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Analysis of M-Learning Technologies and Approaches: A Survey

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Abstract

In this digital era, Mobile phones have taken over various aspects of our lives. Irrespective of the age group, the smartphone ownership is growing rapidly and this rapid growth has paved a way to utilize Mobile phones in our educational system as well. M-Learning platforms these days have exhibited a histrionic withdrawal from old-fashioned computing stages. M-Learning is an upcoming pedagogy which is being largely explored by various institutions to take education system to the next level. This article analyses various research works and identifies several advantages for utilizing these innovative pedagogies effectively via a survey oriented approach. The result of the comparative study identifies the rewards as well as the challenges of numerous M-learning platforms for the maximum utilization to boost the global teaching and learning skill. Moving in to M-learning will definitely make learning more innovative and interactive both in terms of students and teacher's perspective. The various approaches, technologies used and specific applications of M-Learning process have been analysed in this work. Finally, it concludes the best suitable approach and technology is identified for teaching and learning process.

Keywords: M-Learning, pedagogy, Mobile Applications, Educational Environment.

1. Introduction

With the advent of internet and computers the entire education field has seen a remarkable make over in the few decades. Now a days, we are living in an era where anyone can learn anywhere at any time. Every latest information is available at the click of a button to the netizens. M-Learning is a new awareness in our education field these days. M-Learning is the most modern mode for teaching and learning and depends on portable devices like iPod, iPad, Tablets or smartphones [1]. Mobile applications (Mobile apps) can be defined as "software applications that are made for mobile phone operating systems that increase the capabilities of the cell phone by allowing users to do specific tasks" [2]. As rightly said by Y. Mehdipour et al. tutoring is a educating procedure by which knowledge in addition to skills are transported on from one generation to the other[3]. Mobile devices are basically used to enhance communication between people. There is an intimate relationship between communication and education. Peer to peer mobile communication leads to learning [4]. The devices used for Mobile learning can be mobile phones, iPad, tablets, netbooks or even handheld PC. Ease of use offered by these mobile devices contributes to life-long learning [5].

The tremendous change that happens in technology has a proportionate effect on education as well. Before the advent of M-Learning, E-learning was a boon to people who were doing distance education [6]. We are now living in an age, where learners learn not my listening but by doing. The internet and various other simulation technologies have rendered learning with authentic learning experience [7]. The main purpose of this survey paper is to provide a better understanding of Mobile learning in adult education. In section 2, we differentiate

M-Learning from U-Learning & E-Learning. In section 3, we discuss about the benefits of M-learning. In section 4, we identify the various areas of application of M-Learning. In the section 5, we identify few research papers in which we study how this new M-Learning technology is helpful from a teacher's perspective. The section 6 discusses about various research work on M-learning from student's perspective. Finally, we summarize various research works done in M-Learning and tabulate the same with the results.

2. M-Learning Vs E-Learning Vs U-Learning

There are some different versions of Learning, in which the "E" in E-Learning is "electronic". So, E-Learning is a method of education that is done with the help of electronic devices through medium like the Internet. However, learning can also be delivered via the Intranet/Extranet networks. The "M" in M-Learning is "mobile". So, M-Learning is any form of knowledge that is given using hand-held and portable devices. The "U" in U-Learning is "ubiquitous". So, U-Learning is an integration of M-Learning into E-Learning.

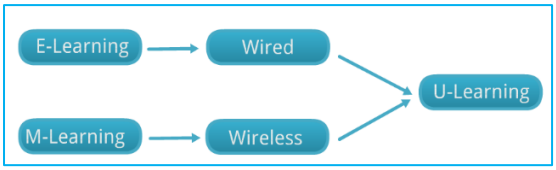

Figure 1: Types of Learning

3. Benefits of M- Learning

As we are all aware, the portability of the computing or mobile devices that are coupled to a wireless network definitely pave way for the idea of mobility and mobile learning. The flexibility gives teaching and learning go beyond the classroom thereby providing wide range of opportunities [8]. Some benefits of mobile learning are listed below:

- M-Learning can be done at any time and any place and the accessibility to the learning content is always there.
- M-learning is a student- centric learning pedagogy that promotes self-centred learning.
- Mobile learning gives a great flexibility of just on time review of contents and accessibility.
- The Teacher and the student can work together in synchronous or asynchronous communication system.
- It's a great opportunity for students to continue to learn on the move as well and promotes active learning.

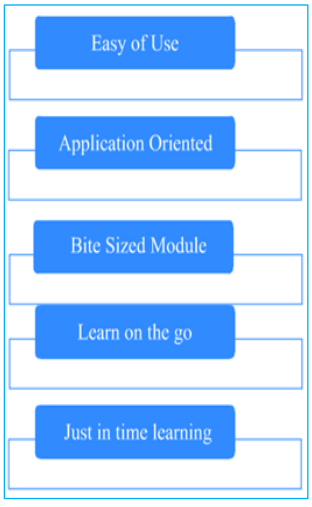

Figure 2: Benefits of M-Learning

4. Application areas of M-Learning

M-Learning can be implemented in various domains. Science discipline has always been in forefront of utilizing this technology. M-learning can be implemented with bite sized micro lessons for performance support tool Language learning is one area where this idea can be implemented for maximum benefit. The reason behind this is Language learning is a lifelong process. Sometimes there are many compelling situations in which people

are forced to learn a new language. For instance, learning Spanish or Mandarin as an optional language in Indonesia [9]. The other discipline aligned with Mobile learning is Medicine. Mobile learning can help individuals study the aids desired to check and manage their disorder on a personal level, to communicate with other diabetes patients, and to connect with professionals and peers [10].

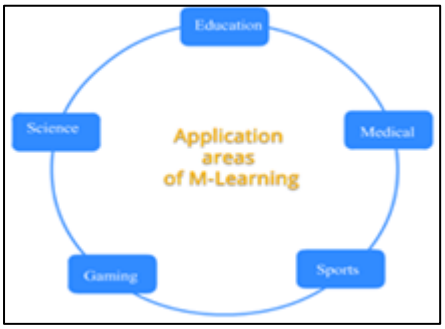

Figure 3: Applications of M- learning

5. M-Learning from Teacher's Perspective

Various research papers have been published so far in showcasing Mobile Learning as a pedagogy from teacher's perspective. This section discusses about several research work done on this innovative teaching. Kearney et al. present three key features of M-Learning namely authenticity, collaboration and personalisation [11]. A basic framework with distinguishing, existing socio-cultural features of mobile teaching had developed from their strategy and growth procedures, along with the project activities. The authenticity feature showcases good opportunities for contextualised, involved, positioned learning; the collaboration feature identifies the often-reported casual, associated aspects of m-learning while the personalisation feature has strong impact for possession and independent learning.

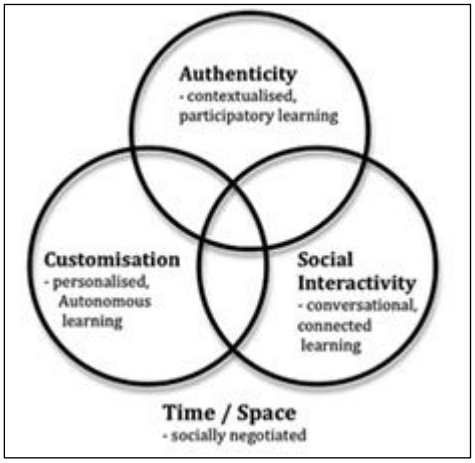

Figure 4: Framework presented at mLearn 2010

While majority of research had focussed M-learning from student's perspective Evrim Baran's work explored the possible potential of Mobile learning from teacher's development [12]. This review dealt with 37 research papers on mobile learning and teacher education. The findings clearly showed mobile learning beneficial in teacher education system as well. Diverse means for mobile learning incorporation into education can be studied, such as the infusion in practical, new courses and through the teacher education program. The impact of M-Learning is also associated with the challenges in implementing the same and the phases of teacher education along with the role of mobile learning in that domain. He concludes his work telling that as teachers realize the need for mobile learning in education, they play a vital role in integrating portable devices like mobiles across various domains. In yet another interesting research work by David De Jong et al. says that mobile technology is moving from an idea to reality. He says that there is a large number of increases in the users of mobile phone at student level itself these days. This technological invention can have a larger impact in the field of education. He concludes by saying that Educators should gradually start to substitute the newest technology for older tools like chalk and talk and redefine their approach and should be mentors to students in using the technology effectively [13].

T.C. Liu et al. research work aims in designing a Wireless Technology Enhanced Classroom (WiTEC) which aids in seamless activities in the classroom. This technology not only helps in engaging students in learning activities but also help empowering teacher to monitor the status of learning. He concludes his article saying that developing effective guideline for appropriate implementation is the key for WiTEC to be successful [14]. The research paper by Nathaniel Samuel et al. [15] had conducted a study using survey method in which 4 research question was raised and answered. The findings revealed that the lecturers had a positive perception towards the usefulness, ease of use and adequacy of use of mobile technology in teaching. A research work by Seppälä et al, mainly focusses on teacher training. The usage of mobile devices to send SMS and to share pictures between the supervisor and student was studied in this research and it was found to be very successful [16]. The perception of teachers towards mobile learning in Malaysia has been studied by Yusri et al. It was found that overall the perception towards M-learning was good among teachers [17]. But the study revealed that the teachers who teach ICT were not comfortable with this invent when compared to other science, maths or other subjects.

A research study conducted in Hongkong also showed positive feedback on mobile based teaching and learning [18]. A total of 61 students were involved in this research. The research group was given a WhatsApp group which was used by both the students and teachers after the working hours. The questionnaire was given to all the participants at the end of the research work and it showed positive perception and acceptance of use of WhatsApp groups. Research work done by Elias et al, identifies the components of m-education along with identifying the various universities that employ and promote m-learning. The authors reiterate that mobile education cannot replace the traditional approach of teaching and learning but can facilitate teaching, learning in an interactive environment [19]. Uzunboylu et al. studied on the perception of teachers in m-learning in Cyprus. 467 teachers from 32 different schools were surveyed. The final results concluded that teachers showed above medium level of perception towards m-learning [20].

6. M-Learning from Learner's Perspective

In this section of the paper, we are going to highlight few of the research work carried out by people from across the globe, which explains the impact of M-learning from a student's or a learner's perspective. In the collection, O. Zawachi et al, reviews a book which talks about how mobile technology can be used in various distance education programs and also explains about the best practises of mobile learning [21]. In a survey conducted to identify the use of mobile phones, the author Poulova et al, divides the mobile phone users in two categories, Digital natives and digital immigrants. Digital natives are people who grow up with technology and are comfortable with the usage. Digital immigrants who find it difficult to use and adapt to new technology. A questionnaire was distributed to both these groups and the results concluded that people prefer to use Smartphones rather than laptops or desktop PC [22].

The barriers to the usage of smartphone among adult learners was identified by Hazwani et al. Interviews were conducted with the participants and it was identified that the elderly people found it difficult to use mobile phone for learning due to various reasons like age, vision, interest and so on [23]. Another research work done by Herrington et al, which is a chapter in the e-book also designed a new pedagogy project using mobile technology. The approach proved not only innovative but also helped in creating knowledgeable and confident mobile users among both teachers and learners [24]. Research work by Jeanne Lam et al, analyses the birth and progress of mobile education and identifies the readiness of using this technology among students [25]. It was concluded that the latest mobile technology is matured to support M-Learning. The research further says that M-Learning increases the interaction and the association between students and teacher. The paper also suggests when M-learning is implemented as a new option to student's adequate safety and patent problems need to be considered carefully. Most Universities in US offer internet courses these days. Peak discusses about Technology Adoption Model with the adoption and acceptance of the latest technologies in learning. An interesting model named Lazy User Model was also proposed in which the user takes the least effort to get great results [26].

The meta data analysis by Sung et al. included 48 peer reviewed journal articles and other doctoral dissertations which has also proved that mobile computer supported collaborative learning yielded favourable results with a remarkable improvement in teaching and learning environment. The result also provides implications for future research and practises to make M-learning an effective tool [27]. Heis et al. study reveals that adult learners are increasingly seeking to learn about how to use smartphones and tablets [28]. The research also says that in Brazil, the Federal University offers a course to older people named as Techmovl: Mobile technology for elderly. The research work stated that many adult learners enrolled in the course to get to know about the latest technology and to learn the usage of the same for better interaction with the society. Clough et al. research work discusses about how the portable devices pay way for increased interested in informal learning among college students [29]. The article says that these unceremonious learning happenings form a basis for scheming an outline that can be stretched to pave way for development in mobile technology

and increase in the relaxed students as well. Different types of life long education is given for elderly people in various parts of the world. Serbia is not an exception. A survey has been conducted among 347 adult learners. Most frequent fields of interest for these learners were identified as computer science and language lessons. Most of applicants, 291 of them, have mobile device, but the broadband at home is often way to access the internet, then mobile access. From the statistics about the rate and kinds of the mobile activities, it can be concluded that even elderly people in Serbia have opportunity to develop their digital literacy in the purpose of adult education [30]. The table 1 shows the summary of all the papers discussed with its objective, methodology and the outcome of the research works.

Table 1: Results Comparison

Paper Id	Author Name	Purpose of Study	Methodology of Study (Survey, case study etc)	Research Outcome
[13]	David De Jong et al.	Elementary and secondary school teacher's perception of mobile technology in classroom.	Qualitative (Review)	The survey results showed that the teacher's impression was positive about the usage and supported the utilization of mobile technology in the classroom.
[11]	Kearney Matthew et al.	The purpose of this research is to demonstrate how the framework can highlight important aspects of learning and pedagogy	Pedagogy Framework Analysis	A pedagogical framework was concluded the role of teachers and the learning task design are crucial factors in implementing this pedagogy.
[15]	Nathaniel Samuel et al.	This paper explored the university lecturers' perceived usefulness, user friendliness and capability of usage of smartphone technologies in South-west, Nigeria.	Quantitative (Questionnaire)	The study revealed that the mobile technologies are vital tools in helping academic research for publication in this era that newer technologies are rapidly evolving.
[18]	Simon So	The study was conducted to identify the use of Mobile Instant Messaging (MIM) to support teaching and learning in ICT course.	Quantitative (Questionnaire)	The participants exhibited positive insight and supported the use of WhatsApp for coaching and learning and also made in clear its usage outside school hours didn't disturb their personal lives.
[12]	Baran E	The study was carried out to identify how mobile technology can be used to develop the potential within teacher.	Quantitative (Questionnaire)	There are various findings from this research work which shows increase in willingness to integrate mobile devices into teacher education settings.
[19]	Elias et al.	This research focusses on Wireless E-Learning and Communication Environment (WELCOME)	Mixed-method (Holistic single-case study and descriptive statistics)	The study clearly revealed that learning has moved to an informal level and mobile education can be incorporated in institutions but with certain restrictions.
[22]	Petra Poulová et al.	The purpose of this study was to explore the issue of user preference between digital natives and digital immigrants.	Quantitative (Questionnaire)	The results reveal that the users prefer smartphone when compared to PC or laptops.
[14]	Liu et al.	This study intents to design a technology supported classroom that helps everyday activities unobtrusively and seamlessly in classroom contexts.	Qualitative (case study)	It shows that the technology supported classrooms permits the educator and the learners to focus on training instead of spending too much time and energy on unwanted tedious tasks.
[20]	H. Uzunboylu et al.	The teacher's perception of m-learning in Cyprus was studied in this research work.	Quantitative (questionnaires)	According to the result of the study, tutors showed more support towards m-learning.
[16]	Seppälä, P et al.	The idea of the pilot was that the supervising teacher and trainee students could discus and share their ideas about teaching methods through the mobile device and use of a short message service (SMS)	Mixed Method (questionnaires, open ended questions, focus group discussions)	The research work showed that the informative use of smartphones and the educational prospects of mobile learning are worth further researching and testing.
[17]	Yusri et al.	This research examined the awareness of teachers in Indonesia of m-learning to determine their willingness to involve in using m-education for training.	Quantitative (questionnaires)	The outcomes display that educators in Indonesia had optimistic observation of mobile learning and were looking frontward to participate in mobile learning.
[21]	Olaf Zawacki-	This article talks about how	(Qualitative)	The author says that the challenges

	Richter	mobile technology can be used in various distance education programs and also explains about the best practises of mobile learning	Case Study	for teachers and organizations to advance learning materials for mobile devices and to integrate them into mainstream delivery is more.
[25]	Lam Jeanne et al.	This paper aims to identify the growth of m-learning and to find out the educational trends and willingness to use mobile technologies so that some practices could be encouraged to enhance learning experience.	Qualitative/interpretive (Interviews analysis)	It's found that Mobile-Learning is now supposed as an extension of E-learning that helps students learn anywhere and anytime.
[23]	H. M. Mohadisdudis et al.	This paper reviews on the barriers to mobile phone usage among the elderly and adult learners.	Qualitative (Semi Structured Interview Method)	Outcomes reveal that the aged people have hitches in using smartphones due to various explanations such as vision difficulties, finance etc.
[26]	Peak et al	This research work discusses about the adoption and acceptance of internet course in various institutions.	Quantitative (questionnaires)	Interestingly most of the tutors was found to be precisely technical persons and were good at handling even advanced mobile phone devices. The internet has become a boon to enhance the usage of mobile devices by students.
[24]	Herrington Jan et al.	The research endeavoured to take a pioneering method not only in the making of new, approaches for mobile devices but also in the action learning approach adopted for the proficient growth of students.	Mixed Method (questionnaires, open ended questions, focus group discussions)	It was a great and determined mission that lead to not only in a new range of pedagogy, but also made of more educated and self-assured workers of mobile technologies among teachers and students.
[27]	Sung Yao-Ting et al.	The research work analysed the 48 peer reviewed articles of collaborative learning	Quantitative (questionnaires)	The results revealed the use of functionalities of mobile devices in education domain by both students and teachers.
[29]	Clough et al.	The focus of this study is to measure the usage of mobile phones for informal learning by adults.	Quantitative (questionnaires)	An outline of learning pattern framework developed, some of which deployed the smartphone abilities fairly unaffected, others triggered revisions to typical learning pedagogy to provide a better fit to the needs of the learner.
[30]	Slavkovic Nikola et al.	To identify the possibility of adult learner's participation in long -life learning education using Mobile education.	Quantitative (Questionnaire)	The authors concluded that elderly people in Serbia have prospect to progress their digital knowledge in the drive of adult education.
[28]	Edimara Heis et al.	To map elderly people who started to use technology for learning in adult education.	Qualitative and quantitative case study	There is a steep increase in usage of mobile phones by elderly people these days. Educational domains should be aware of these changes and should design teaching strategies that can help these elderly people to use the latest technology.

From table 1, it is observed that M-learning will pave the way for collaborative teaching and learning experience for the coming generations. It is also observed that the scholastic people need to exploit on these prospects and build a future for mobile education to felicitate learning for all.

7. Conclusion

The future of mobile learning (m-learning) beholds lots of new avenues for various pedagogies that will enhance the teaching and learning process of the coming generations. Whatever advances come in technology or in training, mobility feature of m-learning will exhibit a very significant role in the all-time learning method. Previously research works recommends that expertise such as smartphones, portable devices, tabs, iPad and other electronic gadgets can effectively be employed both in and out of the teaching space to accomplish a diversity of learning results, while permitting students to take advantage of flexibility and personalized learning experience. If the educationalists are proficient to use this supporting technology then the learning process becomes more fluid, adaptive, collaborative and exploratory. While M-Learning unlocks new ways for enhancement, it will continue to get more intricate in the coming years. Based on the recent developments,

researchers predict technological advances and mobile learning will get attention on various domains and that which will open doors for more research and development in near future.

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