



**MASTERS OF SCIENCE IN TECHNICAL EDUCATION
(COMPUTER SCIENCE AND ENGINEERING)**

**STUDENTS' CONCEPTIONS OF MOBILE LEARNING (M-LEARNING)
IN UNIVERSITY EDUCATION OF BANGLADESH**

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DHAKA-BANGLADESH

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By

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Science in Technical Education** with Specialization in **Computer Science and
Engineering**

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This is to certify that the work presented in this thesis is the result of an original research study carried out by **Benadjih Oiriddine Abdou** under the supervision of **Dr. Shahadat Hossain Khan** and Co-supervisor **Prof. Dr. Che Kum Clement** in the Department of Technical and Vocational Education (TVE), Islamic University of Technology (IUT), the Organisation of the Islamic Cooperation (OIC) Dhaka, Bangladesh. It is hereby declared that this work has not been submitted for any other degree or award in any other university or educational establishment.

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DEDICATION

I dedicate this work to my beloved parents, brothers, sisters and the whole family in general for their love and support to me during my studies. Without them, the accomplishment of this work would not have been possible. May the Almighty reward them endlessly!

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LIST OF ACRONYMS

ICT	Information Communication Technology
m-learning	Mobile learning
CSE	Computer Science & Engineering
EEE	Electrical & Electronic Engineering
MCE	Mechanical & Chemical Engineering
E&L	English & Literature
BBA	Bachelor of Business Administration
LAW	Law
PHARM	Pharmacology
P(1-16)	Participant (1-16)
U(1-4)	University (1-4)

ABSTRACT

This Masters' thesis discusses emerging results from a phenomenographic research study that was conducted in Bangladesh to investigate the students' experience on the use of mobile devices in their learning. In total, 16 students from four universities of Bangladesh took part in the semi-structured interviews to explore their understandings and experiences on m-learning. The findings of this study have been categorized into six qualitatively conceptions: (i) storing learning materials, (ii) accessing and sharing information and knowledge, (iii) effective learning tool, (iv) effective tool for communication, (v) effective tool for collaborative learning and lastly (vi) effective tool for developing new ideas. This research built on prior studies that explored university students' conceptions of learning in other areas of education. However, the main emphasis in this study was on investigating their experiences in mobile learning, as an emerging area of education research, which revealed aspects of university learning. The findings of this masters' thesis could play a significant role in faculty development programs and have an impact on teaching and learning practice in the university education. With reference to prior studies that defined a relationship between student's learning methods and teacher methods, the study suggested that future research on teacher's conception on mobile learning may be conducted in order to create clear link between students and teachers in the use of mobile devices in learning environment.

CHAPTER I

INTRODUCTION

1.1 Background of the study

Over the last few decades, most of the developing countries have been trying to introduce Information Communication Technology (ICT) in their education sector (Kafyulilo, 2014; Kozma, 2005, 2008). As such, ICT, in recent years, has gone on to become one of the most crucial components that determine the basic competences of students besides the basic calculation, reading and writing skills (Noor-Ul-Amin, 2013; Potyrala, 2001). This has been possible because of a number of reasons. For example, Hammond (2014) claimed that some of the major reasons why the introduction of ICT in education was promoted so much in England were because of the “belief that ICT can have an impact on the standards, and provide more vocational relevance in the curriculum and can be a catalyst for curriculum reform” (p. 192). On the other hand, Hammond, Reynolds, & Ingram (2011) reported that ICT offers a number of benefits such as “supporting personalized pathways; monitoring progress; providing for ‘anytime anywhere’ learning; enabling independent and collaborative learning and developing new modes of learning” (p. 191). All these reasons have led to the successful introduction of ICT in education at different levels in almost all the countries in the world.

There are various ways in which ICT can be applied in the teaching-learning process. From the use of a computer and a multimedia projector in a traditional classroom environment to facilitate learning to the use of the internet at home or work place to learn straight from online situations can be viewed as some of the means ICT can be used in the education sectors. However, the trend goes well beyond this with the rapid advancement of mobile devices. This whole new development has led to the formulation of the mobile learning or simply m-learning (Serin, 2012). Bearing in mind the importance of ICT, the Bangladeshi government has already taken quite a number of measures to introduce it, including m-learning, in various stages in their education system (Karim, 2010). Furthermore, Bangladesh being a developing country and the poverty rate being considered to be high, the government believes that it will play a key role in their attempt to improve the life of their citizens by producing people capable of depending on themselves for daily living. For that reason, learning through mobile devices is viewed as an integral part in the

successful implementation of this project. This has led the government to introduce a new charter known as “Digital Bangladesh”. In order for this goal to be successful, institutions of higher education (universities particularly) have been viewed as one of the most important areas in which ICT, m-learning for example, can be put into full implementation. This newly emerging area is expected to have an enormous contribution as it will help produce graduates with rich technological background that will be very much useful in meeting the requirements of the community. That knowledge will be vital in the digital environment that the government intends to provide to their citizens. It should however be mentioned that these expected benefits will only be realized when the students indeed use these devices practically in their daily activities to support their learning. This is particularly true with reference to Koehler and Mishra (2005) who claimed that technology alone is not enough to guarantee the learning of a student. But it also takes his commitment to using it to his benefits. Therefore, research needs to be conducted urgently on how the students could use mobile devices efficiently and effectively to complement their learning. Considering the emergency of this matter, this current study was suggested to investigate the experiences of university students on using mobile devices in their learning.

1.2 Statement of the problem

In order to fill up this emerging gap, the main problem of this study was to identify exactly what the experiences of the university students in Bangladesh are on the use of mobile or handheld devices in their learning.

1.3 Aims of the study

The aims of this study were set for identifying the qualitatively different ways in which Bangladesh university students experience the role of mobile devices in their learning.

1.4 Objectives of the study

The objectives of this research are the following:

- 1) To get a deep insight of the university students’ conceptions of the role of mobile devices in their learning
- 2) To find out the different ways in which these devices can be used to support the learning of the students

1.5 Research questions

In order to achieve those objectives, the following research questions were used to guide the study:

- 1) What are the qualitative different ways university students understand about the role of mobile devices in their learning?
- 2) How different could mobile devices be used for students' learning?

1.6 Delimitations

The scope of this study will be within Dhaka city and include a few universities from where a sample of the respondents will be selected for data collection whose findings will be generalized to the totality of the country. This is done like this because most of the highly ranked universities in Bangladesh have their bases in Dhaka city. Due to its technological advancement and availability of facilities, Dhaka city represents the ideal place where students will be able to use mobile devices in their learning. For those few reasons therefore, the researcher has identified it as the scope where the study will be conducted.

CHAPTER II

REVIEW OF RELATED LITERATURE

2.1 Introduction

In this chapter, the various studies about students' conception of learning and Information Communication technology (ICT) in education as well as mobile learning conducted previously by different researcher were reviewed. It was done in an attempt to identify the research gaps that the researcher needed to addressed in this study. The first part of this review concentrated on the students' conception on learning and a number of studies were reviewed in that section. It was then followed by students' conceptions of ICT in learning and the last part addressed students' conceptions of m-learning.

2.2 Students' conceptions of learning

For quite some time now, a number of research studies (Eklund-Myrskog, 1998; Loyens, Rikers, & Schmidt, 2009; Marshall, Summer, & Woolnough, 1999; Wihlborg, 1999) have been going on to find out students' experiences of learning at different levels of education but most higher education. It has been revealed that students come to learning environments with many different understandings of what is meant by "learning" (Marshall et al., 1999). The first major step taken in an attempt to find out how students conceptualize the learning was made by Perry (1970) when he thoroughly investigated students Intellectual and Ethical Development during their time in higher education. Thereafter, with the advent of phenomenography as a theoretical framework, a significant amount of research on student's conceptions of learning was carried out in the subsequent decades (Saljo, 1979). Ultimately, a number of definitions were revealed about that then emerging trend. For instance Ference Marton (1981) described conceptions as the ultimate ways in which an individual understands a particular phenomenon or an object in his surrounding area. It may not be visible, vary from one individual to another or from one period of time to another but is viewed nonetheless as a qualitative relationship between an individual and a particular phenomenon (Johansson, Marton, & Svensson, 1985). In this study, where the phenomenon is the "learning" and the individual being the "student", the meaning of conception are the various ways in which students understand or conceive the learning.

The first study aiming at exploring people's conception of learning was conducted in the late 1970s in Sweden by Säljö (1979) when he asked 90 people of various age the question "What do you actually mean by learning?" A significant amount of data was collected and after analysis, five qualitatively different and hierarchically arranged conceptions were identified namely (1) increasing one's knowledge, (2) memorising, (3) acquisition of facts, procedures etc. which can be retained and/or utilised in practice, (4) abstraction of meaning and (5) an interpretative process aimed at the understanding of reality. A subsequent study by Ference Marton, Dall'Alba, & Beaty (1993) has also revealed similar results with the addition of one extra conception that was not in the earlier study of Säljö (1979) and that is "learning as change as a person". Having already mentioned earlier that the conceptions have been arranged hierarchically, it is worth clarifying that the first three conceptions are believed to be of low-level learning where the learner simply quantitatively reproduces what he has been taught. The later three, on the other hand, are considered to be of higher-level with a qualitative view of learning as the learner seeks to get a deeper meaning and understanding of what he is learning as well as a transformation of his view of things or himself.

Students' conception on learning per se is a very broad concept and quite a substantial amount of studies have been conducted in this field over the last few decades (Eklund-Myrskog, 1998; Eklund-Myrskog, 1997; Marshall et al., 1999; Richardson, 2005). In this study, with the use of phenomenography, the researcher narrowed down the scope significantly the students' conception of learning to the students' conception of Information Communication Technology (ICT) in learning. This was done like this because that is major area of interest for this study.

2.3 Students' conceptions of ICT

The impact that ICT has had on the world's activities over the last couple of decades is clearly substantial and the education sector is no different (Dawson, Forster, & Reid, 2006; Potyrala, 2001). Since its establishment after the World War II, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) has been aiming at ensuring that all the countries of the world are provided with the best possible and necessary facilities to train their youth so that they can become useful members and contribute to the development of their society (Unesco, 2002). Considering its importance and the positive impact it had in other fields, countries, both developed and developing, have been strong recommended to introduce ICT in their education

systems starting from primary education through higher education to facilitate the teaching learning process (Unesco, 2002). In fact, it has been reported that computer games and simulations have had a very great effect in increasing students' motivation and performance, both young and adult learners, in various areas of education (Couceiro, Papastergiou, Kordaki, & Veloso, 2013). Those areas may include Sciences & Mathematics (Smith & Munro, 2009), Language (Garrett, McGraw, & Walter, 2009), Geography (Virvou, Katsionis, & Manos, 2005), Physics (Jimoyiannis & Komis, 2001), Biology (Kubiatko & Haláková, 2009) and Computer Science (Kordaki, 2011). Further studies also claimed that the rapid growth of ICT along with the various changes that occur in the society have placed high pressure on institutions of higher education in the whole world to introduce ICT in the teaching learning process so that they can meet the needs of the stakeholders in the 21st century (Pouratashi & Rezvanfar, 2010).

In most cases, ICT is considered to be the sophisticated and expensive computer-based technologies (Ogato, 2013). But it actually includes the more traditional technologies such as radio, telephone and television. The United Nations Development Programme (UNDP) claimed that 'ICTs are basically information-handling tools- a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information. They include the 'old' ICTs of radio, television and telephone, and the 'new' ICTs of computers, satellite and wireless technology and the Internet. These different tools are now able to work together, and combine to form our 'networked world' – a massive infrastructure of interconnected telephone services, standardized computing hardware, the internet, radio and television, which reaches into every corner of the globe'(Force, 2003). Thus, based on this definition, it is clearly believed that ICT is far much bigger and covers a wider scope than the general perception that many believe in. In this study therefore, ICTs in education can therefore be defined as the use of, not only modern computer and internet based technologies (e-learning, web-based learning, etc.), but also of simple power point slides, radio tapes, video tapes, etc. to facilitate learning. Additionally, students' conceptions of ICT in education can be said to be the different ways in which the students understand the use of those technologies to support their learning.

Quite a number of advantages have been realized over the years as a results of the introduction of ICT stages of education throughout the world. Jimoyiannis and Komis (2001) claimed that "From a qualitative point of view, the range of the students' types of responses is

similar for both groups indicating alternative conceptions of the same type, but are different as far as their frequencies are concerned. Students in the experimental group exhibited significantly improved achievement rates. It seems that working with computer simulations helps students overcome their cognitive constraints and effectively apply the concept of instantaneous velocity and acceleration” (p. 200). Furthermore, Chitla (2012) claimed that ICT has been of great benefit in the overall development of India. He pointed out that it has played a vital role in the development of the rural areas, poverty reduction, the governance of the country as well as the impact it has had in the e-governance of the rural areas of the country. Finally, Kubiak and Haláková (2009) have found out that younger male students benefit more by learning Biology through ICT than the much older ones or ladies. All these are making a strong case in the successful implementation of ICT in various sectors of education

As ICT grew popular among different universities and schools, it had become paramount for research to be conducted in order to determine what students think of it in their learning context. In a study conducted in Australia, it was discovered that students’ conception in Online Collaborative Writing (OCW) comprises of four major categories (Limbu & Markauskaite, 2015). They include (1) Division of work to complete the task, (2) Combination of expertise to produce a good end product, (3) Fusion of ideas and insights to enable deeper understanding, and (4) Development of new skills and attitudes for collaborative work. Further research carried out in Taiwan also showed different opinions as far as the students’ perception of ICT in education is concerned (Lin & Yang, 2011). Student think that with the integrating Wiki technology and peer feedback into English writing courses, there is (1) Immediate response from instructors, (2) Learning lessons from the grammatical mistakes of others, (3) Convenient interface design, (4) Benefits of peer reviews as well as (5) Less authoritative peer reviews. Bliuc et al. (2011) have revealed the following experiences of students through online discussion on Foreign Policies. “(1) Discussion as a way to stimulate reflection and promote an integrated understanding of theory and its application to real issues, (2) Discussion as a way to encourage a more holistic understanding, (3) Discussion as a way of acquiring various items of information, (4) Discussion as an opportunity to practice for exams, and (5) Discussions as not useful for learning”. These experiences are vital in the success of these projects that governments in developing countries are trying to establish.

ICT has grown significantly influential in the education in recent years (Kubiatko & Haláková, 2009). As new devices or equipments are coming into the market at such a constantly high rate, the field of ICT in education has become even wider to study altogether. For that reason, this study was proposed to focus solely in one important emerging aspect of ICT in education which is referred to as mobile learning or simply m-learning. With the use of phenomenography, this study investigated the experiences of the students on the use of mobile or handheld devices in their learning. This is so because m-learning is a new and interesting portion of ICT in education that is still very much novel and research is needed in this area to better understand how this can be used to benefit the students fully.

2.4 Student's conceptions on m-learning

With the rapid and breathtaking advancement of ICT, the ways in which learning materials are being delivered to the students are taking a completely different landscape (Hashim, Tan, & Rashid, 2014). Until just recently, in so many countries, institutions of higher learning have been taking full advantage of the technological tools (ICT) not only to supplement the traditional classroom to facilitate the learning (blended-learning) but also as an alternative learning environment in which instructions could be fully established. This had made the electronic learning (e-learning) a popular choice among many (Park, Nam, & Cha, 2012). However in the last few years, the trend of ICT in education has been growing towards m-learning (Park et al., 2012) as mobile phones are becoming more and more popular among students. To support this claim, it has been seen reported in other studies that universal and networked devices such as Third Generation (3 G) of mobile telecommunication, and more recently Fourth Generation (4 G) in some countries, have been extensively used in educational purposes and settings (Hsu, Hwang, & Chang, 2013; Ozdamli & Uzunboylu, 2014; Schepman, Rodway, Beattie, & Lambert, 2012; R. Wang, Wiesemes, & Gibbons, 2012). Those devices include smartphones, Personal Digital Assistants (PDAs), notebooks, iPads and tablets. Kim et al. (2012), believe that simple portable devices such as smartphones are more beneficial to the students than traditional computers due to their portability and flexibility. Therefore, m-learning technological devices remove the geographical barriers and allow students to learn anywhere and anytime (Girgin, Kurt, & Odabasi, 2011; Hsu et al., 2013; Ozdamli & Uzunboylu, 2014; Peck, Deans, & Stockhausen, 2010; Sandberg, Maris, & de Geus, 2011).

As a result of this growing trend, several studies have been conducted of late to clarify how students can use these mobile devices in their learning. As such, a number of researchers, over the last decade, have given their opinions with regard to m-learning. For instance, Lan & Sie (2010) have defined m-learning as the type of learning model that allows learners to get access to learning materials anywhere and anytime with the use of mobile technologies assisted by the internet. Furthermore, Dorman (2007) described m-learning as an ever-changing electronic world where “knowledge, power, and productive capability will be more dispersed than at any time in our history, a world where value creation will be fast, fluid, and persistently disruptive, a world where only the connected will survive” (p. 6). On their part, Park et al. (2012) have viewed m-learning as “any educational provision where the sole or dominant technologies are handheld or palmtop devices”. These handheld devices include cell phones, smartphones, palmtops, tablets, personal computers (PCs), personal digital assistants (PDAs) and portable multimedia players (PMPs) (Park et al., 2012). In this study, m-learning is defined as the kind of learning that takes place by using handheld devices (smartphones, iPads, PDAs, notebooks, etc.) with or without internet connectivity. This is especially correct because these devices can be used to get access to materials on the internet (Lan & Sie, 2010; Thomas & Li, 2008) as well as read something that was downloaded earlier (Wagner, 2005).

A number of advantages have been reported by many in recent times related to m-learning. One of the most important benefits of m-learning is the ability to offer learning experiences that are purely student-centered where students are seen as “agents” or “masters” of their own learning (Sha, Looi, Chen, Seow, & Wong, 2012). This allows them to learn at their own pace as well as stimulating critical thinking which is an important aspect of the learning in higher education. In another study, it has been reported that learning through mobile devices (iPad) also makes the process pretty much engaging to the students (Fontelo, Faustorilla, Gavino, & Marcelo, 2012). The teacher simply gives the students the instructions and they engage into the learning which makes the process more interesting and enjoyable. Among other advantages, (Geist, 2011) claimed that m-learning brings about the notion of collaborative learning where students form some group and share their views, ideas and understanding about some specific topic. It was further explained that students found the use of iPad in their learning very much convenient as they can easily buy eBooks online and save them in their devices (Geist, 2011; Hahn & Bussell, 2012). This enables

them to access to crucial information at the time it is needed. Therefore, using these technologies affords countless means of offering learning opportunities to students at higher education.

Given its ability to provide myriad ways of offering learning experiences, m-learning has rapidly grown pretty popular among university students, both in developed and developing countries. This has been made possible because of the fact that students have been in possession of these devices in recent years. Presently, Bangladesh, in spite of it being a developing country, has been following the same trend. It was discovered that a substantial amount of university students in Bangladesh own smartphones or other types of handheld devices (tablets, iPhones, etc.) simply due to the availability of the device. Moreover, with so many local companies nowadays manufacturing them, the trend is not expected to change course any time soon. Additionally, the speed of internet has increased significantly in recent years compared to before while its cost has become reasonably affordable to most of the students. All these aspects make the use of mobile devices in Bangladeshi universities for learning purposes a realistic possibility.

In addition to that, it has been realized that there has been very little research conducted both in developed and developing countries, including Bangladesh that explores the students' experiences on the use of mobile devices in their learning. The majority of the prior studies mainly focused on finding the benefits and impacts of m-learning (Al-Fahad, 2009; Geist, 2011; Hahn & Bussell, 2012; M. Wang, Shen, Novak, & Pan, 2009), the factor that influence students to use mobile devices in their learning (Dyson, Litchfield, Lawrence, Raban, & Leijdekkers, 2009; Ozdogan, Basoglu, & Erçetin, 2012; Park et al., 2012; Wong, Chin, Tan, & Liu, 2010), students' perceptions on the use mobile devices (Kafyulilo, 2014; Ozdamli & Uzunboylu, 2014) and how mobile technologies can be used to facilitate learning (Rogers, Connelly, Hazlewood, & Tedesco, 2010) but there is none that has explored the students' conceptions of m-learning. Moreover, the studies that are currently available were conducted either in a mixture of quantitative and qualitative paradigm or other methodologies including surveys. However, none of them was found to have been conducted with the use of phenomenography as the methodological and theoretical framework. Yet it was discovered that a huge number of studies focusing on the conceptions of learning were carried out with phenomenography as the theoretical framework (Eklund-Myrskog, 1998; Ellis, Goodyear, Calvo, & Prosser, 2008; F Marton et al., 1993; Purdie & Hattie, 2002; Säljö, 1979). Moreover, there is clear evidence that prior studies on conception of learning with

phenomenography has made a significant contribution and improvement on the learning in general. Given that gap, methodological and theoretical, it became increasingly clear that there was an urgent need for research to be conducted on the experiences of the students in the use of m-learning. Therefore, this study was proposed to fill those gaps by investigating the students' experiences in the learning through mobile devices with the use of phenomenography as the methodological and theoretical framework. Those experiences will be fundamental in formulating teaching and instructional approaches that will allow the teachers to provide the right environment that will support the learning through the mobile devices. Additionally, curriculum developers and policy makers could use those experiences to formulate or amend the curriculum in a way that will encourage the use of mobile devices in the learning.

CHAPTER III

METHODOLOGY

3.1 Introduction

This chapter describes the methodology or theoretical framework that was used to carry out this research. It started by justifying the reasons as to why the selected methodology was used instead of another. This was followed by some extensive discussions and analyses of the methodology (definitions, components and outcome space) and how it works. After that part, the sample and data collection of the study were discussed and finally the analysis of the data.

3.2 Theoretical and methodological background

This study is a qualitative-based and was carried out using a qualitative research methodology, phenomenography. As the use of handheld devices is becoming increasingly popular among university students in learning contexts, there is an urgent need to investigate the understandings, experiences and interpretations of what students feel is the role these devices are playing in their learning (Akerlind, 2005). Such kind of answers are known as people's conceptions and can be best described by phenomenography (Ferenc Marton, 1981). Moreover, a respectable number of the research studies that explored the experiences of students in learning context were found to have been conducted with the use of phenomenography (Eklund-Myrskog, 1998; Eklund-Myrskog, 1997; Ellis, Goodyear, Prosser, & O'Hara, 2006; Limbu & Markauskaite, 2015; F Marton et al., 1993; Wihlborg, 1999). Furthermore, phenomenography was deployed in this study in order to develop a set of categories of description derived from the students' understanding of the use of mobile devices in their learning. Another reason for choosing this methodology is pedagogical. It is believed that there is a relationship between students' approaches to learning and teachers' approaches to teaching (Trigwell, Prosser, & Waterhouse, 1999). Through such studies, teachers, educational administrators, curriculum experts and policy makers can get the needed information to provide the kind of environment or platform that will facilitate the learning through these mobile devices. Therefore, phenomenography was used to determine the sample size and selection of the study, data collection method as well as the process of analysis.

3.3 Phenomenographic approach

3.3.1 What is phenomenography?

This study, being qualitative in nature, was conducted using phenomenography as its theoretical and methodological framework. The term phenomenography was first put into use by Ference Marton (1981) as he attempted to find systematic “forms of thought in terms of which people interpret aspects of reality” (p.180). It is this point of view that led him to suggesting the first definition of phenomenography. It was defined as “The kind of research we wish to argue for is complementary to other kinds of research. It is research which aims at description, analysis, and understanding of experiences; that is, research which is directed towards experiential description. Such an approach points to a relatively distinct field of inquiry which we would like to label phenomenography” (p. 180). It is a part of descriptive research whose major concern lies on how different people conceptualize various phenomena (Ballantyne & Bruce, 1994). In this case, it was used to describe the experience of students on the use of handheld devices in their learning. Subsequently, phenomenography was defined again by Ference Marton (1994) claiming that “the empirical study of the limited number of qualitatively different ways in which various phenomena in, and aspects of, the world are experienced, conceptualized, understood, perceived and apprehended” (p. 4424). This approach takes a deep insight into the dissimilarities between people’s understanding and the analytically represents them into a number of qualitatively diverse ways of experiencing a phenomenon, known as ‘categories of description’ (Åkerlind, 2012). Each ‘categories of description’ (one way of experiencing the phenomenon) is considered a distinct feature of the experience and they are linked with one another by structural relationships. Those relationships according to Åkerlind (2012) “represent the structure of the ‘outcome space’, in terms of providing an elucidation of relations between different ways of experiencing the one phenomenon” (p. 322).

3.3.2 Components of phenomenography

There are some distinctions in phenomenography that are used to analyze the various conceptions of people in a particular phenomenon. These distinctions also known as frameworks include the what/how framework and the referential/structural (Akerlind, 2005; Harris, 2011). However, these two major frameworks can be divided into two parts and individually, they are referred to as aspects (what aspect, how aspect, referential aspect and lastly structural aspect) (Akerlind, 2005; Harris, 2011).The what/how aspects were defined by Ference Marton (1988):

“We could say that the outcome represents the “what” aspect of learning and the approach represents the “how” aspect. Furthermore . . .it seems reasonable recursively to discern the “what” and “how” aspects again within both, in terms of their referential and structural aspects” (p. 66). While also describing the referential/structural aspects as “Qualitative differences in the outcome of learning have logically and dialectically related structural and referential aspects. Structure refers to how the outcome is arranged, and reference refers to what the outcome is about” (p. 64). On the other hand, F Marton et al. (1993) have claimed that there exists a number of possible components of the conception. These include referential aspects - considered to be the same as the ‘what’ aspects - and the structural aspects - considered synonymous to the ‘how’ aspect - as well as both the internal and external horizons. The referential aspects refer to the overall meaning given to the phenomenon while the structural aspects deal with the way in which the phenomenon and its components are related to each other. The internal horizon was defined by C. S. Bruce (1994) as “characteristics delimiting the phenomenon” while the external horizon as “the outer boundaries of their understanding” (p. 50).

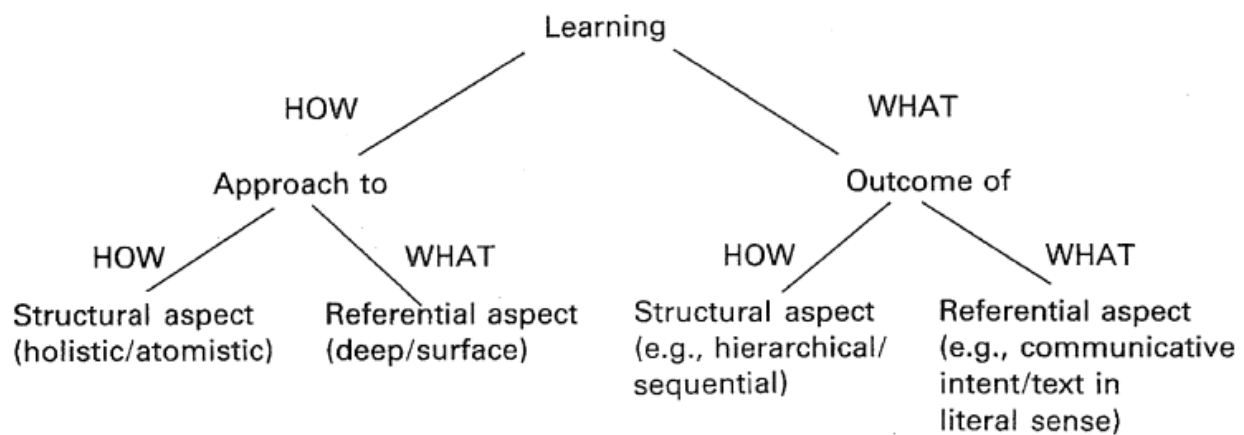


Fig. 1. Diagram of the structure of categories describing learning from [Marton \(1988, p. 66\)](#).

3.3.3 Outcome space

As an approach, phenomenography analyzes the differences between people’s conceptions and scientifically arranges them in a hierarchical structured “categories of description” (Limbu & Markauskaite, 2015). Each one of these “categories of description” logically regroups or organises the thoughts of the participants, at the same time grouping their similarities and contrasting their dissimilarities (C. Bruce et al., 2004). When all these categories are combined together, they constitute a structure that is known as the “outcome space” which describes the different ways and

relationships, in which a researcher has interpreted how a phenomenon is experienced at a cohort, group or collection level (C. Bruce et al., 2004; Limbu & Markauskaite, 2015; Vermunt, 1996). In investigating students' conceptions on m-learning of Bangladesh university education, interviewees were asked to give their reflection on the role of mobile devices in their learning as well as how these devices can be useful in their learning. As the researcher attempted to establish the organisational aspect of their experiences, respondents were asked to consider the major elements of the study as mobile devices, students, as well as learning and show the relationship among them (Brodahl, Hadjerrouit, & Hansen, 2011). In this study, the outcome space is comprised of five categories of description

3.4 Sample and data collection

In this study, the major tool that was used for collecting data were the phenomenographic interviews (Akerlind, 2005; Barnard, McCosker, & Gerber, 1999; C. Bruce et al., 2004; Harris, 2011; Limbu & Markauskaite, 2015; Vermunt, 1996). Based on the nature of the study, the sample that was used in the data collection was chosen according to the purposive sampling techniques. This sampling technique was employed here because the respondents were required to have some basic experience on the use of mobile devices in learning context in order for them to be considered. In this case, each selected student had some experience using mobile device in his learning for at least six months so as to maximize on their in-depth understanding with regard to the phenomenon. However, the degree of experience among different respondents and the type of handheld devices they use were not necessarily the same and were tolerated in order to get various experiences and use from one respondent to another. Moreover, the aim was to get students who have different experiences of using various handheld in their learning -- smartphones, PDAs, iPads, etc. The level of study also varied as respondents were selected from both undergraduate and postgraduate level. Moreover, participants were chosen from different disciplines of study so as to maximize on the various from all these disciplines. In total, 16 students from different universities of Bangladesh participated in taking part in the interviews during the data collection. This sample size may seem to be a small one but it is in relation with what Akerlind (2005) has described in the phenomenographic methodology. In this regard, it has been discovered that there are a number of phenomenographic studies that have used quite a smaller sample size. That was the case in Limbu & Markauskaite (2015) study when they used 15 participant to conduct their study on How do learners experience joint writing: University students' conceptions of online

collaborative writing tasks and environments. Furthermore, Roberts (2003) in his study, *Teaching using the web: Conceptions and approaches from a phenomenographic perspective*, has emphasize that the sample size does not necessarily have to be very big. What matters is to get a broad range of experience about the study. Similarly, Gonzalez (2009) used as small a sample size as seven in his study *Conceptions of, and approaches to, teaching online: a study of lecturers teaching postgraduate distance courses*. Thus, all these demonstrate that this sample size can be considered satisfactory to carry out the study.

The tools deployed for that collection in this study were semi-structured interviews (Akerlind, 2005; Åkerlind, 2012; Alsop & Tompsett, 2006; Prosser, Trigwell, & Taylor, 1994). Interviews were used primarily because they are viewed by most phenomenographers as the most common and appropriate tools for data collection (Akerlind, 2005; Åkerlind, 2012; Prosser et al., 1994). Secondly Akerlind (2005) claimed that the follow-up prompts provided by phenomenographic interview are sometimes more important in stimulating fundamental meaning from the interviewee than the primary questions that were formulated. A list of questions was prepared and individual interviews, lasting between 35 and 50 minutes, were conducted separately in public places which were convenient for the interviewees to freely and comfortably express their views. A prior permission was sought by the researcher regarding the date, time and place of the interview before going to interview a participant. During the conversation with the participant moreover, all the ethical issues of research were discussed in order to assure them that their privacy and identity would not be disclose anywhere or to anyone by any possible means. During the interview process, questions were asked and whenever necessary, follow-up prompts were used to ask for more detailed explanation whenever the answers given by the interviewee were deemed unclear and ambiguous to understand and interpret. The questions were mainly divided into two parts. The first part put much emphasis on the “what” questions; such as ‘What does m-learning mean to you?’; while the later part emphasized more on the “how” questions including questions like ‘How do you use mobile device in your learning?’. Likewise, whenever any questions did not appear to be understandable to the respondents, clarifications were provided in a much simpler language to help him understand what was needed. With the help of an audio recorder, every interview was recorded so as to avoid taking notes during the interview in order that time could be saved during the exercise.

3.5 Analysis of the data

The interviews taken from the various respondents of the study were recorded by an audio recorder and listened to several times before its transcription was done. The audio-recorded data from the interviews was transcribed verbatim. The individual interview transcripts were extensively read by the researcher to develop initial ideas regarding the students' understanding of the use of mobile devices in learning context. During this process, the researcher was able to identify the primary categories and arranged them in a hierarchical order.

When formulating the categories, no single transcript was singled out and analyzed individually. All transcripts were analyzed together as a whole with no regard to their individual variation (Åkerlind, 2012; Prosser et al., 1994). Consequently, the categories that were developed are considered to be fairly representing the wholeness of the various interview transcripts. The aim was not to describe the variation between the individual interviews but rather to obtain a wide range of categories capable of representing the set of transcripts wholly. In an attempt to show more support to this approach, it was discovered that the same method was deployed by Prosser et al. (1994) in their study where they were investigating the 'Academic' conceptions of science of learning and teaching'.

Lastly, the various conceptions of the students on the use of mobile devices in their learning were classified as they appeared in the individual transcripts. As students described various ways of using mobile devices in their learning depending on the circumstances, quite a few conceptions were represented in the various transcripts of the interviews. The conceptions were classified from the lowest to the highest category of description. Each conception, bearing in mind their position in the hierarchy, were finalized with clear and strong evidence in the transcripts.

Before the final categories of description were finalized, two experts in the field were invited to give their opinions with regard to the categories vis-à-vis the interviews transcripts. After going through the 16 transcripts along with the researcher, the categories of description were then finalized as well as the hierarchical structure in which they are arranged along with the respective quotations that backed them from the set of interview transcripts.

Table 1 Summary of the Characteristics of the Participants

Participant	Level of study	Discipline	Experience on m-learning	Institution	Gender	English Fluency
P1	Postgraduate	CSE	2 years	U1	Male	Fluent
P2	Undergraduate	EEE	4 years	U1	Male	Fluent
P3	Postgraduate	CSE	3 years	U1	Male	Fluent
P4	Undergraduate	E&L	4 years	U2	Male	Fluent
P5	Undergraduate	EEE	3 years	U1	Male	Fluent
P6	Undergraduate	E&L	5 years	U2	Male	Fluent
P7	Undergraduate	BBA	3 years	U2	Female	Fluent
P8	Undergraduate	LAW	3 years	U3	Male	Fluent
P9	Undergraduate	CSE	3 years	U1	Male	Fluent
P10	Undergraduate	E&L	2 years	U2	Female	Fluent
P11	Undergraduate	PHARM	1 years	U2	Male	Fluent
P12	Undergraduate	MCE	3 years	U1	Male	Fluent
P13	Undergraduate	BBA	4 years	U4	Male	Fluent
P14	Undergraduate	E&L	6 months	U2	Male	Fluent
P15	Undergraduate	CSE	1 year	U1	Male	Fluent
P16	Undergraduate	E&L	2 years	U4	Male	Fluent

CHAPTER IV

INTERPRETATION OF DATA

4.1 Introduction

In this chapter, the findings of the study were presented in the form of hierarchically categories of description. The categories of description were finalized after extensive reading, by the researcher, of the interview transcripts in consultation with two experts in research, the first one being my supervisor and the second one my co-supervisor. All the various categories of description were supported by clearly evident quotations from the interview transcripts.

4.2 Results

This study, students' conceptions of mobile learning (m-learning) in university education of Bangladesh, after analysis of the various interviews has revealed five major conceptions known as categories of description which are given below. They include:

- Category A: storing learning materials
- Category B: accessing and sharing of information and knowledge
- Category C: effective learning tool
- Category D: effective tool for communication
- Category E: effective tool for collaborative learning
- Category F: effective tool for developing new ideas

The detail description of the various categories respectively was given along with the relevant quotations from the interview transcripts to justify each one of them. Some identification numbers were deployed to in every quotation in order to help the researcher keep track of the participants whose views have been used in the study directly. Moreover, this gave the researcher chance to hide and protect the identity of his participants and keep them anonymous.

4.2.1 Categories of description

There are five categories of description discovered during the investigation of the students' experiences on the use of mobile devices in learning. In the first instance, an elaborative

explanation of the category A was given with the appropriate quotations. This was followed by a detailed description of the second category which is category B and its appropriate quotations from the interview transcripts. The same was done with category C, D and E as they were clearly explained and supported by quotations from the transcripts.

4.2.1.1 Category A: storing learning materials

In Category A, mobile learning was considered as the various way of getting various learning materials from different sources and storing them in these handheld devices for further use as required. Participants highlighted that with the use of their handheld devices, they can get various learning materials and save them in there. In this way, they will be able to get these learning materials from different sources stored in their mobile for later use as they may require. This helps them store a high volume of information which plays a vital role in their study and they can always get them whenever they are needed.

For instance, if a teacher gives a lecture using PowerPoint presentations, students can easily download those presentations from the sharing device (teacher usually uploads that presentation for the students) by using their mobile devices and save them. In that way, they have wider scope for keeping learning materials safe. With reference to this argument, some participants explained that:

....sometimes I take all teachers' lectures [P10]

I use it [mobile device] to collect information, collect notes from teachers [P8]

Students also highlighted the ease at which they can transfer their learning materials from their computers to their devices in order to access them whenever and wherever they need them. This is especially important during time of reading or revising from their rooms, where their computers, are becomes difficult. In such circumstances, participants highlighted that they prefer to move to a much quieter and cooler environment where they can sit comfortably and do their revision. In that regard, some students noted that:

I also use my tablet in my studies.... So I just try to put the file in my tablet so that it can be accessible and go somewhere else, sit down and try to read. [P9]

So we can just transfer the tutorial or the PDFs, whatever the teacher provides us and just read it through. [P15]

Besides in this category, mobile device is also seen as a recoding tool for future learning both audio and video. Students, while the class is ongoing, press the record button of their mobile devices and record everything being said during the class. This practice is mostly used during students' presentations where every student or a group of students are assigned various topics to go, prepare and then come and make presentations in class. In most cases, all the topics being presented play an important role in the examination. Therefore, students do not want to miss anything from these the various presenters. For the case of audio for example, the participating students explained that with their mobile devices, they can record the lecture live during classes so that the teachers' explanations will be used later during their free time:

You can even make records. You can record the lectures ... [P2]

Then well, I recorded numerous lectures and I listen to them now and then when I feel like. [P14]

On the other hand, students also underlined that they use their handheld devices to video record their lectures. This practice was reported to have been mostly utilized during practical classes where manipulation and interaction with various devices and components is the center of the focus. For example, during lab classes, students make video record of the exercises that seem difficult to them as the teacher is performing in order that they can get to watch them over and again in their free time. In that way, they can practice by replicating the steps as the teacher did and master them easily. In this respect, participants explained that:

You can record the lectures, you can make videos during the labs and you can practice later. [P2]

Those who cannot get everything they can just record the thing, record the whole lecture and watch it latter. [P15]

Additionally, students also stated that they use their mobile devices to take snapshots of important things that will be helpful in their studies. This view has been shared by the majority of the participants as they feel that taking a snapshot helps them whether in the classroom or outside.

While the teacher is explaining the lesson, sometimes it becomes difficult for them to pay attention to the explanations and take important notes simultaneously. Thus, they argue that with the use of their mobile devices, they can easily take a snapshot within few second and at the same time concentrate on what the teacher is explaining. Evidently, participants highlighted that:

May be I came in a little bit late, but my friends took notes and I don't have that much time to copy and write everything, so I just get my phone, take a snap of the notes and then when I go back to my room ... Then I just read them direct. [P3]

So after the teacher finishes before he wipes off the board, you just try to capture the images from board so that when you go back, maybe you will try to copy them to your PC or you just try to ok I have this in my phone I'll just read it. [P9]

Finally, it was acknowledged by the vast majority of the participants that internet is such a rich environment as far as getting more in-depth information about their learning is concerned. With the use of their mobile devices and internet connectivity, they are able to download and store an unlimited range of learning materials that can be so much useful in their study. They simply search the internet and when they find what they were looking for, they download and save it in their phones so that it can be accessible anytime. With regard to that, some participants illustrated that:

... You will get everything like PDF that you can put in your phone, you can even download many books in your phone and pictures also. [P2]

But with books, basically the PDF books, you can get well referenced information. So it will be more precise if you download a PDF book. [P11]

4.2.1.2 Category B: accessing and sharing of information and knowledge

In the second category of this study, mobile learning is regarded as a means to access and share a wide array of information and knowledge that is key for the learning of the students. Participants commented that using of mobile devices with internet connectivity exposes one to a significant amount of knowledge and information that would prove difficult, if not impossible, to access with such ease. Moreover, students can also share these information easily as their mobile phones provide them with various possibilities in which things can be shared among various users.

For the case of information access, participants elaborated that handheld devices are very interesting tools of fetching various learning materials and other worldly news with the help of internet connectivity. Regarding this matter, some interviewees expressed that:

We use the mobile phone to search for something which is not understandable or which we try to at least clarify. [P9]

...so whenever you need something to know from the outside, you just go to the internet and pick the knowledge from there. [P15]

Alternatively, information can also be accessed straight from the mobile phone without the use of internet. This is made possible with the use of the various mobile phone apps [applications] that can operate offline and still provide the students with the kind of the information they require. For that, participants revealed the following:

I installed a dictionary application. In case I get a word that I don't understand, I use the dictionary on my mobile phone then I can know the meaning of that word. [P1]

When something is difficult for me, direct I am going to my phone. It's like my friend and my teacher. [P2]

Besides the accessibility, sharing information and knowledge was described as being very a key element in their learning. Knowledge and information can be shared or disseminated through various means such as social media among others. This can be supported by the following views:

Sometimes you may have emergences contact like a teacher is sick you cannot come to class and other teacher can reschedule a class and if wake up in the morning and check am among your groups you can find the information. [P5]

I can give the example from the university am residing at the moment we have a group on Facebook called our department group where we share our document, routines and other academic document. [P5]

4.2.1.3 Category C: effective learning tool

In this category, learning through mobile devices is perceived as an effective learning tool. This perceived effectiveness is observed through numerous ways. Students described m-learning

as time-saving. Factors such as time, cost, mobility, flexibility and efficiency have all been emphasised significantly by participants as some of the greatest advantages of m-learning. This is particularly essential because m-learning provides a platform on which students can access whatever they need wherever and whenever they need it.

Participants emphasised that within the shortest time possible, they can access whatever information they need to enhance their learning. This can be evidently seen where some participants stated that:

If I just take a snap, it will take like a second but if my colleague decides to draw it in his book, it will take him like 20 minutes. So in such a way, it saves time to me. [P3]

During exams and during other tutorials, I gain different types of suggestion from my friends. If I go physically to them, it will take a long time and waste all the day. [P4]

It [mobile device] is easy to carry and it saves our time. [P10]

Furthermore, m-learning is also perceived to be cost effective. Participants explained that with significantly less amount of money, they can access so many things that will assist them in their learning. Without their mobile devices and internet connection, these resources would require high amounts of money in order to access them but their mobile devices have somehow reduces that burden by priding them either at a cheaper price or for free of charge. And although it involves an initial cost [which is slightly high] to buy a mobile device and subscribing for internet bundles frequently, the results of this in the long run prove to be so much cost-effective for them. On this evidence, some participants pointed out that:

Then another thing [is that], it saves money. In which way? For example if a teacher gives us a slide which has like 56 pages, it means if I print it will be costly. But if I just copy the slide to my phone, I think in that way, it saves me some TAKA [Bangladeshi Currency]. [P3]

It costs student less because you can buy credit and load internet where you can download some apps which can help you make free calls to contact your teachers without costing you any money. [P5]

It saves me money. For example in library if you want to get a question paper you need to photocopy but here, I just take snapshot, It's easy to use just one click. [P12]

Additionally, this in category, participants viewed mobile learning as a means for students to learn with mobility flexibility. University students in this category perceived m-learning as the learning that occurs anytime and anywhere that students want. It enables them to access their learning materials whenever they feel comfortable and ready to learn efficiently. For example, the participants stated that in most cases, they can move with these devices anywhere they go and whenever the opportunity comes, they can utilise it to either learn something new or revise their class notes that have saved in there. Thus, the mobile devices enable them to access to whatever they want to learn at their convenient time. With reference to this argument, some interviewees stated that:

It always depends but the major point is that it's mobile. The mobility aspect. It's like wherever I go I have my mobile phone... [P3]

Mobile learning, I understand it by using some devices which you hold in your hands and can have access to it anywhere and anytime for your use in learning. [P1]

For example if I'm in the bus or I'm going somewhere, I can use my handheld device and take look on my notes or I can use it to communicate with my universities. [P12]

In brief, in this category the use of mobile devices is seen as a time-saving cost effective and portable devices for enhancing student learning in university.

4.2.1.4 Category D: effective tool for communication

In this category, m-learning is viewed as an essential tool for communication. Students use their mobile devices to easily communicate among themselves whenever needed it is required or communicate with their teacher for some information regarding the timing of their classes, quizzes and among other things. It was stated, in one case, that if a student is late for classes, his colleagues move to another room which is not the usual one where they have classes, he can easily give them a phone call and they direct him to the right place. Therefore, communication here is a major factor that helps them in pursuing their studies.

So in WhatsApp, we have one group which we try to communicate every time when someone is confused about something; information regarding some classes or quizzes.

So we just try to update each other so remember that we have quiz tomorrow, or there is no class or they will be class. [P9]

So you may be having classes at this level you think ok here is where we have classes from but at time you can go there and you don't find them there then you call them to find where they are. [P5]

Without contacting your class captain or teacher you will not know where the class will be because they are so many classes in that area. [P5]

Participants also explained that there is collaboration between them and their teachers in order to facilitate their learning. In this case, it was reported that whenever students have any confusion regarding some class schedule, they make direct phone calls to the teachers so that it can be clarified. And occasionally, teachers call the class leader to give him information about their classes.

Sometimes when we come to class and the teachers are not yet there and we see that the time is passing. So we use to call our teachers 'ok Sir remember we have class with you, are coming or not?' [P9]

You should leave your mobile phones on because I'll call so, and so time to inform you whether this class will be held or not. [P9]

Therefore in this category, the main point is that the mobile device is used to enable students get the necessary information about their classes and some other activities regarding their learning. It plays an important role as the flow of information becomes much more efficient.

4.2.1.5 Category E: effective tool for collaborative learning

Category E presents another understanding of using mobile devices in students' learning which is direct (synchronous) and indirect (asynchronous) collaboration among student and teacher and/ or student and student. In this point, students are seen to use different social Medias such as Facebook, LinkedIn, and WhatsApp for stated collaboration. For instance, university students in many cases used Facebook for collaborating with their teachers, and supervisors when they face any difficulties with regards to their projects, theses and so on. They contact their teachers through social networks or email service with the use of their mobile devices to ask for clarification

and further explanation whenever they get confused or have difficulties in understanding something while studying or doing some practical work given to them by the teacher. Then through the same channel [social networks or email service with the use of their mobile devices], they receive the feedback from their teachers or supervisors explaining what they needed to know and that enables them to carry on with their studies even when they are away from their instructors. On this argument, students underlined that:

During that time, our teacher was not in the campus. Even he was not in Bangladesh. He gave us his Skype and I used one time to ask him one question.... I practice most of the problems, I got some difficulties. So I sent a message to the teacher through Skype, he answered me and I got the answered, I practiced and it worked. [P2]

Also having communication with the teacher because I can easily consult the teacher through the email for more clarification. [P1]

Collaboration is also seen while students work in a group. Students added that they generally use their mobile devices to get in touch with their colleagues (peer groups) to complete their group works such as assignments, solving problems, group discussion. Furthermore, whenever they get stuck while revising or doing something, they usually contact their classmates to ask them for more explanation if they have understood that particular area. Their colleagues give them some explanation and that enables them to have a better idea of the topic than before. On this perspective, participants stressed in their responses the importance of the mobile devices in helping them to learn collaboratively.

... But remember you have to work on the assignment in time. So I may do something, maybe my part, first of all maybe we can divide the assignment. So I do my part, maybe go to Facebook, send him what I have done, when he is at home. When he reads through he also maybe sends me his. So by the time he comes back to school... [P3]

I can always use the phone and I can get in touch with them and I can always use their own idea to incorporate into my own learning. [P16]

I start a chat; I'm not understanding this thing, what about it? [P14]

Even I can use social sites to by group chats to learn things which I cannot understand from my teachers. My friends can share or explain it to me or I can teach my friends in a group chat [P7]

4.2.1.5 Category F: effective too for developing new ideas

In category E, participants mention that the use of mobile devices in their learning enhances their deep analysis, understanding and interpretation of various aspects of their studies. As learning takes place mostly independently, students have the opportunity to think critically and carefully about something that they do not understand clearly before finally making a breakthrough on their own. This helps them improve and expand their existing knowledge which results to learning to create new ideas and knowledge that they did not have before. These new ideas and opinions will be useful in their learning as they enable students to have various views of the same topic which enriches their knowledge further.

Critical thinking is an important aspect of higher education and during the teaching learning process, a lot of emphasis is given in that regard. Students are assigned some specific tasks which requires deep understanding and interpretation on their part before they can solve. In m-learning, students mentioned that it provides them with the right platform to do that. They access various types of information regarding their topics which give them different ideas that help them understand their topic better. These various ideas help them to analyse their work critically and understand it in a better way than it would be the case in other form of studies. With reference to that argument, some participants stated that:

I mostly use it for analysis. Like we have to do a lot of literature analysis and it is not like a given fact, like you don't just study, you form your own idea around it. So to do that, you need to be involved with it as much as possible... So the more I read it, the more ideas I get about it. So it helps me analyse more. It gives me the idea that I didn't think of before. [P16]

Simultaneously, m-learning helps students into developing new ideas in their learning that they did not think of before. Students explained that as a results of them thinking carefully while trying to analyse something, they tend to develop new and better understand with time regarding

that particular topic in question. They make use of the widely available knowledge provided by m-learning to enhance their existing knowledge and develop new understanding and conceptions that were not there previously. In light of this reasoning, some participants explained the following:

If anything seems to me that this gonna [going to] help me and some billboard are very creative that I cannot understand at that spot at that moment..... So that particular moment I just take screen shot of that billboard then in my leisure time I watch that screen shot and try to analyze it what it says and what it talks about. [P7]

Whenever you are, you know, communicating with friends, whenever you chat with friends, different kinds of aspects are coming out. So in that case, the inner ideas of creativity is enriched. So in that case, it's another, you know, in our literature terms, it is known as ideas. So these ideas always get fractured, rendered and then joined up together. And that's why when they are joined up together, they will become a good new thing. It's something different, you know, and you will feel like you have created something. [P4]

In this last category, participants viewed creativity in learning as an important aspect in their studies. They felt that using handheld devices will enable them to develop further and become in terms of critical thinking and deep analysis which then leads to the creation of new concepts.

4.3 Hierarchical relationship between the categories

Table 2 Referential and structural elements of using mobile devices in learning

Referential (what of the conceptions)	Structural (how of the conceptions)	
	Simple learning	Deep level learning
Storing learning materials	A	
As in (A) and accessing and sharing of information and knowledge	B	
As in (B) and effective learning tool	C	
As in (C) and effective tool for communication	D	
As in (D) and effective tool for collaborative learning		E
As in (E) and effective tool for developing new ideas		F

The six categories established from this research study form a hierarchical relationship that represents an expanding conception, from viewing mobile learning as mere means of storing various learning materials and accessing them in later times to viewing it as a process that can enhance the creativity of students in their learning (**Table 2**). In between these six categories, there is a very fine margin that indicates the boundaries; but nevertheless, each conception signifies a distinct way of viewing. Category A (*storing learning materials*), B (*accessing and sharing of information and knowledge*), C (*effective learning tool*) and D (*effective tool for communication*) focus surface level learning.

For instance, category A mainly focuses on the students getting the learning materials from multiple sources and saving them in their handheld devices for later use as required. This leads to category B which put more emphasis on the availability of various information and knowledge to the students and assist them in sharing them. In that way, students are able access a wide range of rich information which is crucial in their day-to-day learning. Those saved and shared information

from the previous categories can then be learned in a more efficient manner and that is what happens in category C. C is more interested in providing the students the kind of environment which is very much appropriate and flexible for the learning to take place. This would also imply that learning takes place in the most economical manner in order to assist students succeed in their learning at a reasonably low cost. Lastly, category D emphasizes on the use of mobile devices for communicating with teachers as well as colleagues in order to get some information about the classes and quizzes and so on. Generally in these first four categories, it can clearly be seen that there is either no learning that is taking place or, if there is any, it is simple kind of learning which does not require any kind of deep analysis but rather to simply read and memorise in most cases. In that case, it can thus be concluded that the first four categories represent surface level learning.

Category E (*effective tool for collaborative learning*) and F (*effective tool for developing new ideas*) portray deep level learning. Category E refers to the learning that involves deep analysis and critical thinking for the students to clearly understand the concept. By seeking help from his colleagues or teachers through his mobile, this gives him the opportunity to first think on his own about that particular topic and once he completely fails to understand it, then help can be sought for and this enables him to master it a much better way than if everything was straight away given to him. In category F, likewise, engages the students into deep thinking as he tries to make something that is original and his own. Students think critically while studying or trying to understand something and in that process, new ideas are generated and new ways of solving that particular problem emerge. In this way, it is clearly observed that these last two categories represent deep level learning as students are required to use their thinking power extensively in order to learn something.

CHAPTER V

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussions

The aim of this research was to investigate the various experiences in which students feel about the use of handheld devices in their learning. The study was descriptive by nature and the approach that was deployed was phenomenography. Because the aim of phenomenography is to discover new meanings of a phenomena, the focus was to get heterogeneity and great variation of the participants in question who took part in the study. In totality, 16 students from four different Bangladesh universities of various discipline, including arts and science, participated in taking the interview. Students from various programmes and universities were intentionally invited to take part so that a broad view with regard to the phenomena could be obtained.

The findings of this research study are limited in scope in relation to previous phenomenographic studies primarily because students' conceptions on mobile learning is an emerging concept of investigation in educational research. However, the findings may be interpreted in a wider context. The results of this Master's thesis have revealed five qualitatively different ways in which students view the use of mobile devices in their learning: storing learning materials; accessing and sharing information and knowledge; effective learning tool; effective tool for collaborative learning and enhancing creative learning. The five categories have been arranged hierarchically ranging from the lower ones to the higher levels of understanding. Therefore, these five categories can be widely divided into two orientations: *fragmented orientation* (Category A, B and C) in which the mobile devices are considered as a way to store and access information in student learning and learning simple things which do not require high level thinking. Students do not consider mobile devices for constructing their knowledge or solving their complex problem or engaging collaborative learning. Thus this orientation, mainly focuses on students' surface level of learning. In contrast, *cohesive orientation* (Category D and E), in which the mobile devices are viewed as a means to develop students' understanding, to construct their own knowledge, to engage them in collaborative learning and to enhance their creativity in their learning. It is mainly involved with deep level of learning.

The findings of this study are broadly consistent in previous phenomenographic studies related to students' conceptions of learning. For instance Eklund-Myrskog (1998) explored students' conceptions of learning in different educational contexts, precisely nursing students and car mechanic students. In the case of nursing students, five conceptions were discovered and arranged hierarchically in a way that they ranged from simple remembering to deep level in the form of making one's own conception. Similarly in the case of car mechanic students, four various conceptions were revealed and their arranged matches that of the nursing students. Furthermore, Marshall et al. (1999) also exposed in his study 'Students' conceptions of learning in engineering context' five conceptions whose hierarchical relation is in line with other prior studies. The findings of this study are also consistent with those of studies such as 'How do learners experience joint writing: University students' conceptions of online collaborative writing tasks and environments' (Limbu & Markauskaite, 2015), 'Engineering students' conceptions of and approaches to learning through discussions in face-to-face and online contexts' (Ellis et al., 2008) and 'A phenomenographic study of academics' conceptions of science learning and teaching' (Prosser et al., 1994). All these ones are in line with the first study that was conducted by Säljö (1979) as he investigated the students' conceptions in learning. Generally, these studies reported students' conceptions of learning in different context and were broadly placed into surface and deep level of learning. Nevertheless, the results provide emerging conceptions on the use of mobile devices in learning contexts.

5.2 Conclusions

The introduction of mobile learning in Bangladeshi universities will be not necessarily provide any guarantee for success in learning as technology alone cannot make a student better than he or she is (Koehler & Mishra, 2005). It requires the full commitment of the students in using it regularly in order to fully maximize in the numerous benefits that it provides. Nevertheless, will be crucial in supporting the students to learn better and supplement on the knowledge they get from their normal classes.

As m-learning becomes a growing concern in the teaching and learning practice of a developing country, the role of using mobile in student learning is becoming a major focus of research initiatives (Kafyulilo, 2014; Rogers et al., 2010). It is suggested then that the findings of this study could be used to inform these initiatives, as this study provides a second order experience

(the findings derived from participants who had experiences of m-learning) of the investigated phenomenon. In recognition of the significance of these findings, this research provides different ways of using mobile devices in student learning, which is a potential input for improving teaching practice. For example, it may help teachers to create different teaching approaches that will match students' learning approaches, which will guide university students to make maximum use of mobile devices in their learning. The emerging results also contribute the improvement of professional development program. In addition to that, policy makers and curriculum developers could get empirical evidence about students' experiences so that they can develop a curriculum that will encourage and promote the use of mobile devices in the university education.

5.3 Significance of the study

As the accessibility of handheld devices in developing countries becomes increasingly easy (Kafyulilo, 2014), it has become a necessity for research to be conducted in order to discover the role these devices play in the learning of the students. It is suggested that the findings of this study could play a crucial role in informing students how they can use their mobile devices for learning purposes, besides communication, and the benefits they will gain for doing so. This is important because it will help improve those who already use, through the experience of others, as well as showing the ways for those who do not use them, to see how they can use and benefit from their mobile devices. In terms of the teaching, the findings of this study are expected to assist teachers create teaching approaches that will match with this learning approach in order to guide the learners make maximum use of the mobile devices in their learning. To give more support to this claim, it was research has discovered that the students' approaches to learning go hand in hand with the teaching approaches deployed by the teacher (Prosser & Trigwell, 1999). Furthermore, the findings of this study could also be of vital importance to curriculum developers and policy makers in the sense that they can design a curriculum (or improve the current one) in such a way that will it encourage and promote the use of handheld devices in the universities of Bangladesh.

5.4 Recommendations

Previous research studies have discovered that students' conceptions of learning are interconnected with teachers' conceptions of teaching (Prosser & Trigwell, 1999). Therefore, it is highly recommended that research should be carried out in the future to investigate Bangladesh university teachers' conceptions of m-learning. The main aim of conducting such future study is

to establish the relationships between students' conceptions of m-learning and teachers' conceptions of m-learning. It is important however to acknowledge that this study can and should be broadened further by identifying the various dimensions existing among the categories in order to get a deeper insight of the students' conceptions on m-learning.

5.5 Limitation

The participants were recruited from four university in Bangladesh and were small in number, precisely 16. However, a sample of 16 is considered to be sufficiently enough in the phenomenographic research approach. For instance, Forster (2013) interviewed three professionals from nursing practice about their conceptions of information literacy. Furthermore, Marshall et al. (1999) interviewed 13 engineering students with regard to their conceptions of learning in the engineering context while (Limbu and Markauskaite (2015)) Moreover, the results depend on the setting or the context of each study, therefore this results may not be generalizable for other contexts. However, the aim of phenomenographic research approach is not to provide generalizable results rather its focus is on a particular phenomenon that needs to be investigated deeply.

In addition, this study is somewhat incomplete due to the fact that it does not include the various dimensions and variations that exist in the categories. The dimensions and variations play an important role in identifying the distinctions among the various categories of the study.

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APPENDIX

Interview schedules

This interview schedule is semi-structured, audio-recorded and designed to be used flexibly for interviewing students. The interviewer will concentrate on the enlisted questions.

I sincerely thank you for agreeing to participate in this study. It interview will take approximately 30-40 minutes of your time today.

First of all, I would like to Commence with the purpose of the research.

This study focuses on discovering the university students' experience and understanding about the use of mobile devices in their learning.

Secondly, allow me to give you a brief introduction on the project

This study is about students' conceptions on m-learning in Bangladesh university education. Basically, focuses on uncover how university students in Bangladesh conceptualize the role and use of mobile technology devices to support their learning or in other words their conceptions or experiences on mobile devices in their learning.

Definition of Technologies

Information Communication Technology in Education (ICT in education):

The use of, not only modern computer and internet based technologies (e-learning, web-based learning, etc.), but also of simple power point slides, radio tapes, video tapes, etc. to facilitate learning.

Mobile learning (m-learning):

In this study, the researcher defines m-learning as all sorts of learning that takes place with the use of mobile technologies (smartphones, iPads, PDAs, notebooks, etc.) with or without internet connection.

As mentioned, I would like to request your permission to digitally audio-record the interview as it

will be transcribed (along with others). All data collected, used, reported and published from this study will use pseudonyms (not your name). Hence your identity will be kept confidential to the researcher. Is it alright to start to record the interview now?

Part one: Conception of Mobile Learning (m-learning) (What Aspect)

- a) Do you use ICT to support your learning?
- b) For how long have you been using it/them?
- c) Do you use handheld or mobile devices (Smartphones, Personal Digital Assistants (PDAs), Tablets, etc.) in your learning?
- d) Which handheld device or mobile devices do you use in your learning
- e) For how long have you been using it (them) in your learning?
- f) What does m-learning mean to you? Or what is your understanding about the use of mobile devices in your learning?
 - i. Why do you think so?
 - ii. Could you explain more or further?
- g) Why do you use mobile device in your learning?
 - i. Could you provide more reasons?
- h) Do you find it good in your learning?
 - i. Give some reasons why you think like that?

Part Two: Ways of using mobile devices (How aspect)

- a) How often do you use mobile devices in your learning?
- b) What do you learn (content) with mobile devices?
- c) Which subject do you use mobile device?
 - i. If more than one please name them.
- d) How do you use mobile device in your learning?
 - i. Could you explain more elaborately?
 - ii. Could you give an example to clarify your explanation?
- e) What activities do you do while you use mobile device in your learning?

- i. While you are using mobile device in your learning, is there any other person (teachers/students) connect with you by mobile device and help you to learn by these devices?
- ii. If yes, then explain how other persons are involved in learning by using mobile devices.

f) What are the possible benefits and limitations of using Mobile device in professions?

Closing of the interview:

Before we finish, is there anything else you would like to include or explain about your experience of m-learning to me that you have not already mentioned?

Thank-you for your time.