at the highest level. In addition, use of applications and tools at the lower level is focused on information access compared to data capture and real time communications at the higher level. This correlates with the discussion of context awareness in Chapter 2, where students use the capabilities and technological affordances of the device in different contexts and this use is defined partly by the space in which these devices are used i.e. formal or informal.

The hierarchies found in this study are evident in all three cultural contexts, where each set of interviews resulted in an inclusive hierarchy of categories of description that increase in complexity, moving from access to information in category one through communication in category two to collaboration in category three. In each cultural context students described the affordances of mobile phones that were drivers for their use, including portability, connectivity and the tools available to access information, collect data and conduct synchronous or asynchronous communications across a range of contexts.

Given that the three cultural contexts not only show the same hierarchy in terms of complexity of use but all levels of the hierarchy are described, it could be assumed that the technological capabilities of mobile devices being used by students offer the full range of affordances in each context, however this may be predicated on certain conditions being met:

- the device being used across these contexts is a smartphone, which will either come supplied with the tools that allow for information access, capture and retrieval, communication and collaboration or have the capacity to have these tools installed.
- the presence of the infrastructure required to support the use of these tools e.g. connectivity to the Internet.

Where there is a lack of the technological infrastructure required to support the tools used for communication and collaboration this may result in less complex uses of mobile devices for learning, for example in a developing country context. Kaliisa et al (2017), in a comparative study of Australian and Ugandan students, found that Australian university students felt they were better served in terms of facilitating conditions such as technical infrastructure, compared to their Ugandan counterparts, though both sets of students reported that this is only part of the picture in terms of encouraging the use of mobile phones for learning, citing institutional support as a key issue.

Additionally, where the device itself does not offer the features required for operating at the higher levels of the hierarchy this may limit whether these devices are used. Kaliisa et al (ibid) highlight that there were students in both the Australian and Ugandan universities that used a mobile phone and not a smartphone, who were then less likely to engage in learning activities such as communicating with others or browsing for resources.

Whilst the difference between developed and developing countries may be more pronounced, it cannot be assumed that all students in a 'developed' context will have mobile phones that offer the full range of features that can be used to engage with all levels of the hierarchy. It also does not necessarily mean that more complex levels of the hierarchy are not possible if smartphones are not used. As discussed in the literature review there are examples of mobile learning activities involving simulation and problem solving that use SMS, a basic feature of mobile devices. These were, however, tutor led activities and as such the role and the expertise of the tutor may be a significant factor in terms of how devices are used.

In my study, at a device level, all contexts described use of mobile phones across all levels of the hierarchy when considered as a *collective*. At an *individual* level some students did not engage in some levels of the mobility hierarchy because of the technological limitations of their mobile device, for example where a student in the UK context describes using another student's phone to send a file.

At the infrastructure level, across the three cultural contexts students foregrounded aspects of infrastructure and connectivity that either, in the UK context, facilitated the use of mobile phones over other devices such as laptops or, as highlighted in the Japanese context, were a barrier to their use, for example because of the costs involved in using data. In the Chinese context, the lack of a VLE was the key driver for the use of mobile devices in formal sessions, as there was no other convenient mechanism for the distribution of materials such as PowerPoints. Mobile phones were also used to enable the sharing of resources between students and tutors and for submitting assignments.

Tutor support for the complexity of use of mobile phones at the different levels of the hierarchy is evidenced to varying degrees across the three contexts. Students in all three contexts describe using mobile phones to: receive notifications and schedules and access grades; communicate with tutors and peers and facilitate collaboration. In the Chinese context students are directed to use their phones in sessions to view PowerPoints and UK students are permitted by tutors to use their phones to create notes and capture resources related to learning. However, in the Japanese context mobile phone use in class is discouraged. This suggests that there are differences across the cultural contexts in terms of facilitating more complex uses of technology in formal settings such as the classroom and these are not necessarily related to technological readiness or capability.

5.1.4 Findings in relation to theories and frameworks for mobile learning

Several frameworks that could be used to inform discussion around mobile learning were presented in the literature review. Frameworks variously focus on learning design, technology acceptance and psychological factors. and identify a number of elements that can be considered core to the discussion of mobile learning: pedagogy, context, learner aspects, psychological, device aspects and social interactions.

Koole (2006) suggests that mobile learning is a process involving the convergence of mobile technologies; human learning capacities and social interaction. These are represented as device aspects, learner aspects and social aspects.

There are two aspects of the model that explicitly reference cultural influences: the Social Aspect (S) and the Interaction Learning aspect (LS), which is formed at the intersection of the Learner and Social Aspects.

Koole (ibid) describes the Social Aspect as processes of social interaction and rules of co-operation, which are influenced by either the culture of the learner or the context in which learning takes place, and suggests that interactions that are mediated through technology are constrained by rules that provide predictability and enable effective communication.

The influence of culture on technology mediated social interactions is evident across the three cultural contexts in this study, where students described examples of rules and constraints in terms of use of mobile phones for learning that impacted on how they were used in each context. These rules and constraints governed:

- the language used in communications conducted on mobile phones, with fellow students or tutors, in terms of politeness and formality/informality.
- the use of either synchronous or asynchronous tools on mobile phones when communicating with tutors and peers.
- The positioning of students or tutors in the communications conducted on mobile devices

These differences in the Social Aspect can be explored in a variety of ways: politeness theory, high and low context cultures, transactional distance and social presence.

Students in the UK and Japanese contexts predominantly used email when communicating with tutors. Students described using email as a means of showing respect to the tutor and

the word ‘polite’ was used to support the use of email over text messaging or group chat tools. Students acknowledged that these communications would take longer to construct because they had to think about how to articulate and express themselves in a medium that they considered to be more formal than texting or group chat.

Conversely, Chinese students readily communicated with tutors using ‘informal’ chat tools: in this context the tutor was still positioned as the knowledge expert in student descriptions and the tutor/student dynamic was retained but both staff and students inhabited the same online spaces, unlike the separation evident in the UK and Japanese contexts.

Politeness theory (Brown and Levinson, 1987) has been discussed in a variety of literature and more recently has been applied to computer mediated communications. Politeness theory identifies ‘face’ as a key factor in social interactions, where face is a projection of an individual’s self-esteem, identity and credibility as a member of a social group (Ocker and Morand 2002). Social interaction events, such as requesting information or agreeing/disagreeing with others, are classified as face threatening acts i.e. exposing one’s face. Tactics for engaging with others, for example through technology mediated tools, are either ‘positive’ or ‘negative’. Positive strategies use slang or colloquialisms, first names or reciprocity to engage with others, whereas negative tactics use formal language and titles (Mr., Sir), hedge their requests for assistance e.g. asking if the recipient can spare their time and use more formal language to indicate social distance.

The use of email by the UK and Japanese students, particularly the use of more formal language in these communications, serves to distance the student from the tutor and is an example of a negative face strategy. This social distancing strategy can be seen in the both the Japanese and UK contexts, where students described feelings of awkwardness when communicating with tutors using tools other than email. Tools such as SMS and group chat were used with people they considered ‘friends’ or who were positioned as peers. The mobile device and by extension the mobile phone number were described by some UK students in terms of personal identity, such that students felt uncomfortable sharing their number with tutors in order to facilitate communications such as SMS and chat, as this seemed to cross a professional and social barrier separating them from the tutor. The use of email thus reinforced the distance between tutor and student.

In the Chinese context staff and students used synchronous group chat tools for communications. Email, an asynchronous form of communication, was described as a tool for business or for submitting assignments. This is a shift from what is identified in earlier literature as a preference for asynchronous communications amongst Eastern students. For example Wang (2007), in a cross cultural study of American, Korean and Chinese students found a preference for asynchronous communication tools amongst Korean and Chinese students, that allowed them to think through their discussions in detail before posting, attributing this finding to a cultural trait that encourages them to 'think more, talk less and think it through before speaking'. However, more recent studies have highlighted a preference for synchronous communications and the increased use of tools such as group chat amongst Chinese students, where tools such as WeChat offer the ability to create rich, multi-modal messages using a combination of text, images and character sets leading to a greater feeling of intimacy and closeness amongst chat participants (Sandel et al 2019).

Students across all contexts describe group chat as informal, so it is interesting that in the Chinese context tutors are present in these informal spaces as it implies that group chat tools are viewed differently by tutors in the Chinese context compared to the UK and Japanese contexts. There may be several drivers for this. Across all contexts students saw the speed of response as an advantage of synchronous communication. Issues of privacy, and the barrier between staff and students, appeared to be less of an issue for Chinese tutors compared to the UK and Japanese contexts. Sandel and Ju (2015) reported that in their study of WeChat amongst Chinese university students the hierarchical nature of the relationship with their tutors was flattened in the group chat context and tutors were seen more as peers, with no compulsion or pressure to 'like' posts just because they were posted by tutors. Adoption of group chat tools such as WeChat and QQ in the Chinese context may also be partly driven by the lack of a VLE, which was the case in the institution used for this study, where perhaps tools in the VLE may facilitate discussion and socialisation. Finally, whereas some social media tools such as Twitter, Facebook and Instagram are blocked or restricted in China tools instant messaging services that offer similar functionality and are developed by Chinese companies e.g. WeChat are readily available (Chang and Woo 2019).

Hall's (1976) high and low context concept could also be used to explain the processes of social interaction. Countries which are individualistic in nature, such as the US and the UK, are labelled as low context cultures which are task oriented, form short term relationships

and where communications tend to be explicit and avoid ambiguity. Collectivistic societies, such as China and South Korea, are high context cultures that emphasise group achievement and communications tend to be more ambiguous (Wang, 2007).

Setlock and Fussell (2010) suggests that there are cultural preferences in high context cultures for tools that facilitate social as well as task processes and these cultures give more thought to conveying emotional information and when to mask or reveal it. As such, the use of group chat tools by Chinese students in this study is a means of transmitting emotional information, where email does not offer this opportunity, and where some Chinese students describe using 'stickers', i.e emoji's, this is a way of conveying emotion that would otherwise be difficult for them to express through text alone.

The concept of social presence can also be examined in relation to the Social Aspect of Koole's model, where the availability of synchronous and asynchronous tools encourages a feeling of social presence i.e. a sense of connectedness and, in the context of mobile communications, an awareness of continuous availability (Koole, 2010). Tang and Hew (2017) suggest that social presence helps to promote student satisfaction in computer mediated communications, facilitates online interactions and supports cognitive learning processes. Alsadoon (2018) highlights the link between teacher-learner interactions and the immediacy behaviours of the tutor, such that a lack of immediate response impacts negatively on students. In the three contexts of this study students in the UK and Japanese contexts commented on the ready availability of the tutors for face to face meetings, whereas the Chinese students described the tutors as too busy for face to face meetings, even though this was the preferred method of communication across all contexts. As such, the use of synchronous communication tools on mobile phones in the Chinese context, as opposed to asynchronous tools, is perhaps an attempt to bolster the feeling of social presence in that the tutor is seen as readily available through these tools.

In relation to the literature on cognition and cognitive styles, Witkin et al (1971) developed the dimensions of field dependence, which is a tendency towards a more socially oriented form of learning and field independence, where learners are more individualistic and less reliant on others as part of their learning. Pithers (2002) suggests that whilst a learner may adjust their learning strategies according to the learning situation, cognitive styles are more permanent and influential.

The dimensions of variation for the three contexts highlight differences in terms of how students described themselves in relation to others when using their mobile phones e.g. the Japanese and UK student viewed themselves as primarily individual learners who would collaborate on group activities but were otherwise reluctant to share their work with others whereas the Chinese students were more prepared to share their work with fellow students through mobile phones and described a collective approach to learning that is more about developing the knowledge base of the collective. This would suggest a categorisation of UK and Japanese students as field independent learners and Chinese students as field dependent. However, there can be variation within a single cultural context in terms of cognitive styles, for example Varnum et al (2010) identified studies that found cognitive differences between regions of Japan, adjacent villages in Turkey and between working class and middle-class Americans. As such, whilst differences were found in these three contexts in terms of individualism versus collectivism it would be perhaps unhelpful to ascribe this to an entire cultural context and assume that all members of this context will behave in the same way.

The Interaction Learning intersection draws heavily on social constructivism as the dominant philosophy and considers that learners either indirectly compare their understanding of material with that of the creators or directly negotiate meaning through contact with others. Again, there is evidence of this across the three contexts, where students use mobile phones to interact with tutors and peers in order to clarify aspects of their learning and develop their knowledge and understanding. Park (2011) frames these mobile learning interactions in terms of transactional distance between learners and the tutor and the structuring of content, which is either highly or loosely structured. Four type of mobile learning interaction are identified:

- Type 1: high transactional distance socialized m-learning, where the instructor provides the mobile learning application or sets up the rules of interaction. Students collaborate and communicate with each other in the performance of the task, but the tutor does not facilitate the activity.
- Type 2: high transactional distance individualized m-learning, where students receive structured content such as readings through their mobile devices and are in control of how and when they consume it. Interactions are between the learner and the content.

- Type 3: low transactional distance socialized m-learning, where students interact with the tutor and their peers using mobile devices. Instruction is loosely structured and staff and students work together and communicate frequently to perform the task.
- Type 4: low transactional distance individualized m-learning, where the tutor controls the learning and content is loosely structured.

There is evidence of low transactional distance and socialised learning in the Chinese context, where tutors are described as being present in the same spaces occupied by students and resources are shared via mobile devices. In the UK context, there is evidence of a high transactional distance, where students are given tasks to complete by the tutor, who is not subsequently involved in the task, and students use mobile devices to communicate, collaborate or access structured resources provided by the tutor at a time and place that suits them. This appears to correlate with Hall's concepts of high/low context culture as well as the cognitive concepts of field dependence and independence.

Continuing with the concept of cognition, Palalas (2013) identified five conceptual spaces of mobile learning that make up a mobile learning ecosystem: transactional space; physical space; temporal space; technological space and pedagogical space, where learning in the transactional space is triggered by cognitive processes that are themselves mediated by social and cultural influences. Gunawardena et al (2016) built upon this model of conceptual spaces through their analysis of the cultural spaces that need to be negotiated when designing mobile blended learning activities, presenting a cultural lens through which these relationships can be viewed (Figure 17).

Figure 17: Cultural Spaces and Corresponding m-learning Spaces, from Gunawardena et al (2016)

The five conceptual spaces of the mobile learning model map to the six cultural spaces of the mobile and blended learning model. Applying this combined model to the outcome spaces and dimensions of variation identified in the three cultural contexts the following findings from the study can be seen to correlate with the inner aspects of the model and hence the transactional aspects of the outer model:

- differences in *identity negotiation.* In terms of how students viewed themselves in relation to each other, students in the UK and Japanese contexts viewed themselves as individual learners whereas the Chinese students viewed themselves as part of a collective.
- evidence of divisions in terms of *power, status and authority*. Tutors in the UK and Japanese context were situated outside of the informal spaces used by students and tutors in the Chinese context. 'Knowledge experts' were prioritised in the Japanese and Chinese contexts and in the Chinese context students identified as experts would provide models for other to follow. Additionally, students in the Chinese context would defer to tutors in terms of use of mobile devices whereas UK students described themselves as self-directed in terms of use of devices.
- preferences for different forms of *communication* across the three contexts, which were either described as formal or informal and were occupied by both staff and students e.g. in the Chinese context, or solely by students in the other contexts. Students in the Chinese context described a preference for using media rich tools that allowed for emotion to be conveyed in communications, whereas UK and Japanese students switched between formal and informal tools depending on whether communication is with the tutor or peers.
- the *relational* aspects of these communications, where importance was placed on contextual and emotional cues in the Chinese context.
- *organisational* issues in terms of infrastructure and staff support for the use of mobile phones, either in or out of formal sessions.

In relation to the other aspects of the cultural spaces model, Qi and Boyle's (2011) dimensions of design of learning objects framework discusses how cultural factors may impact on four dimensions: knowledge; pedagogy; access and technology, where the pedagogy dimension can be impacted by a number of culturally significant factors, specifically: learner control and the extent to which students are directed or guided through learning tasks; feedback, where different types of feedback are expected across

different cultural groups; motivation and stimulation, such that the manner of stimulating differs across cultures; communication manner, with preferences for synchronous or asynchronous tools and issues around identity and collaborative tasks, with issues around acceptance of ideas and criticism. These aspects are clearly visible across the three cultural contexts when describing how they communicate, collaborate and interact with tutors and peers.

Additionally, Qi and Boyle (ibid) outline different groups of learning activity, as outlined in Table 21, and suggest that these activities are culturally mediated, with preferences for different types of activity depending on the context.

Group of learning activities	**Learning experiences**
Narrative based activity	Attending, apprehending, experiencing
Interactive based activity	Investigating, exploring
Adaptive based activity	Scaffolding, experimenting, practising
Communicative based activity	Discussing, debating, group project
Productive based activity	Articulating, synthesising,

Table 21: Groups of learning activities with learning experiences covered, from Qi and Boyle (2011)

A number of these activity groups were evident in the descriptions of mobile learning across the three cultural contexts and there were differences and similarities across the contexts in how these activity groups were described, specifically:

- Narrative based activities, which are tutor led and one way, usually involving the transfer of information, such as learning resources. Students across the three contexts described one-way interactions between themselves and learning resources provided by tutors, conforming to the lowest level of the category of

description across all outcome spaces and mapping to the lowest level of the mobility hierarchy presented by Gay, Rieger, and Bennington (2002).

- Interactive based activities, which are two-way interactions with learning resources, such that the system provides feedback to the learner based on input. Students in the Japanese context described using apps as part of their learning and getting scores in apps that served as motivation when comparing these scores to their peers. However, students in the UK context questioned the value of activities such as quizzes on mobile phones, citing concerns as to the lack of tutor input and highlighting that they would want additional feedback that provided context to the answers from the quiz.
- Communication based activities, which are centred around discussion, debates and group work and involves learners in a learning community. Across all three context students described differing attitudes towards collaborative exchange, such that they positioned themselves as individual learners at times competing with other students, as in the UK and Japanese contexts, or saw themselves as both individual and collective learners, contributing to positive outcomes for all as in the Chinese context. In addition, students in the UK and Japanese contexts described using mobile phones to plan and organise face to face meetings, rather than conducting these collaborations on mobile devices whereas Chinese students readily collaborated within tools on mobile devices.

However, whilst there is evidence across the three contexts that there are a variety of narrative, interactive and communication-based activities being undertaken by students with their phones there is limited evidence of this being tutor directed outside of formal contexts, particularly at the higher levels of complexity. For example, students in the Chinese context described being directed to set up a group chat for communication, which the tutor then joins, whereas UK and Japanese students described setting up shared social spaces or using their mobile devices to capture or create materials without needing direction and these are spaces in which the tutor is absent. This may be related to aspects of power, status and authority, as identified in the cultural spaces of the model presented by Gunawardena et al (2016), such that Chinese students described how they would defer to the tutor whereas the UK and Japanese students exhibited more individualistic traits, describing the tutor as a facilitator of learning and as someone who can recommend but not necessarily enforce technology use.

5.1.5 Findings in relation to permanence and honesty in feedback

Across the three contexts, feedback is described as a useful mechanism for evaluating the quality of work, though there are differences across the three contexts in terms of how students engage in feedback, particularly when describing the permanence of postings and the honesty of technology mediated versus face to face communications.

Across all contexts students described giving feedback to each other, as well as posting up work for feedback from their peers, though this was mainly in relation to group oriented tasks. In the Chinese context students also described requesting feedback on individual work from their peers. There is some recognition, across all aspects, of the emotional impact of negative feedback but also a recognition that purely positive feedback is not helpful.

One difference that emerges in analysis of students' transcripts was attitude towards the permanency of communications conducted via mobile phones, such as those related to feedback. Chinese students welcomed the opportunity to review a record of conversations conducted via mobile devices. Some Japanese students, however, expressed reservations about the permanence of these conversations. In addition, Japanese students described that they could be more honest in technology mediated conversations compared to face to face interactions, for example highlighting that feedback transmitted through mobile devices would be franker than that given face to face.

Sidi-Ali et al (2019) comment on the dearth of literature related to culturally adapted feedback and in a study conducted with groups of students from differing cultural contexts found that there were relationships between Hofstede's cultural dimensions and how feedback was provided, such that groups of students representing more collectivist cultures tended to favour more emotional support in their feedback.

Walther et al (2016) suggest that persistence of messaging leads to feelings of closeness between participants, linking this to levels of self-disclosure where revealing more personal information leads to greater levels of trust. Schouten et al (2007), also frames computer mediated communications in terms of self-disclosure, suggesting that a lack of verbal cues can lead to disinhibition on the part of the person taking part in online communications, thus participants are able to express themselves more freely than they would in face to face interactions. Given this link between disclosure and persistence it is therefore interesting that some Japanese students expressed concerns about the permanence of

their postings. It may be related to the earlier discussion of face and the extent to which exposing one's face by posting in an online forum reveals aspects which may cause anxiety in terms of how this contribution impacts on others, and continues to cause impact after the initial posting because of its permanence. It may also be related to collectivism and the desire to create group harmony, where permanent records of disagreement serve to undermine this. Choi et al (2016) reports on the general belief that Eastern societies are more concerned with group cohesion and harmony and avoid direct confrontation whereas Western cultures tend to tackle disagreements head on. However, in their study on collaboration using Twitter, testing the hypothesis that American students would send more tweets expressing disagreement than Korean students, they found no significant difference in the number of messages expressing disagreement.

Overall, there is some evidence in the transcripts that across the three cultural contexts there are differences in how feedback is framed when using mobile phones and that these may be culturally mediated, but this needs further investigation.

5.1.6 Findings in relation to distraction

Across the three contexts, students described using mobile phones in formal contexts or having the mobile phone to hand in the class. For example, in the UK context students described using mobile phones to take notes, capture images of material presented on boards, recording videos for use in activities and looking up information related to class discussions. In the Chinese context students described using mobile phones to view PowerPoints, as directed by the tutor. However, across all contexts students described the potential for distraction when using phones in the session, as well as tutor disapproval or at times tutor instruction to put the device away. There was evidence of differing levels of tolerance for the use of mobile phones in the classroom, where students either cite the tutor or their peers as the influencing factor in their use. A number of studies highlight the potential for distraction when mobile phones are brought into the educational arena, citing issues such as students checking emails, making calls and texting and the difficulties tutors have in detecting and managing their use (O'Bannon et al 2017; Cheong et al 2016; Ott et al 2017). However, whilst there is acknowledgement of these issues in the three contexts of this study there seems to be varying levels of tolerance for the use of mobile phones in classrooms. This is partly tutor directed, where tutors explicitly allow the use of mobile phones because they offer an opportunity to extend the learning or, conversely, limit their use and ask for devices to be put away during the class. It is also influenced by students,

who may express disapproval if their peers use mobile phones in class. Some students described this in terms of respect for the tutor, such that attention should be paid to what is being presented by the tutor in the class, others in terms of the impact on their own learning if they are distracted by others using phones in the session.

Studies have identified differences in terms of tolerance of mobile phones use in class settings, suggesting that this is culturally mediated. For example, Shuter et al (2017) found significant differences in their comparison of US and Indian students' attitudes towards the use of mobile devices in class and the sanctions used by tutors, where Indian students were less tolerant of their use compared to their US counterparts. Additionally, Indian students expressed the view that the institution should dictate how devices are used whereas US students felt that this should be decided by individual tutors. Shuter et al (ibid) frame this difference in terms of individualistic versus collectivist cultures, as well as differences between the two countries in terms of perceptions of the power of individual tutors relative to the authority of the institution.

In the context of this study there are differences between the Japanese and the UK students. The UK students described using devices in class, highlighted acceptance of their use by tutors whilst also recognising the potential for distraction. Japanese students, however, described their tutors as being more explicit about limiting phone use and the students themselves expressed concerns about how they would be perceived by the tutor if they used their mobile phone in the session. Langan et al (2016) highlights this complex relationship between acceptance, distraction and respect in their study of university students in Ontario. They found that students would justify their own use of mobile phones whilst at the same time stating that they would feel distracted by others using their devices, they also recognised that such use could be seen as showing a lack of respect for the tutor. Langan et al (ibid) also suggests that the use of additional technologies in the lecture impacts on the power relations between student and tutor, such that the instantaneous access to information degrades the status of the tutor as the focal point of learning. This may explain why students in the UK context are more willing to use mobile devices in the formal classroom setting, without necessarily seeking tutor approval, compared to the Chinese and Japanese students because it relates to the previously identified literature on power distance and high/low context cultures i.e. the extent to which students either feel in control of their own learning or are directed by tutors, based on the power relationship within the tutor/student dynamic.

5.2 A framework for mobile learning in international contexts

In relation to the sub research question about existing theories and frameworks for mobile learning and the extent to which they take into account the cultural context of the learner, it is evident that many aspects are identified as relevant, including context, pedagogy, learner control, social interaction and technological issues. However, there is a) no single unifying framework that addresses mobile learning, with varying emphasis being placed on learning design, evaluation, technology acceptance and psychological and social factors and b) culture is either not addressed, is partly addressed e.g. in terms of design of learning activities or learning objects, or does not consider the range of aspects of cultural context that may impact on the use of mobile phones in learning.

This section will now propose a framework for mobile learning in international contexts. This framework attempts to capture the aspects of mobile learning that were foregrounded by participants, as well as highlighting the aspects of the phenomenon of mobile learning that are culturally mediated.

The aspects discussed by Koole (2006) and Gunawardena et al (2016) are a useful starting point. Koole's FRAME model (2006) describes mobile learning as the intersection of social, device and learner aspects. The device aspect is concerned with the features and functionalities of the mobile device and as highlighted in the findings participants indicated that, in part, how they use their device is dictated by its capabilities e.g. smartphone versus non-smartphone, internet access, apps etc. In terms of structural aspects, participants would foreground some of these capabilities when describing mobile learning activities and interactions. From a cultural perspective, participants described varying attitudes towards the use of mobile devices in a learning context, citing aspects such as formality and respect, distraction and tutor and peer expectations.

The social aspect, which governs processes of social interaction that are mediated through technology, suggests that the rules that are created to enable effective communication are culturally constrained. This was highlighted by a number of participants in the study in terms of how socialisation occurred, who with, what platforms were used and the formality of these interactions and aligns with research into aspects such as politeness, presence and permanence.

Finally, the learner aspect is concerned with aspects such as cognition, prior knowledge, emotions, motivations and how learners encode and transfer information. Participants

described differing views of themselves in relation to others in terms of learning, for example in terms of student to student or student to tutor interactions, as well as expectations of tutor presence in mobile learning spaces.

Gunawardena et al (2016), whose mobile learning model identifies six cultural spaces that need to be considered when designing mobile learning activities, was evidenced in the data in aspects such as identity negotiation of learners in relation to others, differences in status, authority and power in mobile learning spaces, differing preferences for communication in terms of tools, immediacy, formality and the emotional cues used in communications and the influence of the organisational context in term of where and when mobile devices are used.

Context is a key aspect of both models. In Koole's (2009) model mobile learning experiences are viewed in the context of information where learners engage with and create information and these interactions are mediated through technology. In Gunawardena et al (2016) culture is the lens through which mobile learning activities are viewed, such that *culture* is the context in which learning occurs and includes aspects such as location, the focus of the task, how the learners position themselves and others and the types of tasks being undertaken. These aspects of context were evident when participants described their experiences of mobile learning.

The findings from the study showed outcome spaces where Gay, Rieger, and Bennington's (2002) mobility hierarchy was evident in the categories of description in each context, such that participants moved from simple to more complex interactions in an inclusive hierarchy and within each level of the hierarchy participants foregrounded aspects of the phenomenon according to their cultural context. Dimensions of variation highlighted aspects such as tutor positioning, perception of self in relation to others and group versus individual orientation in tasks.

With these models and the findings from the study in mind a framework is proposed as shown in Figure 18.

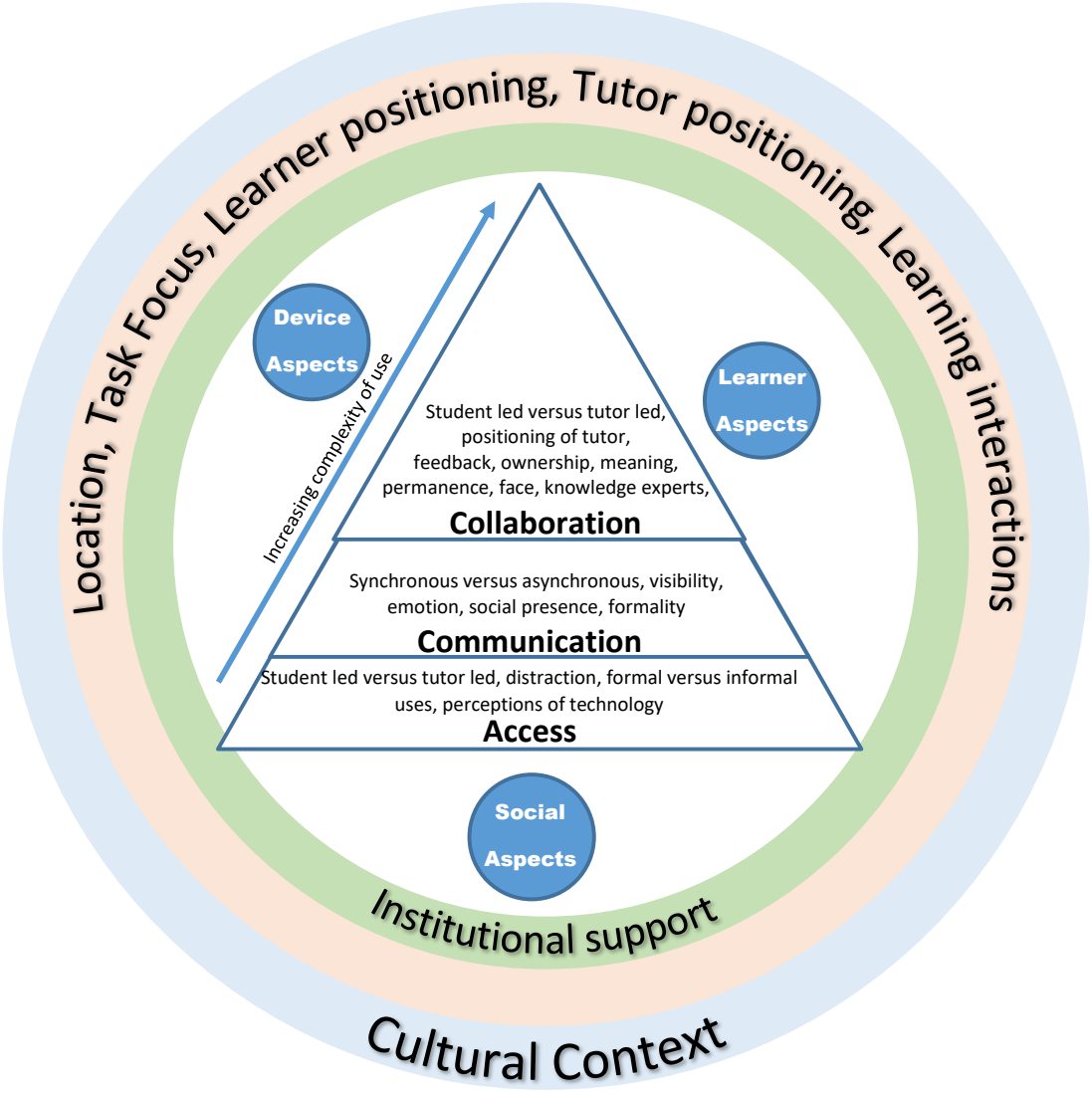

Figure 18: a framework for mobile learning in international contexts

The elements of the framework have emerged from the analysis of transcripts and the resulting categories of description, outcomes spaces and expanding themes of awareness. The remainder of this section will explain their inclusion.

5.2.1 Cultural context

In terms of context, Sharples, Taylor and Vavoula's (2005) proposition is that context is a dynamic entity that is created through the interactions between actors and technology. This is not disputed. Context has emerged as a key aspect of mobile learning, both within the literature and as evidenced by student descriptions of how, why and where they use

mobile phones. However, all aspects *within* the proposed framework are considered in relation to a shell of *cultural context*, where learners are using mobile phones and the affordances of these devices in ways that reflect the social and cultural milieu in which they are situated. This cultural context is all-encompassing and influences all of the elements within the framework.

5.2.2 Themes of expanding awareness

Within the cultural context shell are the themes identified by students i.e. aspects that are foregrounded by students across the differing cultural contexts that influence how mobile phones are used. These were present in all contexts as aspects that may either be the same across contexts or exhibit differences due to the cultural context, these themes are:

- the locations in which mobile phones are used, which may either be in formal or informal settings depending on the cultural context. Use in the classroom may either be discouraged or prohibited. Issues such as the potential for distraction and the perception that devices are not being used for study were cited, as well as issues around respect for the tutor.
- whether the learning task being undertaken on mobile phones is an individual or group task. As identified in the findings, students
- the extent to which the learner considers themselves an individual learner competing with others or part of a collective working towards the achievement of all;
- the positioning of the tutor in terms of directing the student or acting as a facilitator
- the extent to which interactions are one way or two way.

These are placed as inside the cultural context as factors that may influence how mobile learning works in practice.

5.2.3 Institutional support

Institutional support is then positioned as an aspect of mobile learning that is culturally mediated, which influences how and where mobile phones are used. It may constrain mobile learning implementations, for example, because of a mismatch between the culture of the institution and that of the students. The extent to which the institution, the staff and

the technological infrastructure support activities across all levels of the mobility hierarchy is important in terms of enabling mobile phone usage.

5.2.4 Expanding the concept of mobile learning in Koole's Frame Model

Koole's (2006) FRAME model describes mobile learning as the intersection of social, learner and device aspects. These are retained, but the intersections of these aspects is presented now as the outcome space constructed after analysis of student utterances. The hierarchy reflects the increasingly complex ways in which mobile phones are used across all contexts, which is influenced by the social, learner and device aspects identified in Koole's model. The central triangle depicts the increasing levels of complexity of mobile phone usage, which is analogous to the hierarchy of categories of description highlighted in the outcome spaces. Within each level of the hierarchy are the aspects that were foregrounded in the descriptions of students in the three cultural contexts, with the suggestion that these aspects are culturally influenced, such that issues such as distraction, formality, preferences for synchronous and asynchronous communication and social presence need to be considered.

5.2.5 How to use the framework

This framework is presented as a tool that can be used to consider aspects of mobile learning that are culturally mediated and may impact on mobile learning interventions, such that educators need to take these aspects into account and the extent to which they may influence how and where students use mobile devices.

As such, an educator may first consider the context in which mobile learning is going to take place in order to identify whether learning approaches using mobile devices would be likely to succeed or fail because of the prevailing cultural context. Secondly, the institutional environment in which mobile learning occurs will need to be considered: are initiatives involving mobile devices likely to proceed or will they be rejected because of institutional attitudes towards their use?

Moving inwards, the educator may need to answer questions about the formal and informal spaces in which the use of mobile devices will occur, the types of activities being undertaken and the extent to which the tutor will be present in the technology mediated spaces that students will use to communicate, collaborate and share resources. The positioning of the tutor, and the expectations students have as to whether tutors would be

accepted in these spaces, may facilitate or inhibit learning interactions. The types of learning interactions must be considered, will they be tutor directed or student directed, will there be dialogue between the tutor and the student or will interactions be student to student? All of these aspects are identified as being influenced by cultural context so the educator would need to consider whether these will influence how mobile devices are used.

Finally, where mobile devices can facilitate access to learning resources, communication and collaboration, how will this occur in practice? Given that the cultural context in which devices are used will impact on how and where students access resources, use mobile devices for communication and collaborate on learning activities, what are the issues to consider when aspects such as permanence, emotion, and ownership are culturally mediated and impact on how mobile devices are used?

Where issues are identified, it may be possible to mitigate against them. It may require a reworking of the intended learning approach so that it is culturally appropriate. Otherwise, assuming that all types of learning activity will be readily adopted by students across all cultural contexts may lead to frustration for the students and the academic.

5.2.6 Framework validity

In considering the validity of the proposed framework Taylor, Sharples and Vavoula (2005) provide guidelines based on their own work in developing a framework for analysing mobile learning, where they consider learning to be a socio-cultural process that is framed by cultural constraints. These include: accounting for the mobility of learners; covering formal and informal learning; theorising learning as a social process and analysing learning as a personal and situated activity mediated by technology. The framework *does* account for mobility, in considering location as an aspect of where mobile learning occurs and that this can occur in formal and informal spaces, as well as mobility in terms of the online spaces that students move across as part of their learning. Mobile learning *is* framed as a social process, incorporating as it does the aspects of the FRAME model as well as the aspects identified in the hierarchy in terms of communication and collaboration. Finally, learning as a personal and situated activity mediated by technology is encompassed in the learner and device aspects used from the FRAME model as well as aspects such as task focus and learner positioning and the cultural context shell that forms the outermost part of the framework.

Additionally Hsu and Ching (2015), in reviewing a range of frameworks and models for designing mobile learning experiences, highlight the lack of consideration of the needs of developing countries, specifically the need to consider differing cultures, infrastructure issues and varying conceptions of what learning is. Whilst not specifically considering the developing country context his framework encompasses these aspects, for example where infrastructure issues may impact on institutional support and capability for mobile learning and where expectations around learning and learning interactions may influence how students engage with mobile learning.

Having developed the framework, potential next steps would be to test it in additional cultural contexts to establish whether the factors identified are evident outside of those used in the study and their relative importance. For example, as identified in the literature there is a lack of studies in developing countries, where infrastructure may have a much greater impact than in a developed country context. This may not necessarily be a barrier to engaging students in engaging mobile learning activities. Cornelius and Marston (2009) highlighted that basic features of mobile devices, such as SMS, can be used in ways that encourage problem solving and collaboration.

5.3 Reflecting on the study and the phenomenographic research process

The output of this study was a set of outcome spaces that described conceptions of mobile learning across three cultural contexts: China, Japan and the UK. Examination of transcripts led to the presentation of three outcome spaces which were presented as an inclusive hierarchy moving from simple to more complex uses of mobile devices, ranging from data access at the simplest level to collaboration at the most complex level.

What also emerged from the analysis were descriptions of how students engage with mobile phones for learning which could be linked to the cultural context of the learner, where students describe conceptions of mobile learning, based on their lived experiences, that impact on the activities they undertake as part of their learning, the nature of the relationships conducted through mobile phones and the extent to which mobile phones are accepted across formal and informal contexts by staff and students.

These findings were linked with the literature that examined definitions of mobile learning, aspects of frameworks for mobile learning that can be influenced by cultural context and

issues such as distraction, social presence and the positioning of the tutor which can be impacted by the cultural context of the learner. This study therefore contributes to the body of knowledge that considers the relationship between technology, learning and cultural context, particularly with regards to studies that are conducted outside of the predominantly European focussed academic literature on mobile phone usage in academic settings and the lack of studies that seek to examine the influence of culture on such usage.

In terms of the participants chosen for this study, there was a recognition that Hofstede's cultural dimensions is prevalent in a number of studies examining culture and a number of researchers have used Hofstede's work to frame their work. This was identified as problematic and critics of Hofstede identify the tendency to link country and culture. This study was conscious of the need to avoid this. At the same time there was a requirement to identify participants that could contribute to the study and perhaps represent a diversity of experiences without necessarily assuming that such diversity of experience exists, given that the phenomenographic approach requires bracketing of assumptions. How then to choose participants for the study? King (2015), suggests that regionality is the answer. In a discussion of South East Asia, a region which contains a number of countries, there is a recognition that political boundaries do not define culture, which can vary within countries and across borders. Cohen and Varnum (2016) also consider that culture is more than ethnicity and nationality, highlighting social class, region and religion as other forms of culture. In this study, participants were chosen from the UK, China and Japan, but whilst these participants were chosen in a particular country context because of established relationships that facilitated the conduct of the interviews they were also chosen because they represented regions of the world that are recognised as being distinct, where a number of authors have identified differences between Western and Eastern cultures in aspects such as mindfulness (Raphiphatthana, Jose, and Chobthamkit 2019), personality, motivation and cognition (Boyle et al 2020) and communication using technological tools (Guntuku et al, 2019). Kitayama et al (2019) cite a number of studies that have found differences between Eastern and Western cultures and challenge the notion of 'psychic unity' where all cultures are assumed to be universal.

Phenomenography was selected as the approach to gathering and analysing data for this study, in order to provide a collective understanding of the phenomenon of mobile learning for each cultural context. Presentation of the resulting categories of description and the

hierarchical outcome space was based on analysis of student transcripts, extracts from which are which are used to support the findings.

In terms of phenomenography, the question of repeatability is discussed in the literature. Cossham (2018) identifies some of the key criticisms levelled against phenomenography: the issue of replicability and the potential for researcher bias in interpreting the data gathered from interviews, such that the researcher fails to adequately capture the phenomenon from the perspective of the participants. Moffitt (2020) echoes some of these criticisms, in particular that the novice researcher may potentially reveal their own pre-ordained categories based on their assumptions as to what the data will uncover.

It is possible that a different researcher may start with the same set of interview questions but the follow up questions may focus on different aspects. In part this is a result of the interaction between the interviewer and interviewee and the data that emerges from this interaction.

It is also acknowledged that these outcome spaces are the result of interpretation by the researcher, attempts have been made by the researcher to discuss the approach taken in the study, including the bracketing of prior assumptions, testing of the interview protocol and an examination of the methods employed by a variety of researchers in the analysis and presentation phases of their phenomenographic studies in order to identify a suitable approach for tackling data analysis and presentation of the results.

As this was a PhD study, the interpretation of the interview transcripts was an individual endeavour that resulted in a set of outcomes spaces and categories of description arrived at through examination of participant utterances and this can be seen as a limitation in this context. It is possible that another researcher may present a different set of categories of description, themes of awareness and outcome spaces, or highlight different structural and referential aspects. Some phenomenographers highlight the usefulness of a 'critical friend' who can sense check the analysis. Aflague and Ferszt (2010) describe using phenomenographic 'experts' to check their emerging categories of description. Outside of the context of a PhD study this may be helpful in ensuring validity of analysis.

As described in the methodology section, the lack of a common approach to phenomenographic data analysis provided some challenges in attempting to make sense of the interview transcripts, such that this researcher struggled for a time to develop a strategy for constructing the outcome spaces for each context and indeed whether to

construct one outcome space representing all contexts of one for each context. Additionally, the range of approaches to presenting the outcome space, where researchers differed in their use of structural/referential frameworks, categories of description and dimensions of variation, was also a significant barrier that needed to be overcome in order to understand how best to present the results of analysis.

What has emerged, through engagement with a wide range of literature on phenomenography and discussions with academics, researchers and Professor Ference Marton himself, who developed the phenomenographic framework, is that there is still debate as to how best to employ phenomenographic methods and that there is not a prescribed procedure for conducting analysis. Certainly, there are tenets of phenomenography that distinguish it from other approaches, such as the categories of description and the outcome space but in analysing a number studies purporting to use the phenomenographic method it was clear that these supposed tenets are sometimes absent, which raises the question as to whether these *are* actually phenomenographic studies. Additionally, phenomenography seems to be evolving, such that more recent studies include aspects that are absent from earlier investigations as academics attempt to refine the framework in order to increase its validity. As such, this study is a snapshot of the use of phenomenography at a certain point in time and does not attempt to present a definitive approach but instead attempts to understand and apply phenomenographic methods in a manner that allows for useful analysis and discussion. It is hoped, therefore, that as well as contributing to the body of knowledge on culture and its impact on the use of mobile phones in learning, this thesis will contribute to the body of knowledge that discusses phenomenography and its use.

The inconsistency in how phenomenographic analysis is undertaken has been a limiting factor in terms of understanding how to analyse the data and present it in a manner that maps to the tenets of phenomenography. Researchers attempting to use phenomenography must take this into account when seeking to justify why it is an appropriate approach to utilise in their study.

5.4 Implications for academic practice and policy

The aim of this study was partly to address the limitations identified by previous researchers in terms of the applicability of their work outside of the European/Western context. As identified in the literature review the predominantly Western focus of research into mobile learning has meant that researchers cannot argue that their findings are applicable across all contexts and certainly some academic have stated this as a significant limitation in their studies. Thus, further work needs to be done to challenge assumptions around the effectiveness of mobile learning interventions when considered in a global context, where learners are perhaps attempting to use mobile phones for learning whilst at the same time struggling to reconcile their use within the rules and constraints of their cultural context.

This researcher was also motivated to pursue this study as an educator in the UK HE sector, working with students from diverse cultural backgrounds. Assumptions that students will readily adapt to accommodate UK educational practices means that perhaps academics are ignoring aspects of the learner's culture that are perhaps difficult for them to change. It is also arrogant to expect international students to change their learning habits for the relatively brief period that they will be studying elsewhere and assume that this will not cause problems. In addition, where students from varying cultural contexts are using mobile phones in ways that are not congruent with their tutors or their peers in other contexts to what extent will this lead to a lack of engagement or mismatch of expectations between staff and students? To what extent should the tutor or institution adapt to accommodate student expectations and what issues does this raise?

John Traxler, professor of digital learning at the University of Wolverhampton's Institute of Education and author of many articles and studies investigating mobile learning in a global context, argued in an online article in 2016 that the promise of mobile learning has not been fulfilled. He suggests that students are bringing their own technologies, as well as expectations and habits about how they learn with them, and finding that institutions lock them into traditional models of learning where Virtual Learning Environments are used as repositories and technologies such as mobile devices are being used at very low levels of complexity to access these repositories.

This study has shown that students in differing cultural contexts *can* engage with mobile learning at differing and increasing levels of complexity, encompassing the lower level of

resource access as described by Professor Traxler, but also engaging in more complex interactions that include communication, collaboration, critical thinking and questioning. The literature review also identified innovative strategies for using mobile devices in learning that do not necessarily require students to have smartphones but can still engage them in problem solving, simulation and reflection. The onus is on institutions and educators to consider how to best use mobile phones as part of a range of strategies that engage with learners, taking into account the need to accommodate learner preferences but also challenging instructors to move into and across the spaces occupied by learners as part of their learning journey.

5.5 Limitations of the study

The interviews conducted for this study were conducted in-situ at three universities which involved travel to China and Japan and significant additional administration. Whilst this means that the study cannot be accused of convenience in its sampling, there are also numerous other countries that would merit investigation to see if they exhibit aspects of the outcome spaces created for these three contexts and whether the frameworks identified in the literature, such as high/low context and field dependence/independence, are applicable.

These three countries could be considered ‘developed’ as opposed to ‘developing’. Brown and Mbati (2015) highlight that whilst there is a rapid increase in wireless infrastructure in developing countries, essentially leapfrogging the wired infrastructure of developed countries, connectivity is still low bandwidth, restricting the availability of rich data applications such as video, audio and streaming. As such, uses of mobile phones may not exhibit the levels of the hierarchy evident in the developed country contexts.

As discussed in the methodology section, interview participants were selected based on their ability to converse in English, the native language of the researcher. This was to avoid the use of an interpreter which, as discussed in the literature review, may lead to multiple translations of meaning as part of the interview that obfuscate the process of gathering conceptions. An argument was made for this in terms of English as a lingua franca, such that English is considered a neutral language that still allows for effective articulation of meaning. In some of the Japanese interviews it was clear that some of the participants struggled to express themselves when using a non-native language. When it became clear that they were having difficulty the decision was made to conduct a shorter interview,

rather than offending the participant by terminating the process prematurely, and these interviews were not subsequently used in the analysis. Au (2019) highlights some of the issues when conducting interviews with participants who struggle to express themselves in a non-native language, where participants are trying *not* to use their native language because they are deferring to the authority of the interviewer but also apologising for their inability to express themselves because of their lack of fluency in the language. It was not possible to pre-screen participants prior to travelling to Japan but perhaps a self-assessment checklist, given to participants ahead of the process, can give them the opportunity to avoid placing themselves in a position where they may feel anxious. Au (ibid) also suggests a natural conversation strategy may help to transform the context of the interview, removing the power distance barrier between interviewer and interviewee and creating a more emotional rapport between them.

5.6 Areas for future research

Given that this research was conducted in three cultural contexts there is potential for this research to be expanded and to consider a wider variety of contexts. Given that the participant groups in this study evidenced all three levels of the mobility hierarchy outlined by Gay, Rieger, and Bennington (2002) it would be useful to apply this to other contexts to see whether these increasing levels of complexity of use of mobile phones is possible regardless of cultural context, whether issues around infrastructure, institutional support and tutor support may limit more complex uses of mobile devices and the extent to which students themselves would embrace or reject the use of mobile phones in learning due to their cultural context. It would be interesting to investigate how educators can mitigate against these issues and still engage students in higher levels of the hierarchy without necessarily having access to more technologically capable devices i.e. smartphones.

The African and Middle Eastern cultural contexts would be an interesting area of further research, where the literature review highlights that many studies of mobile learning in Africa are focused on students in primary and secondary schools.

As this was a study into *student* conceptions of mobile learning a study of tutor conceptions of mobile learning may be an opportunity to consider how educators view the use of mobile phones for learning. Given the limited analysis in this study of strategies employed by tutors in using mobile phones as part of their teaching, since the focus was on student descriptions of their use of mobile phones, further investigation of the effectiveness of

different modes of teaching e.g. constructivist, behaviourist and problem based approaches, could provide some insight into issues of andragogy across the differing cultural contexts and the effectiveness of strategies that use mobile phones in a variety of ways to engage with learners. As identified in the literature, much is made of constructivist approaches to learning, but the extent to which constructivist approaches would work equally cross all cultural contexts merits further scrutiny.

The framework suggests that a one-size-fits-all approach to the use of mobile phones ignores the cultural context in which mobile phones are used by students. The question for educators is to what extent aspects such as social presence, preferences for synchronous and asynchronous communication tools, issues around distraction and attitudes towards collaboration are difficult to adapt when students move from one cultural context to another, for example when undertaking study in another country. In addition, to what extent do educational institutions and tutors need to adapt to accommodate the cultural 'baggage' that the learner brings with them? A study that examines international student conceptions of mobile, for example in a UK based HE institution, would offer an insight into how these students adapt to the local context and whether their expectations of mobile phone use are met.

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Appendix A: Interview questions

1. What do you use your phone for?

    a) why are those aspects important to you?

    b) do you use any other technologies for the same purpose?

2. What is mobile learning?

    a) why do you say that?

3. Can you describe a situation where you used a mobile phone as part of your learning?

    a) when was it?

    b) were you on your own or part of a group?

    c) why did you use the phone?

    d) where you told to do it?

    e) was the tutor involved in this learning?

        - how did you feel about that?

    g) how were your classmates involved?

        - how did you feel about that?

    h) where were you in this situation, at university, at home, or somewhere else?

4. Have you used mobile phones for group work?

    a) If yes, how did you feel about it?

    b) If no, why not?

5. Have you used mobile phones for communicating with your tutor?

    a) If yes, how did you do it?

    b) if No why not?

6. Have you used mobile phone to communicate with class mates?

a) If yes, how did you do it?

why did you do it?

how did you feel about it?

b) if no, why not?