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# Towards an Inclusive Definition and Framework Development for M-Learning

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## ABSTRACT

*Mobile learning has changed the course of learning in higher and tertiary education. However, there are still mixed views on the inclusive definition and best usable frameworks for implementing mobile learning in formal education system. Hence, the question, which has been posed but not been explicitly answered by researchers, is: What is the correct view of mobile learning? This question has left so many researchers mystified but the answer lies in the way in which mobile learning is defined. How then should mobile learning be defined? This article serves to propose an inclusive definition that can be used to guide the development of mobile learning systems in formal education. In addition to the guide, this paper proposes a framework for usage and implementing multimedia mobile e-learning.*

## TYPE OF PAPER AND KEYWORDS

Short Communication: *E-learning*, M-learning, *mobile learning, mobile technology, mobile learner, multimedia, inclusive definition, Framework*

## 1 INTRODUCTION

The increase in mobile penetration rate in the world has a significance impact on the ways in which learning is now being delivered [20]. With the advent of distance learning, electronic learning has become a significant way to deliver learning material and enhance communication between students and lecturers. However, due to the increase in usage of mobile phones, especially smartphones and other handheld devices, there has been a transition from conventional electronic learning (e-learning) to mobile learning (m-learning). Y.Park [20] viewed e-learning as desktop confined learning and inflexible whereas m-learning promotes mobility and flexibility to learning. In addition, m-learning is seen as dynamic as compared to e-learning that is fixed and static. Other researchers view m-learning as extremely personal, collaborative and long term [23]. In other words, m-learning is learner-centric. C.P. Schofield et al. [23] highlighted six features of mobile devices that are changing the way of learning, and these include:

- Portability: The ability of the mobile devices to be carried or moved with ease.
- Context sensitivity: The ability of mobile devices to enable learning by making use of a person's immediate context and surroundings.
- Connectivity: The ability of the devices to connect with most learning platforms and other devices or network connectivity.
- Individuality: Customized learning based on previous learning familiarities.
- Interactivity: Mobile devices are potential tools for enhanced cooperative learning.

- Lifelong: Mobile content consumption is continuous.

Learning on mobile devices has recently been explored more widely with the rise of tablets and smartphones [16]. Mobile learning suits in conditions were the traditional or situated learning does not work for students. The concept of mobile learning is still emerging [26] and hence it is unclear [25]. There are different views proposed by different authors in defining mobile learning. Such differences impact the future of mobile learning and how it will be used. J. Traxler [25] posited how the concept of mobile learning will ultimately be defined and conceptualised will determine its future and the course of evolution.

Therefore, defining mobile learning should be taken as the first step towards building an understanding of the requirements for mobile learning systems. Mobile and wireless technologies such as handheld devices, personal digital assistances, smartphones, graphic calculators and personal media players are becoming more omnipresent in most parts of the world and have led to the advancement of m-learning as a distinctive *but ill-defined entity* [6].

There must be a consensus amongst the academic world in the way in which mobile learning is to be defined. The current definitions of mobile learning are not clear enough. Hence, the frameworks that are developed are not inclusive in the aspects of mobile e-learning. There is uncertainty about whether laptops and tablets deliver mobile learning [6]. This "noise" is a result of an ill definition of mobile learning. It is easy to define 'learning', but the introduction of the term 'mobile' has created numerous definitions and frameworks of 'mobile learning'.

The main purpose of this research is to review definitions of mobile learning from different authors, come up with an inclusive definition of mobile learning, propose, design and create a framework for mobile learning. However, the framework attributes have not been tested, but have been compared with other prominent frameworks from literature. The rest of the paper is organized as follows: Section 2 revisits the history of e-learning and m-learning and the definitions of mobile learning by different authors. This section furthers looks at the other two frameworks that are used to explain m-learning. In Section 3, we present our framework for implementing mobile e-learning. Section 4 suggests an implementation design of our m-learning framework. The last section is the conclusion and future work.

## 2 RELATED WORK

This section starts with the history of e-learning and multimedia e- and m-learning. This is followed by the evolution of mobile technologies. This section also looks at the definitions of m-learning by different authors and the frameworks for m-learning.

### 2.1 History of E-Learning

E-learning as currently used in tertiary institutions has no clear origin [11]. Due to no clear information of the origins of the idea of e-learning, there is no single view point from which e-learning can be defined. T.T. Kidd [11] pointed out that e-learning is defined differently from one sector to another. In the education, military, and business sectors, e-learning is viewed differently from each of these sectors.

Researches of e-learning started from as early as the 1960s and the contributions by D.L.Bitzer et al. in 1962 [3] made a significant impact into the studies [11]. [3] is regarded as the brains behind e-learning due to the research on the first generalised computer based instruction system, which is called PLATO (Programmed Logic for Automatic Teaching Operations). PLATO was firstly used in the 1960s and then incorporated a network, which was distributed to support thousand graphic terminals in the 1970s [30]. According to [30], the system pioneered online forums, message boards, instant messaging and email chat rooms among other notable e-learning services and brought to the world the first online community for education and learning purposes.

### 2.2 Models of E-Learning

The idea of e-learning came at the same time with the introduction of personal computers in 1960 [3] and became prominent in 1999. With the increase in personal computers and distance learning, e-learning became an alternative way to courses and material delivery. J.A. Itmazi et al. [8] argued that there are two models of e-learning: synchronous e-learning and asynchronous e-learning models. Synchronous e-learning model involves students and lecturers logging into the system at the same time so that learning can start. This model includes chat rooms, live discussion forums, and white board sessions. Communication between participants occurs simultaneously. On the other hand, asynchronous model facilitates non-simultaneously communication to enable learning. Learning material can be posted on the system by the lecturer, and students can access the material later when they need it.

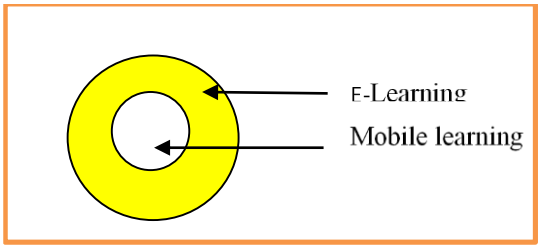


**Figure 1: E-Learning vs. M-Learning**

## 2.3 M-Learning vs. E-Learning

Recent advancements in the capabilities of smartphones and tablets coupled with their inherent ubiquity have led to an increased interest in leveraging mobile devices for education and learning purposes [7]. Mobile based learning, is commonly referred to as m-learning in the circles of research towards distance learning, e-learning and mobile learning. Advanced Distributed Learning Initiative (ADL) defines mobile learning or "m-learning" as the use of handheld computing devices to provide access to learning content and information resources [7]. Here, m-learning is simply viewed as an extension of e-learning [29]. [4] viewed m-learning as a subset of e-learning.

### 2.3.1 Evolution of M-Learning

Mobile learning like e-learning dated back to the late 20th century specifically year 1999, and became more prominent in the year 2001. Mobile learning continues to gain visibility almost forty years after its birth [28]. It came up as a result of the increasing capabilities of mobile devices to work as an aid to learning. Fast internet and the mobility brought about by mobile devices changed the delivery method of learning to mobile learners. A rapid increase in the penetration of smartphones and other handheld devices have also influenced the entrance of mobile learning in research. In the past two decades m-learning has grown from a minor research area to a significant one. From the 1970s up to the current period, [28] described the evolution of m-learning as represented in Figure 2 below.

P.W. Williams [28] argued that e-learning emerged as a prominent technology trigger and its visibility disappeared but m-learning is still a burning issue almost four decades after its birth. Thus [28] describes the periods of m-learning development using statements as shown in Figure 2. Current innovations in program applications and social software have made mobile devices more dynamic and pervasive, and also promise more educational potential than in the past [20]. This change in the way mobile devices are now perceived will determine the fate of mobile learning. R. Guy [6] argued that the history and development of m-learning need to be understood as a continuation and reaction of 'conventional' e-learning that is perceived inadequate to learning and has limitations.

### 2.3.2 Evolution of Mobile Technologies

A lot has changed in the technologies that support mobile learning which is generally termed *anywhere anytime learning*. New mobile wireless technologies of 4G (fourth-generation) and LTE (long term evolution) has improved the connectivity capacity that once affected mobile devices. 4G is relatively faster than all prior mobile network technologies (1G, 2G and 3G), and is currently being offered at a premium price. There is a lot of investments in research and development on how processing power, memory, and graphics on mobile and other smart devices can be increased. Also a notable mention is the Google's recent launch of a smart television set, which runs on the Android operating system, codenamed Android Lollipop [9]. All these developments pose a new dimension in the education and learning circles.

## 2.4 Review of M-Learning Definitions

There is no clear inclusive definitions of mobile learning proposed by authors in literature [10]. J. Traxler [25] pointed out that some academic authors define m-learning in terms of devices and technologies involved, while others define it in terms of learners and learning mobility. Emphasis was on the key aspects of technology and devices that support the learning process and mobility of the learner as well as the process of learning.

The way in which J. Traxler [25] tried to define m-learning concurred with that of [5]. El-Hussein and Cronje [5] broke down m-learning into three components and then derived the concepts from which the definition of m-learning can be made. The three components are the technology, the learner and the learning process. The concepts derived from the components are the mobility of technology involved in mobile learning, learner mobility, and mobility and dynamism of the learning processes and information flow. What is common in the viewpoints of Traxler [25] and El-Hussein and Cronje [5] is the mobility of devices and technologies involved.

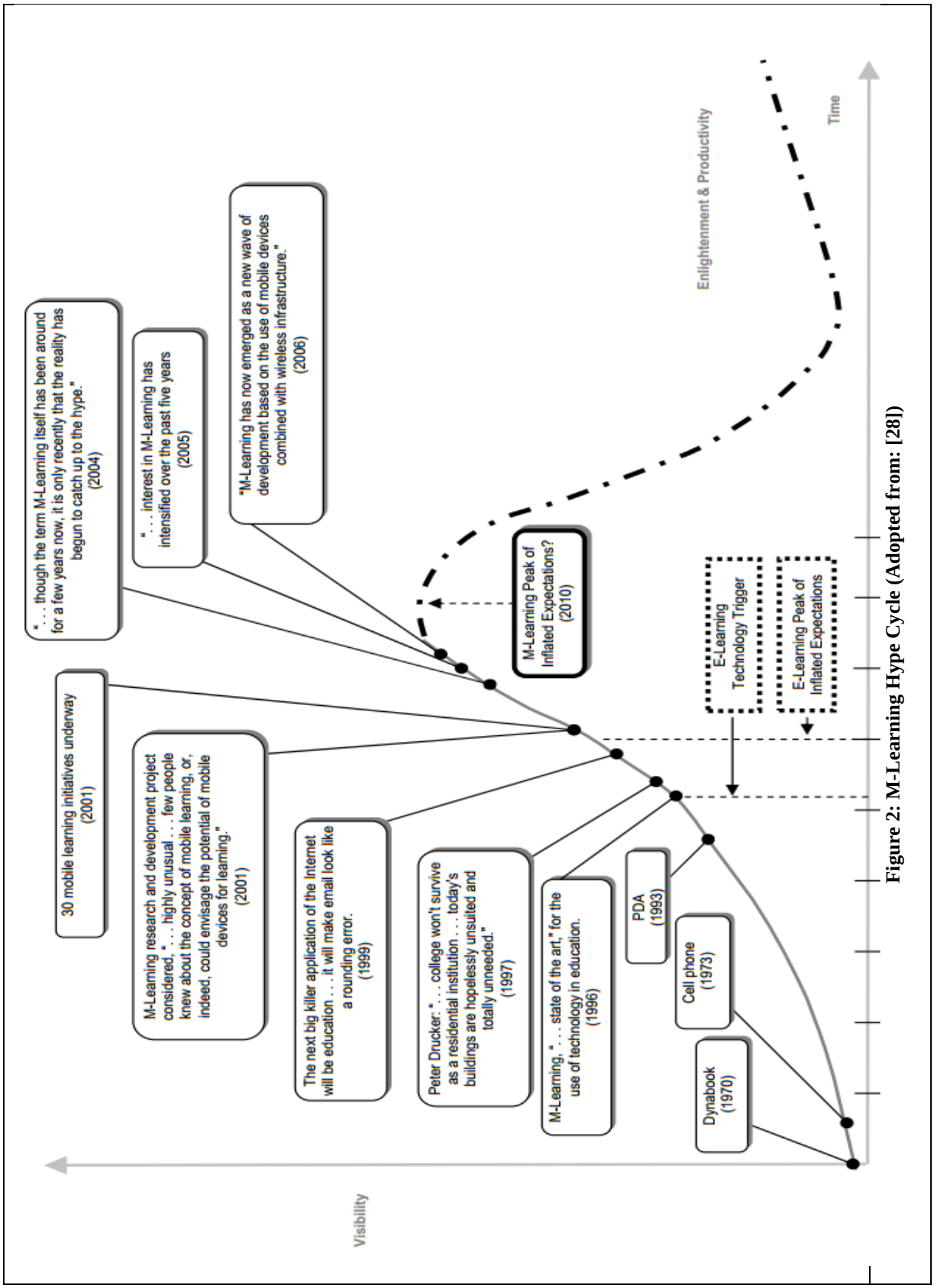


**Figure 2: M-Learning Hype Cycle (Adopted from: [28])**

This brings on board the definition of m-learning proposed by [2] as learning through the use of any devices of wireless technology. The devices are portable and can be used anywhere where there is unbroken internet connectivity. These devices such as smartphones are able to connect to the internet using wireless technology. Also R. Oller [19] emphasized mobility as a key aspect in defining mobile learning, but acknowledged that the devices included in the definition of the field changed over time.

To support that notion, C. Quinn [22] simply defined mobile learning as learning, which takes place with the assistance of mobile devices. Pinkwart et al. [21] defined mobile learning as "e-learning that uses mobile devices". In this view, though the aspect of mobility is being emphasized through the use of mobile devices, there are other technologies that are involved. This gives another dimension to the definition of m-learning.

Some authors define mobile learning focusing mainly on the mobility characteristic of the devices [19] [22]. However, Laouris and Eteokleous [14] argued that there must be a shift from defining m-learning focusing on the mobility of devices to defining it looking at the mobility of the learner. [14] suggested a definition that takes a "broader view that accounts for a learner freely moving in his physical environment". In addition, [14] proposed what moves with the learner is not the device, but his/her whole learning environment. From the above discussed views of how m-learning can be defined, what is common is the aspect of mobility.

All the same, there are still arguments in trying to understand what mobility refers to. Is it the mobility of the learner or the mobility of the devices? Due to this perplexed view in defining mobile learning, [25] admitted that the characteristics of m-learning makes it difficult to develop a definition. The author identified three characteristics of mobile learning: personal, contextual and situated, and argued that these lead to the variation of the concept. [6] argued that irrespective of the exact definition of the phrase "mobile learning", mobile and wireless technologies such as handheld devices, personal digital assistances, smartphones, and personal media players are the key technological issues in mobile learning.

However, after a thirty month research period Sharples et al [24] explicitly mentioned that the learner is the one that is mobile and not the technology involved. [24] argued that while on the move, the learner can use any technologies at hand as an aid to learning. Learners can use their personal mobile devices or palmtops, or they can use other people's devices. Thus, the technology is not very key in defining the mobility aspect of the phrase "mobile learning". Table 1 outlines the m-learning aspects taken from different authors.

**Table 1: M-learning aspects depicted by different authors**

| Number | M-learning aspect | Authors |
|---|---|---|
| 1 | • Devices<br>• Technologies<br>• Personal<br>• Contextual situated<br>• Learning assisted by mobile devices | [23], [6], [29], [10], [22], [21] |
| 2 | • Mobile and wireless technologies<br>• Learning through use of any wireless technology<br>• e-learning that uses mobile devices | [16], [8], [4], [2] |
| 3 | • Mobility of technology<br>• Learner mobility<br>• Mobility and dynamism of the learning process<br>• Mobility aspect<br>• Device changes over time<br>• Mobility of learner with devices | [25], [30], [7], [10], [5], [14], [24] |

## 2.5 Frameworks in M-Learning

There are several models and frameworks of delivering training and learning. Like e-learning, there is no standard models or frameworks for m-learning [26]. This section examines two major frameworks in m-learning: Framework for Rational Analysis of Mobile Education (FRAME) model and the Motiwalla's m-learning framework. The two frameworks have aspects that can clearly define and propose a new inclusive framework for mobile learning.

### 2.5.1 Framework for Rational Analysis of Mobile Education (FRAME) Model

Koole [12] indicated that Framework for the Rational Analysis of Mobile Education (FRAME) model takes into consideration the technical features of mobile devices and the factors in social and personal aspects of learning. However, the model recognizes technologies beyond simply an artefact of historic development.

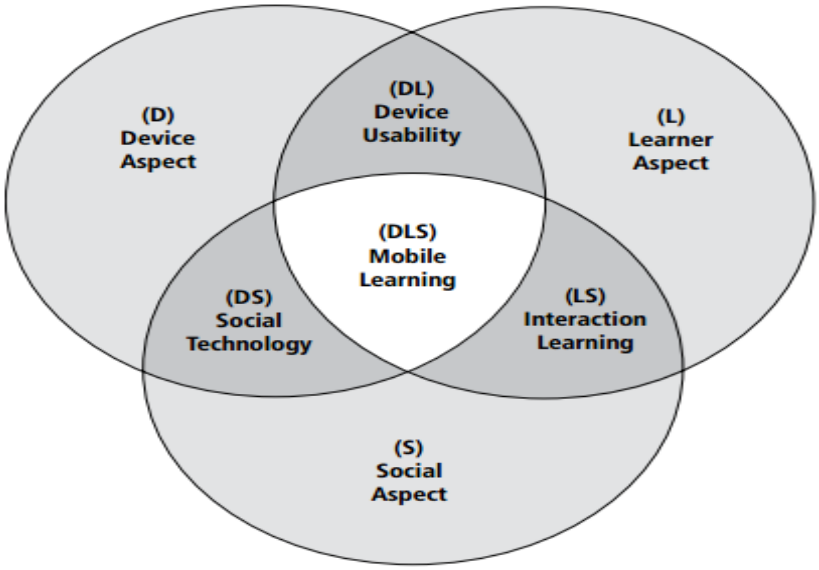


**Figure 3: The model of FRAME (Framework for Rational Analysis of Mobile Education) (Adopted from: [12])**

Koole [12] went further to suggest that in this model the mobile device is an active component with equal importance as in learning and social processes. Thus, the device and technology play an active role in mobile learning.

The FRAME model describes a mode of learning in which the learner moves freely within different physical (virtual) environments [14][12][24], and thereby participates and interrelates with other people (learners and instructors), information, and systems anytime, anywhere [14]. M. Koole [12] further argued that the complex interactions between the three aspects (social, device and technology) and learner help information to become meaningful and useful thereby aiding to learning. Figure 3 shows the interactions between the device (D), learner (L) and social (S) aspects.

Some authors like R. Oller [19] and C. Quinn [22] only focused the concept of mobile learning on the device and the learner. However, M. Koole [12] suggested that the main intersection, "a convergence of all the three aspects (DLS), defines an ideal mobile learning situation". In this way, the framework recognizes collaborative learning. This idea concurred with that of El-Hussein and Cronje [5], who said that mobile learning has the capacity to enhance the learner's sense of motivation through participation in collaborative learning. Laouris and Eteokleous [14] stated that "learners do not learn in a vacuum"; they need to interact with others (their peers and instructors) to enhance their mobile learning experience.

### 2.5.2 Motiwalla's M-Learning Framework

Motiwalla [18] developed a mobile learning framework from two levels of research and analysis. The first level is mobile connectivity, which mainly focused on the technology and applications used by organizations in delivering electronic commerce services. The second level is e-learning, which focused on the use of internet and other information communication technology aspects in delivering education. From the research conducted, he suggested a mobile learning framework for push and pull mechanism, which enabled an evaluation of the personalized and collaborative content in mobile learning applications [27]. Table 2 below describes the framework.

Motiwalla [18] also posited that the immobility of personal computers and internet access has restricted the potential of e-learning access at home and workplace. Further to this Motiwalla [18] argued that e-learning models and approaches help in the designing of applications that incorporate constructive learning and conversation theories into the m-learning environment. The framework's backbone is the ability to integrate mobile connectivity and e-learning to come up with application requirements for mobile learnin

**Table 2: Motiwalla M-Learning Framework (Adopted from: [18])**

| | **Personalised Content** | **Collaborative Content** | |
|---|---|---|---|
| **PUSH Mechanism** | Pedagogical Agents & mentors | Communication Aids | SMS, IM, Alerts, Scheduling Calendars |
| **PULL Mechanism** | Systems Tools & resources | Simulated Classrooms | WML websites, Discussion Board & Chat Forums |
| | Alerts, Scheduling Calendars, WML websites | SMS, IM, Alerts, Scheduling Calendars | **M-learning Applications** |

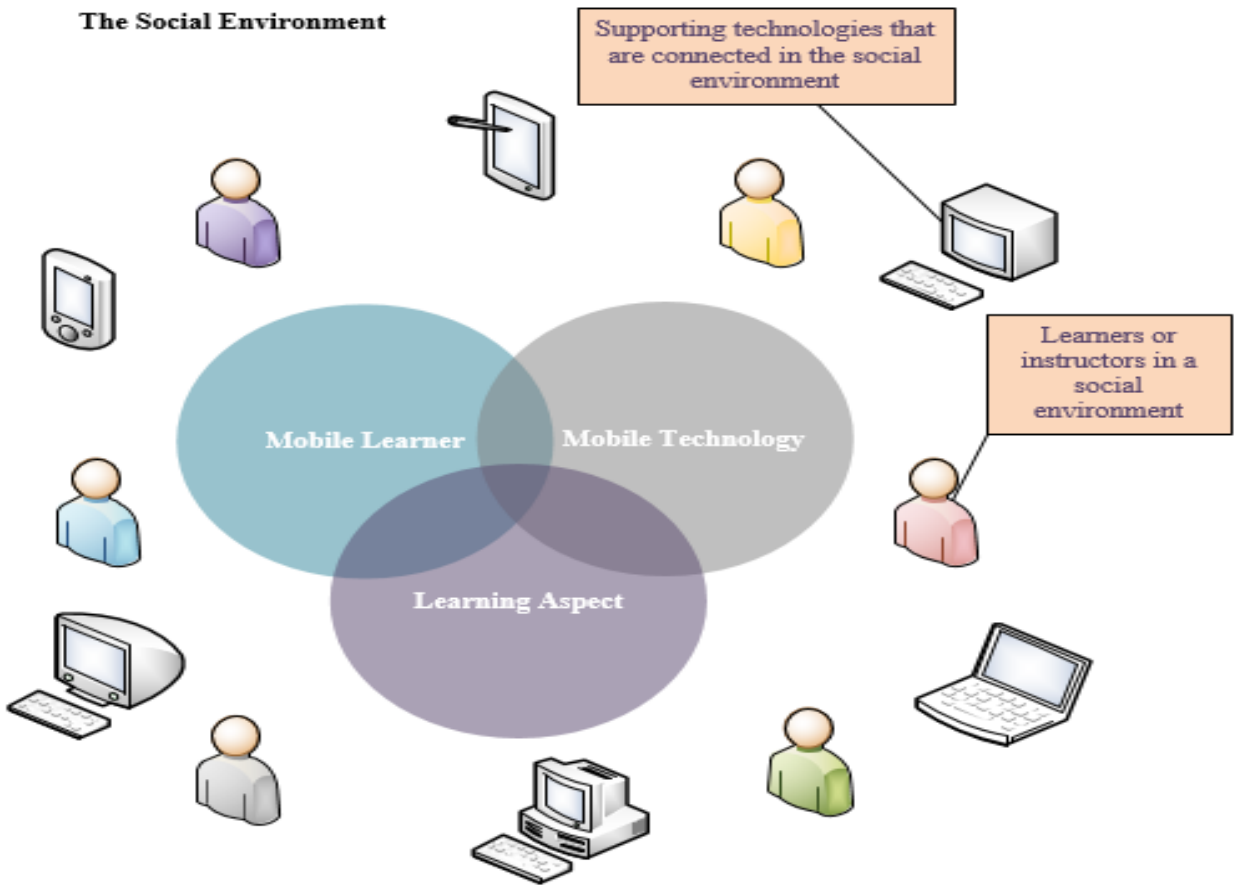


**Figure 4: Framework for defining m-learning in formal tertiary education**

## 3 2M-LS FRAMEWORK AND INCLUSIVE DOMINION

This section discusses the proposed 2M-LS Framework for m-learning. Based on the 2M-LS Framework, we suggest an inclusive definition of m-learning. The proposed framework for m-learning takes into consideration the aspects the FRAME model and the Motiwalla model. The proposed framework also takes into consideration the various aspects from the definitions that had been alluded by different authors earlier.

### 3.1 2M-LS Framework for M-Learning in Tertiary Education

In the framework depicted in Figure 4, the mobility aspect is referring to both the learner and the technology. Also of notable relevance is the idea that learners cannot learn in a vacuum [14]. They need to socialise with other learners and/or instructors. Thus, the framework supports the concepts of collaboration and conversation theories earlier alluded by [14]. The first two components, mobile learner and mobile technology, are based on the mobility aspect. They will be referred to as **2M**. The other two components are learning aspect denoted **L** and social environment denoted **S**.

The framework thus shows three major entities involved in m-learning: the mobile learners, instructors, and mobile technologies involved. However, it further realises that there must be socialisation, interaction, or conversation between the learner and his/her learning environment (other learners and instructors).

**Mobile Learner:** A mobile learner is anyone who has interests in a particular field of study. In this context, all tertiary educationists and students are mobile learners. This definition of a mobile learner is based on the assumption that almost every student at any tertiary education institute has access to a personal mobile device capable of instantiating learning on-the-go. Learners are always on the move [24]. Of notable relevance is the basic assumption that learning occurs anywhere and anytime. This means that even when the learner is going to a field trip, whilst in the bus, learning can still occur.

**Mobile Technology:** Mobile technology refers to mobile devices and network technologies involved in mobile learning. It is important to note that some renowned authors such as [24] explicitly mentioned that the learner is the one that is mobile and not the technology involved. However, it is important to recognize the portability of learning devices and their ability to be mobile together with the learner. Even the authors of [24] argued that only a leaner is mobile because there is enough room for the learner to use other devices other than his/her own. The fact that a learner is mobile together with his environment is still recognizable. Hence, in this environment, a mobile device exists.

Device technology focuses on the type of the mobile device, the capabilities or characteristics of the device (memory, processing power, graphics and screen size). With network technology, what is also important is the network capabilities (2G, 3G or 4G network technology) and the relative cost of obtaining the service thereof.

The level of network technology and its relative cost affect the design and framework used in developing mobile applications suitable for learning purposes. This makes it possible to see various forms of mobile learning platforms. As in traditional learning, there must be convergence in mobile learning from one nation to another across the globe. Mobile technology in this context refers to all the technology (device and network technology) that is involved when learning on the move.

Other mobile devices such as laptops, though included as part of supporting technology of mobile learning in the framework, are not recognised as mobile devices as far as mobile learning is concerned. Adkins argued in the report [1] – *The Worldwide Market for Mobile Learning Products and Services: 2010-2015 Forecast and Analysis* – that laptops and notebooks, while they might be considered mobile, they are not considered as part of the definition of mobile learning. The reason for this is that laptops and notebooks are not as portable as smartphones and mobile phones. Kukulska-Julme and Traxler [13] also supported the notion arguing that m-learning devices are lightweight and handheld. [31] alluded that mobile phones and personal digital assistances are the generally used mobile devices for mobile learning.

**Learning Aspect:** This involves all the pedagogic aspects in learning. The instructor designs the necessary learning materials for learning purposes. Instead of just posting the materials on the platform for the learners' consumption, the instructor socially conveys the material to the learners. In this way, a socially constructivist approach to teaching and learning is encouraged. Of relative importance is the recognition that there is need for the instructor to assess progress in students' learning.

This framework considers the learning aspect from a pedagogic view of traditional learning, which cannot be replaced by either e-learning or m-learning. Learning is only complete if there is well designed curriculum that the instructor manages. And if the students are willing to partake in the learning activities initiated by the instructor. However, it is very critical to note that not all

the pedagogic activities can be simulated in mobile learning. However, the best framework is the one that tries to implement such a concept in mobile learning.

**Social Environment:** For effective learning to occur, there must be interaction among students and instructors. A mobile learner cannot effectively learn in isolation. The human figures in the framework represents the need for a mobile learner to interact with others to achieve the learning outcomes desired. Also, in the social environment are connected technological devices, which enhance and support the learning process. This framework realises that learners can learn more from technology and the internet if used properly.

Components like websites, blogs and other social platforms can support education and learning in higher or tertiary level education. The social environment aspect in this framework represents socially conscious learning in which Laurillard [15] viewed learning as a composition of a series of iterative conversations with the external world and its artefacts, with oneself, other learners and the lecturers thereof. In support of this Laurillard [15] argued that mobile learning can be conceived as a process of coming to know through conversations, across multiple contexts among people and personal interactive technologies. This shows the relative importance of a socially conscious environment supported by technologies in learning. A social environment is always important when learning. In fact, there is no learning without a social environment.

It is important to note that the framework is built from Koole's work [12] in which he proposed the Framework for the Rational Analysis of Mobile Education (FRAME) model. However, this model emphasized on three aspects that were ideal in defining a mobile learning situation. The three aspects were: Device aspect, Learner aspect, and Social aspect. Thus, the framework considers the technical features of mobile devices and factors in the social and learner's personal aspects of learning. However, it did not recognize the relevance of other mobile technologies involved in delivering and supporting mobile learning. The focus was on the device and its characteristics. There is no focus on the network technology independent of the device and associated cost–to the learner–of acquiring such services thereof as discussed above in this framework. Also the model did not recognize the importance of the learning aspects. Pedagogic activities that make learning formal and organized were not involved as part of mobile learning.

However, in a perfect learning environment, pedagogic activities are one of the most important aspect to consider. Mobile learning in this context builds up on traditional learning. It supports rather than replaces traditional learning. That is, the teacher/instructor is equally important in mobile learning as in traditional learning. The framework also borrows from [17] that proposed a model for developing m-learning applications, which appreciated the importance of network technology in mobile learning.

### 3.2 Definition of M-Learning Based on 2M-LS Framework

In the framework above, the intersection of all the three components (Mobile learner (M), Mobile technology (M) and Learning aspect (L) in a Social environment (S)) represents an ideal situation for mobile learning. For mobile learning to exist, a mobile learner must have related mobile technologies and learning material, which is accessible using the mobile devices. However, for effective learning to happen, there is need for collaboration and conversation.

In defining mobile learning, all the aspects of traditional learning and mobility are very important. There is need to realise that in traditional learning, a learner must be involved in a dialogue with the instructor, the learner must be able to socialise with other learners and the instructor must be able to assess the progress made by the learner [15]. All relevant pedagogic activities involved in learning must be met.

Therefore, having looked at the framework for defining m-learning with all its components, an inclusive definition for m-learning can be defined as follows:

*M-learning is learning that involves mobility (mobile learners and mobile technology (2M)), that involves the learning aspects (L) and the social environment (S), and is built up on a traditional learning where conversation and collaboration across multiple learners/instructors is done with use of technologies.*

Therefore, mobile learning can be viewed as a new era in learning realising the technologies involved in learning.

## 4 Implementation Design of M-Learning Framework

This section examines an implementation design of the framework for M-learning proposed in section 3.1. Figure 5 describes the components that should be included in the implementation of the proposed framework. As earlier discussed, mobile learning cannot fully replace e-learning. Thus, mobile learning also borrows heavily from e-learning. In the design, there will be e-learning database, custom tables, primary and secondary database clusters, and a load balancer. These components are discussed below**:**

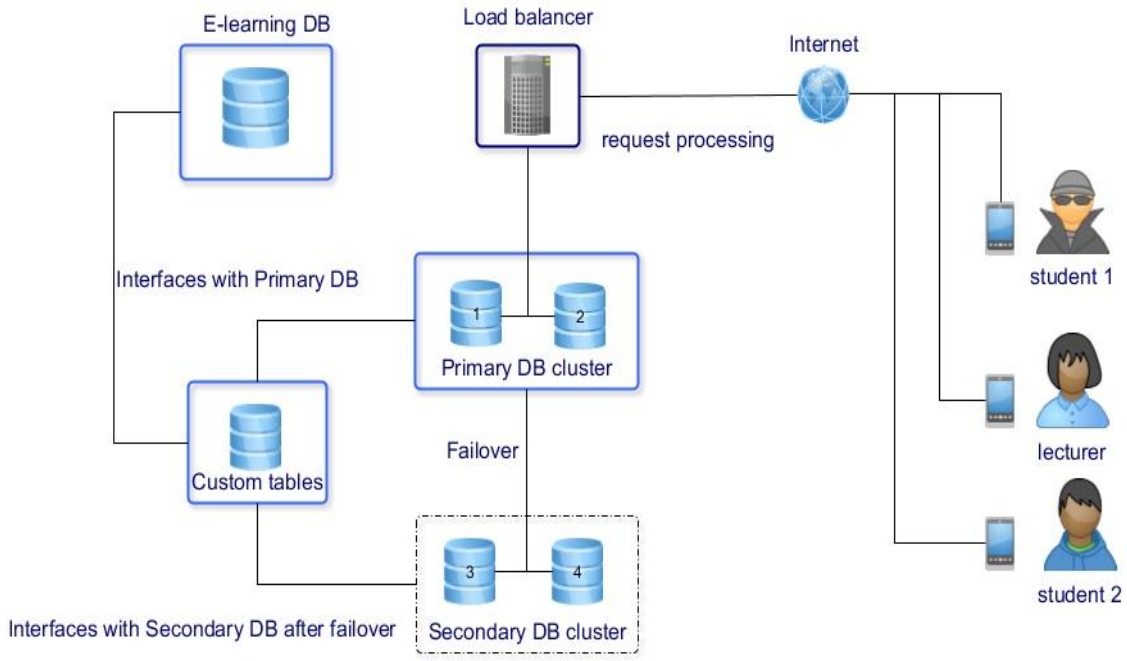


**Figure 5: Implementation scheme of 2M-LS framework for m-learning**

**E-learning database:** This component is important for mobile learning. It will maintain consistency of learning throughout the learner's cycle of learning. This database is used to implement e-learning.

**Custom tables:** these tables come in as an interface database between the mobile learning databases and the e-learning database. This is to increase overall performance of the whole system. The custom tables will be in sync with the e-learning database to facilitate database updates when the e-learning database is not busy. The custom tables will also stay in synchronization with the primary databases in the primary cluster. Updates will only occur when the primary databases are not busy. The custom tables act as an intermediary database between the primary m-learning database and the e-learning database.

**Primary and secondary database clusters:** The primary databases in the primary cluster will remain in use until either one of the database is down. Whenever a single database in the primary cluster is down, a switchover to secondary databases in the secondary cluster occurs. This is technically known as failover.

**Load balancer:** The load balancer is a critical component to address the problem of response effectiveness. It acts as the first point of conduct for a request sent from a mobile device. When a request is sent by either a student or lecturer, it is first received by a load balancer. The load balancer then decides which database in the active cluster (primary database cluster or secondary database cluster) to push the request depending on the type of the request. If the request is a data manipulation request such as an insertion statement (initiated by a user who is uploading an assignment, or a lecturer posting notes onto the platform), the request is handled by a less busy database in the active cluster. If the request is a data accessing request such as a select statement (initiated by a user trying to download notes from the mobile platform), the request is handled by a currently updated database in the primary cluster.

In this implementation design, two main issues have been taken into account in coming up with the design scheme. The issues of concern are:

- Availability of the m-learning platform, and
- Response time of the system in processing a user request.

It is important to recognise when a mobile learner wants to use a mobile application for academic purposes, it should not be generally slower in terms of response time. A load balancer is proposed as a major component to handle requests in a logical manner, which increases system performance. However, as discussed in the section of related work, mobile applications for learning purposes should be highly available when required. To increase availability of the mobile learning

platform, the mobile learning implementation design should implement failover which has been discussed above. Thus, when either of the databases in the primary cluster are unavailable, the system should automatically switch over to the secondary cluster. All transactions will thus be handled by the database systems in the secondary database cluster.

## 4 SUMMARY AND CONCLUSIONS

In this paper, it has been highlighted that the existence of no clear definitions for m-learning makes it difficult to implement mobile learning (m-learning) platforms in higher and tertiary institutions. There is a lack of a complete understanding of how the concept of m-learning can be defined. M-learning is explained from different aspects, activities and learning environments. However, an inclusive definition of m-learning is envisaged. In this work, a 2M-LS framework for m-learning for tertiary education is proposed based on the work previously done by some researchers. An inclusive definition of m-learning is then suggested based on the 2M-LS framework for m-learning. The implementation design for the m-learning framework is also provided. It has been reflected that defining m-learning is one step towards building a solid understanding of the requirements for mobile learning systems in tertiary education. The future work is to implement and test the 2M-LS framework for m-learning on tertiary institutions.

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