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## Contextualizing Mobile Learning (MLearning) Characteristics and Associated Platform Attributes

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### ABSTRACT

Mlearning is a new educational paradigm which is more flexible than learning using the desktop computers. It is moveable from one environment to another such as classroom to outdoors and vice versa. Hence, a seamless learning potential is realized, where the technology mediates between the learners and the learning content; the learning is flexible and adaptable so that teachers and students are not bound to a particular learning space. Learning while being mobile and through the use of mobile devices (such as Mobile phones, PDAs, Smart Phones, Tablets, Palmtop, Laptop or even digital cameras) are considered to be independent of time and location, as it could occur at any time and in any place. It also provides access on demand of learning content to learners. In this paper, we discuss and contextualize mLearning characteristics such as its nomadic nature, ubiquity and personalization. We also elucidate the attributes of mobile systems such as portanility, mobility, flexibility, ease of use and ubiquity that made them appropriate as MLearning tools. We provide graphical descriptive of these characteristics and how they can be used most effectively bring about learning.

**Keywords:** MLearning, Nomadic, ubiquitous, education, laptops, palmtops, mobile phones

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### 1. INTRODUCTION

Mlearning technology is portable as the name suggests and it is wireless. Learners are able to move around with these learning tools. Mlearning can be viewed as the focal point, where mobile technologies and web-based learning intersect to offer anywhere anytime instant on-demand educational information. It can be generally defined as the acquisition of any knowledge and skills through the use of mobile devices anywhere anytime that results in an alteration in behavior. According to (Brown, 2005) “mobile technologies have the power to make learning even more widely available and accessible than we are used to in existing web-based learning environments”. According to the report NCC of 2011, more than 90% of Nigerians own at least one mobile phone and mobile phone usage peaks in the range from 16 to 45 years, where 70% of this age group regularly uses a mobile phone. The majority of Nigerian University Students fall in this age group thus making mobile phones the most commonly used device among University Students.

Therefore, National Open University of Nigeria should take up the challenge to use these mobile devices, specifically mobile phones to provide and offer learning services. New technologies are constantly being developed and produced; examples of different mobile devices that could be used for learning today include; Mobile phones, Ipads, Mp3, Mp4, PDAs, GPS, and Organizers to mention a few. With the rapid advancement of new technologies, you generally will only need one mobile device which will be capable of integrating many features to support learning. Therefore, learners need not have multiple devices but rather one mobile device which will be able to meet their needs, as a standard phone in today's market is equipped with much functionality which if used effectively, can make learning an easy process. Most hi-tech mobile phones, currently available like the 3G iPhone, the Android, the Google G-1 phone or any smart phone, contain the functionalities to help the users perform many tasks and allow them have access to information as required anytime and from anywhere. This access to information is normally achieved in an interactive way, where the mobile phone user feels in control of handling the accessibility, management and sharing of resources.

## 2. MLEARNING CHARACTERISTICS

The mLearning characteristics discussed here give a picture of what is contained in mLearning and how it can be used most effectively to bring about learning. First this study looks at the portability of mobile phones, which is categorized within nomadicy. Being nomadic in nature leads into the ubiquitous nature of mobile technology, the idea of instant connectivity and the ability to connect in any situation. With the idea of being nomadic and ubiquitous it is then important to consider the context sensitivity of mobile learning. Within these contexts the next characteristic to consider is the interaction and collaboration that mLearning can afford. Finally, mLearning also considers personalisation or the individuality of the user, their preferences etc. Figure 2.1 illustrates the major characteristics and contexts of mLearning that are discussed here.

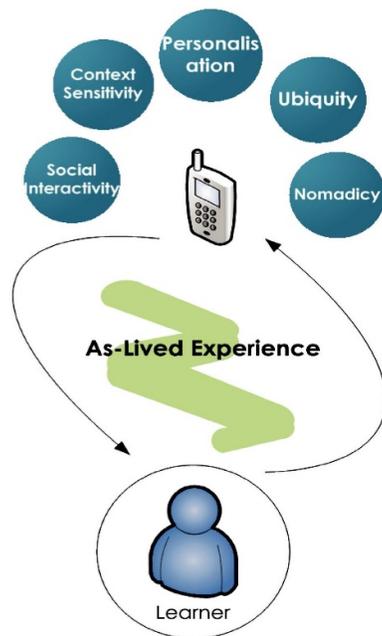


Figure 1: Contexts and characteristics of mobile learning paradigm (Cavus, et.al, 2011)

## 2.1 Features of Mobile Devices Tangential to MLearning

Today mobile devices have some unique features which make them an efficient device capable of providing, sharing and exchanging of learning content. Some of these features are as follows:

- **Portability and Mobility:** Mobile devices are small size lightweight devices, students find them convenient to use and carry with them.
- **Flexibility:** Students and teachers can access the server from almost anywhere.
- **Convenience:** Whenever students need to connect teachers or urgently need information from the Internet, remote access is available to them. In particular accessing the server through WAP (Wireless Application Protocol).
- **Remote Accessibility:** Students can add or update information remotely.
- **Ease of Use:** Using an iPhone provides a larger screen than an ordinary mobile phone and it's convenient for learners input.
- **Utility:** Most of the smart phones provide almost all of the capabilities of a standard computer such as processing and storing data.

### 2.1.1 Nomadicy

The most obvious difference with mLearning is its portability. Mobile devices can travel anywhere with a person with relative ease, but it's not just the moving around but rather a nomadicy. Nomadic refers to "a phenomenon in which the state of being on the move is the normal state and not a break from the normal" (Patokorpi, 2006); even when the device is disconnected, the learner is able to access certain material nomadically. So "being mobile is understood as a form of being-in-the-world" (Fallman, 2011) This changes our perspective of mobile use from something that we are introducing to a learning environment to something that already exists and is part of that environment, as well as learning being something that is not exclusive to a formal situation but can be nomadic as well.

Being nomadic in nature is the very first intention of mobile technology and allows users of this technology to move about and still have the ability to use all the features of the device to make calls, search the web and more, the nomadic nature brings out technological possibilities coupled with the personal aspect of mobile phones (Arnold, 2003; Naismith et al., 2004) . The learner is thus able to take their learning anywhere and anytime without the constraints of a classroom, making learning available at times that are more suitable to the learner, even on the move; this freedom empowers learners (Cavus & Al-Momani, 2011).

The drawback of this nomadicy is that it expands the users context and control over the situation of learning, allowing for distractions and interruptions to be part of the learning experience (Costabile et al., 2008). Fischer (2011) focuses on the interruptions that users experience with mobile phones and has created a model to help understand the nature of both positive (such as reminders and initiating engagement) and negative interruptions (that affect the user's ability to continue a task). Fischer's main conclusion around interruptions was that, the degree to which something interrupts a user is dependent on the context; the importance they place on what is interrupting the situation; and the timing of it in each moment.

Interruptions can include messages, calls and reminders that can interrupt the flow of the context, either on the device while the user is learning or in the actual situation that the person is present in. The nomadic nature of the user implies that "the user is distracted and has a short attention span" (Botha, et al., 2010). This short attention span is affected by the overwhelming amount of information available to an individual using their mobile phone, so it's important that mLearning as a nomadic way of learning supplies users with exactly what they need in the right context (Bray, et.al, 2006). This leads us first to consider ubiquity in mobile learning.

### **2.1.2 Ubiquity**

Ubiquity refers to the interconnectedness of the mobile device with its environment, and other devices, it's more than just being able to move about, it's being able to access information simply and fluidly in any situation (Patokorpi, 2006). "Mobile technologies forge ubiquitous learning spaces and experiences across different scenarios or contexts" (Sha et al., 2012). Ubiquity also refers to the spontaneity of mobile learning, which is allowed because of its on-the-move context. Ozdamli & Cavus (2011) consider spontaneity as a defining characteristic, "revolutionising education" to being nomadic and contextualized. The ability to learn in just about any context with any mobile device is ubiquitous. (Chen et al., 2008) "Mobile devices have become one of the most powerful technologies available to the individual for acquiring knowledge in a ubiquitous manner" (Al-masri & Mahmoud, 2012). Being connected to the Internet, through wireless networks, and telecommunications, means that the world is more connected than ever before. This influences the way we see ourselves in the world, where we are and who we're able to connect to, and the information that is available to us all the time; which leads us to consider what contexts exist in a mLearning environment.

### **2.1.3 Personalisation**

Mobile phones cannot know what context you are in and the sensitivities of it, such as if you are in a meeting or socializing. They act independently of the situational context (Fischer, 2011). It is however important that the context is considered in the design to give the user the best experience possible. A lot of research has been conducted in this area aiming to get to an intelligent device that can react to the environment and respond appropriately (Al-Hmouz, et al., 2010; Kearney, et al., 2012). Using a mobile device for learning personalizes learning and creates anonymity and privacy simply through ownership of that device and the control of the user. Numerous studies have been done to attempt to customize a mLearning environment to a particular learner's context and history. One side of personalisation is allowing for the learner to "have the option to choose learning content based on their interest" (Al-Hmouz, et al., 2010); they can also make small customizations to the look and feel of the content.

Personalisation goes even further though, where algorithms have been produced that will use the data collected from the users performance to customize content that is at their level and preference of learning (Al-Hmouz et al., 2010; Ozdamli & Cavus, 2011). This research is at a technological level and lacks the "user's point of view" (Pato-korpi, 2006) towards being personalized. (Al-Hmouz et al., 2010) speaks about "systems that tailor their behavior to individual users' needs" as well as containing personal information about the user that can help to tailor the mobile technology's behavior. "Learning is no longer restricted by space and time" (Arnold, 2003; Sha, et al., 2012) so it becomes fundamentally important that the user is able to call up the information that is required in their situational context. The learner should be able to choose when and where and how much learning to consume using their mobile devices (Williams, 2009).

### **2.1.4 Social Interactivity**

Collaboration is highly supported for mobile learning. The technology removes borders and allows learners to collaborate with peers or teachers around the world, how and when they want to. This collaboration increases active participation by students. There is a parody at play here where mLearning affords both privacy and freedom to the learner (Alvarez et al., 2011; Ozdamli & Cavus, 2011; Patokorpi, 2006) and "it provides its users with a high degree of independence, mobility and flexibility" (Arnold, 2003) as well as allowing for teachers to respond "in ways that are meaningful to (the learner)" (Schultz, 2011). Although there are many advantages to having this collaborative communication it can also be disadvantageous for the learner.

Being out in the real world means there are plenty of distractions, that can disturb a learner's pattern of thought (Rogers et al., 2009), so when a learner is interacting with the learning environment it is just as easy for the learner to get involved in something that is happening more immediately in their situational context, and disconnecting from that engagement.

The recent developments in mobile technology have created a higher level of interaction (Al-masri & Mahmoud, 2012). MLearning offers the opportunity to move beyond the formal classroom and allow more freedom for learning anywhere, anytime. The nature of mobile devices being portable and personal support many types of interaction (Naismith et al., 2004) “One way of ensuring that learners engage in fruitful collaboration is to engage them in structured interactions, based on prescribed rules establishing how they should form groups, collaborate, and solve problems” (Alvarez et al., 2011) A useful model for understanding the types of interactions that exist has been proposed by Moore, (1989), (Abdous & Yen, 2010), in this model there are three types of interaction: Learner-to-Content Interaction (LCI), Learner-to-Teacher Interaction (LTI), Learner-to-Learner Interaction. Willis and Gunawardena (1994 as cited by Abdous & Yen, 2010) introduced the fourth type of interaction: Learner-Interface Interaction.

These interactions are highly supported by mobile technology and can be utilized quite effectively in a mLearning environment. Learner-to-Content Interaction plays a key role in forming ways of thinking for the learner that will facilitate learning. Learner-to-Teacher Interaction is a motivational and facilitation role in learning as well as providing a supporting role. Learner-to-Learner Interaction allows for more collaborative to take place. Learner-to-Interface Interaction is about the learner’s experience with the mLearning and the quality of it (Abdous & Yen, 2010). These interactions also create formal, informal, social and personal spaces for learning.

## **2.2 Limitations of Mobile Learning**

There are many limitations that need to be considered with mobile learning. The obvious limitations are the ones of the small screen size, the audio quality and connection to the network affecting the speed and quality of delivery for learning content. While a small interface might be limiting in regard to what can be delivered to a learner it could also be advantageous, in that it forces the content to be to the point and meaningful or presented in a more creative manner, which could benefit learners. Attention span or the ability to take in large amounts of information at a time is a shortcoming of learning itself, so the limitation of the small interface actually assists this shortcoming by catering for it in small chunks of information (Chittaro, 2011; Fischer, 2011; Yordanova, 2007).

In some cases the limitation of battery life and the small screen life mean that mLearning might be better used as a support system to the traditional learning, as a middle path between e-learning and the classroom; allowing for just what is necessary when on the move (Chen et al., 2008). Moving away from the technical aspects of the devices, the vast amount of information available on the Internet has made it a common resource to find out or learn about something. Mistaking the Internet as “reflecting reality” (Bray et al., 2006) can be a problem for learners as misunderstandings or confusion arises over a topic. It is necessary that mLearning guides the student, and helps to filter unnecessary information.

Common design issues in mLearning are those of: “usability, communication and interactivity” (Ouda, et.al, 2012). Other things that should be considered are features such as location-based services that could be seen as an infringement on a learner’s privacy, so a learner may not be willing to allow for it. If learning becomes so invasive in an informal environment that it overtakes their social network then learners may have more reason to be rid of the mLearning than to use it (Naismith et al., 2004). After exploring the many characteristics of mobile technology and its limitations, the next section focuses on the contexts that surround mobile learning.

### 3. CONTEXT SENSITIVITY IN MOBILE LEARNING

Keeping in mind that mLearning is ubiquitous and nomadic in nature, this section considers the contexts that exist, are crossed and are created through mobile learning. Context is important as it can help in the design of the mLearning environment. Delivering learning content that is based on the current context of a user should be an important goal of mLearning (Al-Hmouz et al., 2010). “Today, we live in two spheres of existence, a physical sphere and a digital sphere” (Bray et al., 2006) and then these spheres overlap and this can be seen as the interacting of these two worlds. These two spheres are often out of our control, but what can be controlled is what and how we deliver learning into these two spheres to influence the user’s interaction within these overlapping spheres. Further investigation into these spheres is required. Mobile devices and technology in general are now part of our daily lives, and this means that there exists very little separation between work, socializing and our private lives as it is all accessible wherever we are (Weilenmann & Juhlin, 2011).

Within these digital and physical sphere’s Al-Hmouz et al. (2010) proposes a framework for learner personalisation that takes into account different contexts, he refers to these as statuses. The four major statuses that Al-Hmouz et al. (2010) propose are (1) “situation status”, “learner status”, “knowledge and shared properties status” and “educational activity status.” The FRAME model as designed by Koole (2009) identifies information contexts and describes how these overlap each other to create further contexts; the main contexts are the device aspect, learner aspect and social aspect. Combining these perspectives this paper has grouped the contexts into three major contexts that will be explored more fully. These are the (1) learner’s status, referring to the person’s personal being and preferences, the (2) situational context refers to the world that exists physically and nomadically around the user and then the (3) learning environment context that takes into account the environment that is created through the integration of the digital and physical spheres. These contexts are represented in Figure 2. for visual understanding.

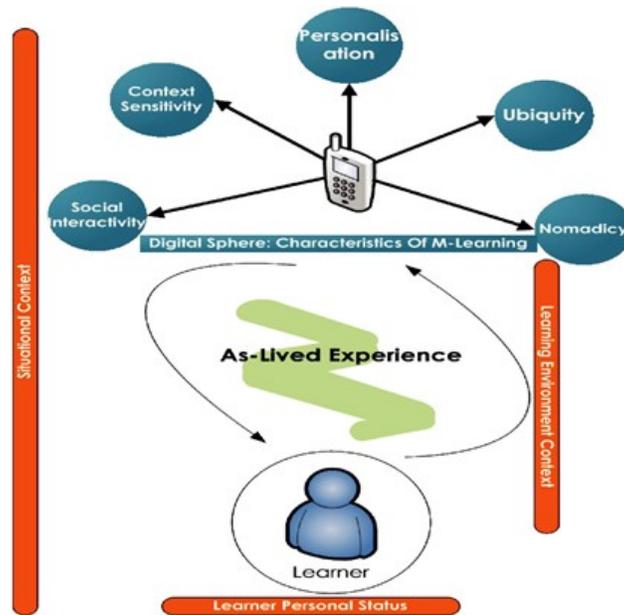


Figure 2: Different contexts in mobile learning (Cavus, et.al, 2011)

### 3.1 Learner's Personal Status

The learner's context considers aspect of the learner such as preferences, demographic information, and learner history as well as "cognitive ability, memory, prior knowledge, emotions and possible motivations" (Al-Hmouz et al., 2010; Koole, 2009). Being in a constantly changing environment means there are numerous influences surrounding the learner that can affect their behavior, emotional state and concentration and ultimately their ability to use the mLearning service appropriately. While there is no control over these aspects it is important to keep these in mind when considering the implications of our design.

### 3.2 Situational Context

Context can be many things for mobile learning. For one, being mobile in nature means that every situation brings its own context that is unpredictable and determined by the user and their environment; thus "mobility and context are seen as inextricably intertwined" (Fischer, 2011). The nomadic and ubiquitous nature of mobile technology means that a user's context is constantly changing due to that movement (Patokorpi, 2006). The social/situational context is the actual context in which the learner currently exists as they access or receive learning from a mobile device (Al-Hmouz et al., 2010). It can be defined by the social interactions, cultural surroundings and rules around communication (Koole, 2009).

This context will involve any distractions or interruptions to the learning environment context. Chittaro (2011) points out that using mobile technology can often be a secondary task within our social context, mobile phones have introduced an unpredictability, when one person calls another they are not sure what situation that person is in and cannot know whether they are interrupting that person. It is also a common expectation that someone can answer a call at any time as they will always have access to their phone. The mobile device is then an extension of that person's situation, so while a user is interacting with the mobile technology they are also involved with "the world as negotiated and enacted in the moment" (Fischer, 2011.) Fischer (2011) further delves into the idea of 'anywhere, anytime' and questions whether people do actually have their devices on them all the time.

While Patel et al. (2006 as cited by Fischer, 2011) found that users "keep their phones switched on 85% of the time on average, but only 58% of the time on average did they also have the phone within arm's reach." So while mobile devices are definitely a part of a person's daily living, it's not necessarily something that is continuously consumed as some might be led to believe. This is an important consideration as it questions how often and how regularly users would engage with their phones for mobile learning. Fischer (2011) also noted that "when users were away from home, they carried their mobile phone with them significantly more often than when at home." This means that the situational context of a user will often be in a non-constant situation; this being on the move often means "that people can de-vote only a very limited attention to the device while they are on the move" (Chittaro, 2011). This brings up an interesting conflict that needs to be taken into account when designing, even though learners are able to learn on the move there is also higher chance of distraction and interruptions.

### 3.3 Learning Environment Context

mLearning has the ability to cross the boundary of a learners context and "facilitate sense making activities" (Rogers et al., 2009). The learner is now able to move beyond the classroom, both taking the classroom with them while being removed from that context. The mLearning environment is able to create its own environment within any situational context and engage the learner (Alvarez et al., 2011; Patokorpi, 2006). The mLearning environment is thus created in the way that it is delivered and the learning styles that it caters for (Al-Hmouz et al., 2010). The mLearning context is where the situational and learner's personal context meet with the digital sphere. The digital sphere can be seen as the device aspect looking at the functional ability of the device, its physical and technical attributes from the hardware and software (Koole, 2009).

This learning space where designers and teachers have the most influence over. Mobile phones have been observed as only being “used for short bursts of times” (Rogers et al., 2009), so learning material would need to cater for such. Being out in the world means that learners can stop and “reflect... deepen their understanding and help integrate their ideas” (Rogers et al., 2009). Furthermore, mobile phones are capable of delivering games that stimulate learning and engagement in a subject (Burdick & Willis, 2011). Using mobile devices in museums, it has been observed that children tend to read the device on their own as opposed to when there was no device, where they would work things out together. There is a difference in the learning experience created through mobile devices and this is the learning environment context created (Rogers et al., 2009). MLearning thus includes the learner’s personal context within a situational context, and these can be considered physical spheres and by introducing the digital sphere into the learning context we have a mLearning environment.

#### **4. AS-LIVED EXPERIENCE**

A theoretical approach to designing for mLearning should observe the as-lived experience. McCarthy & Wright's (2005) use of felt-life, which is another term for as-lived, within human computer interaction is also focused on in this section. This section falls within the understanding of context for mLearning design as it provides the lens to understand the learner’s context further, though it is particularly influencing on the actual design of the course from a designer’s perspective. As-lived experience is understood as looking at the way that people experience technology in a natural setting, the experience as it is beyond logical thinking and rationalism and within a domain of understanding. It allows us to take into account the complexities of as-lived experiences including emotions, feelings and cognitive beliefs and ask questions that were not previously considered. It also considers people as having a relationship with technology, and that relationship is governed by our values and goals (McCarthy & Wright, 2005; Winograd & Flores, 1986). Taking an as-lived approach means looking at the world as it is “sensed and experienced” (McCarthy & Wright, 2005) by people.

Within a mLearning designing perspective this means understanding how users interact and feel about learning using mobile technology in their specific context (Winograd & Flores, 1986). The as-lived experience provides an approach to considering the usability of the technology within the context of learning. Winograd & Flores (1986) look at designing systems in an ontological framework “that facilitate human work and interaction.” MLearning is an interactive space as discussed previously when looking at the different contexts. This ontological design “constitutes an intervention in the background of our heritage, growing out of our already existent ways of *being-in-the-world*, and deeply affecting the kinds of beings that we are.” The as-lived approach to thinking allows us to think about the users experience in designing a mLearning environment. Winograd & Flores propose phenomenological insights into the ways of design. The three major ones are readiness-to-hand, anticipation of breakdown and the blindness created by design; these phenomenologies can be combined into our model for consideration, bringing concepts of context, thoroughness and domains of understanding.

“Readiness to Hand” is when something is designed in such a way that a user can simply use it without much thought such as driving a car or making a phone call; it is a concept that is important to consider in design in ensuring that the user is comfortable with and doesn’t need hand-holding. Part of this is to make sure that a domain of understanding is defined, this is the context that is created within the mLearning system; once this is defined then it is easy to identify where parts of the system might confuse or deter a learner, “a bad design forces the user to deal with complexities that belong to the wrong domain” (Winograd & Flores, 1986). This can also be seen as an “anticipation in breakdown”, identifying something that might cause a break in communication between the device and the user; designers should be aware of anything like this; a breakdown is not a negative situation to be avoided, but a situation of non-obviousness, in which the recognition that something is missing leads to ‘unconcealing’ (Winograd & Flores, 1986).

The breakdowns create clear objectives, providing possibilities for action for when these breakdowns happen (Winograd & Flores, 1986). Another concept of Winograd & Flores is blindness in design; this asks us, when creating the mLearning system what is not being considered; for instance, in the creation of a searchable online database of books the user is able to find books more efficiently but the ability to browse for similar material. For design, this means taking into account many possibilities to know what to expect. McCarthy & Wright (2005) use the term “felt-life” and explain how combining this lens with human computer interaction will allow us to deal with “issues such as resistance, identity, and attachment that are not otherwise addressed in HCI”.

As the as-lived experience takes into account the sensual and emotional experiences that cannot necessarily be measured and gives us a clearer understanding. Technology is increasingly becoming a part of our daily life, especially mobile technology, and they are more than just work tools but are part of our social lives as well. This relationship with technology can define the way we use and interact with technology, making this as lived lens necessary.

Nussbaum (2001) connects people’s actions to their emotion by explaining that emotions are linked to a person’s “goals, needs, desires, and values” which can be used to locate the relationship between self and technology. By recognizing emotions, the as lived approach considers these emotions as responding to the immediate environment in the interests of that person’s goals. “Although these feelings are associated with bodily sensations, they never quite belong in the body, rather they are qualities of interactions between organisms and things in their environments” (McCarthy & Wright, 2005), which gives us some measure of the user’s experience that could identify underlying reasons for breakdowns.

“For people, feeling is inevitably intertwined with language, intentions, and values. Combined with language and intention, feelings become more sophisticated forms of knowledge or sense making, partly because of their proliferation and partly because of their association with a person’s sense of self” (McCarthy & Wright, 2005). This understanding means that there are underlying reasons to people’s resistance to technology, that can be understood through the as-lived approach, and might otherwise be swept over and not considered; it “requires us to model people as always involved and always having preferences, priorities, and values” (McCarthy & Wright, 2005). There is the need to explore “how the person felt about the experience, what it meant to them, whether it was important to them, and whether it sat comfortably with their other values and goals” (McCarthy & Wright, 2005) to get an understanding of that relationship between technology and the user.

## 5. CONCLUDING REMARKS

In this paper, we presented MLearning as a new educational paradigm which is more flexible than learning using the desktop computers. It is moveable from one environment to another such as classroom to outdoors and vice versa. The necessary and required characteristics of MLearning were discussed and contextualized from a socio-educational perspectives. We also discusses the nomadic nature, ubiquity and personalization issues surrounding MLearning and opined that mobile systems contains certain attributes that made them ideal as tools for MLearning

## 6. FUTURE WORKS

In our future works, we will examine MLearning models with a view to determining their appropriateness for instances of MLearning design, implementation and deployment.

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