

A Critical Review on M-learning for Generation Z

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Abstract

Mobile technology has become an essential part of education as it showed its effectiveness in the teaching and learning process. The need for flexibility in teaching and learning has resulted in the shifting paradigm from the traditional methods of teaching towards m-learning. M-learning is a methodology for teaching and learning that uses mobile devices equipped with wireless connectivity, which offers the user to learn anytime and anywhere. Presently, state-of-the-art mobile technologies usage dramatically in high demand and almost dominated our lives in communication, socializing, and learning, especially among the young generation, generation Z. As a result, it is important to improve the attractiveness of the user interface (UI) elements in m-learning application to prevent distraction among generation Z towards m-learning. Therefore, the purpose of this paper is to deliver a critical review of the trend of the m-learning frameworks and models, generation Z characteristics, the teaching and learning strategies based on generation Z's characteristics, benefits, issues, and challenges. Hence, it may become comprehensive guidance for the policymakers, academicians, and researchers in this field who intend to adopt m-learning into the educational program.

Keywords: mobile technology, m-learning, generation Z, user interface.

INTRODUCTION

The adoption of advanced technology in the current century is playing an essential role in daily routine for individuals, school institutions, organizations, governments, industries, etc. For instance, the rapid development of electronic communication and smart devices has improved the platform of teaching and learning in the education field especially for learners, teachers, instructors, lecturers, and administrators. Before the era's 90s, our educational system was conducted based on the traditional method which is known as "face-to-face" learning, which involved the interaction during the class period or in classroom learning. In the era of globalization, the great collaboration of traditional classrooms and advanced technology has triggered the development of electronic learning (e-learning) that contributes to the effectiveness of an educational system for the time being.

As e-learning continues to develop, the user's expectations are high. Therefore, the striking features of e-learning and the advance of mobile technology are leading to a revolution in mobile learning (m-learning). According to Chee et al. (2017), m-learning is a form of learning that integrates its use of mobile devices such as smart phones and tablet devices. Nowadays, to learn, some learners don't have a computer at home but prefer mobile-ready learning since most of them owned smartphone devices. Mobile technology has become an essential part of education as it showed its effectiveness in the teaching and learning process, and become a trend in current education. The need for flexibility in teaching and learning has resulted in the shifting paradigm from the traditional methods of teaching towards m-learning. M-learning is a methodology for teaching and learning that uses mobile devices equipped with wireless connectivity, which offers the user to learn anytime and anywhere. Apart from that, as pointed by (Alhajri, 2016), m-learning allows us to change current learning strategies so that students can have a much more open approach to managing their learning experiences. As mentioned by Khadim (2018), as technology becomes mainstream, the effectiveness of learning will increase and the cost of training will be reduced. Due to the m-learning offers a viable method of solving several long-standing academic problems, emerging technologies and tools have paved the way for learning that can take advantage of the power, speed, and ubiquity of digital capacity. Presently, state-of-the-art mobile technologies usage dramatically in high demand and almost dominated our lives in communication, socializing, and learning, especially among the young generation.

The young generation especially generation Z is a cohort born between the year 1995 – 2012, and mostly known as “Digital Natives”, “Me Generation”, and “Generation N” (Salleh et al., 2017). This generation is the first generation to be born and grown with ready-to-use technology and a high-tech environment that differentiate their outlook from the previous generations. According to (Salleh et al., 2017; Singh, 2014; Wahab et al., 2018) generation Z is tech-savvy, social media users, prefer visual form, low attention time, prefer more entertainment, highly connected, etc. For educational purposes, generation Z commonly used m-learning platforms and they prefer the easy-to-use aspect rather than being trapped in a complicated teaching and learning process. Besides, the most influential factors that distract their attitudes towards the m-learning system are the attractiveness of system interfaces or platform applications. The efficiency and effectiveness of system or application functional requirements are the keys to how the system is rated. As a result, it is important to improve the attractiveness of the user interface (UI) elements in m-learning applications to prevent distraction among generation Z towards m-learning.

Therefore, the purpose of this paper is to deliver a critical review on the trend of the m-learning frameworks and models, generation Z characteristics, the teaching and learning strategies based on generation Z's characteristics, benefits, issues, and challenges. Hence, it may become comprehensive guidance for the policymakers, academicians, and researchers in this field who intend to adopt m-learning into the educational program.

LITERATURE REVIEW

M-learning Definition

The growth of mobile technologies leads to the rapid growth of m-learning, especially in the education field. However, there are various versions of definitions were provided by researchers. Traxler (2005) in his study mentioned that m-learning can be described as provision for learning in which handheld and/or palm equipment is the primary or dominant technology. Whereas, there is a definition of m-learning defined as utilising digital device to learn in a variety of scenarios via digital media platforms interactions (Crompton & Traxler, 2015; Crompton, 2013).

Besides, (Mastura et al., 2012; O' Malley et al., 2005) stated that m-learning is any form of learning that takes place when the learner is not in a fixed, specified location or when the learner takes advantage of the learning materials offered by mobile technologies. According to Ghirardini (2011), m-learning is an e-learning that is facilitated by portable devices such as smartphones, laptop, and personal digital assistants (PDAs). Whereas Behera (2013) defined that m-learning as an extension of e-learning as illustrated in Figure 1 and Figure 2, but effective m-learning, on the other hand, can only be delivered if the constraints and capabilities of mobile devices are acknowledged. M-learning signifies to using mobile with network connectivity for learning purposes in the middle of nowhere.

As pointed by Lee et al. (2014) mentioned that m-learning, is one of the most useful methods in e-learning as it is available from almost anywhere. Another definition of m-learning is it is an emerging fields of e-learning attributed to the increasing need of learners, and also the developing multimedia and networking capabilities of mobile devices (Chachil et al., 2015). In a conclusion, there is no fixed definition of m-learning but the concepts are all the same which focuses on mobility and portability.

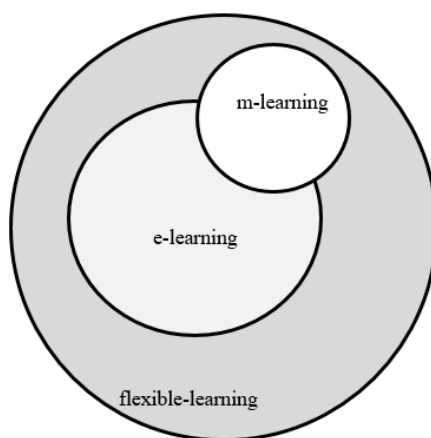


Figure 1: The relationship of e-learning, m-learning and flexible learning (Low & O'Connell, 2006)

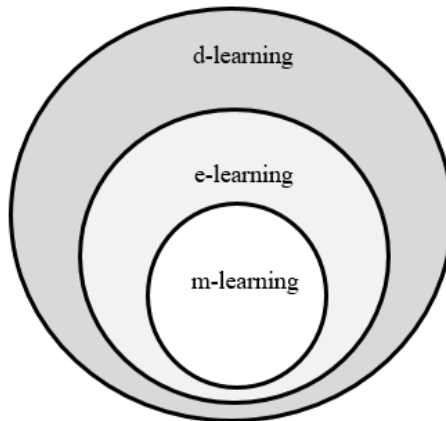


Figure 2: The perspective of learning paradigms (Georgiev, Georgieva, & Smrikarov, 2004)

M-learning Benefits

Mobile technology has developed over recent years and provides benefits among users especially in the education field. There are five ways of opportunities as well as benefits provided via m-learning (Crompton, 2013; Traxler & Wishart, 2011): (1) contingent learning, to allow learners to adapt and react to the environment and to change their experiences; (2) situated learning, in which learning takes place in the surroundings appropriate to the study; (3) authentic learning, tasks directly related to the learning goals; (4) context-aware learning, the learning process is informed by history and the environment; and (5) personalize learning, customized in terms of skills, desires, and expectations for each learner.

According to Sharples, (2013), m-learning is intended to connect learning in both formal and informal contexts, allowing classroom or laboratory work to be carried into authentic situations, or private informal learning to be utilised as a supplementary to formal education. Whereas, according to Hsu (2013), learners can participate in real activities with the help of m-learning, which motivates them to do so. Some other benefit of m-learning utilizing mobile technology is that students can receive rapid feedback. Pointed by Mohamad and Woollard (2010) stressed that m-learning also allows students to become more confident in their learning. Students would have the opportunity to explore information on their own without relying on teachers. Apart from that, portability, bite-size learning, motivation, affordability, personalisation, drill and practise, student engagement, and independent learning are all advantages of m-learning.

On the other hand, the flexibility of mobile technology also provides benefits to using m-learning in education. This is because by using m-learning, it can be used for formal as well as informal education (Ally, 2014). For example, informal learning, learners can access the course materials while they are in the class, on the move, or indeed any time they want to learn. Whereas, for an informal setting,

allows students to learn of any place at any time, and apply this knowledge instantaneously to accommodate positive learning environment. Not only in education, but m-learning can also be a benefit for the health, agriculture, and finance sector. In essence, mobile technology makes m-learning more accessible and increases learners' motivation to preserve, especially for learners with their busy schedules.

M-learning Issues and Challenges

Despite the above-mentioned benefits, many obstacles have to transcend to augment m-learning potency. Many issues arise during the early stages of m-learning research, particularly in Malaysia. As pointed by Chong et al (2011), Malaysia still has a low rate of m-learning when compared to other developed countries. Apart from that, Ariffin (2011) mentioned there is a lack of research on culture dimensions to boost m-learning and participation of university students in Malaysia. More research needs to do on the perspectives of m-learning and culture in Malaysia students' context.

Next, the readiness of students for m-learning is low, the self-efficacy of students is significant consideration just before discussing acceptance of information technology (Mahat et al., 2012). This is due to the fact that students are interpersonally creative and eager to incorporate m-learning into their lesson. Besides, according to Parhizkar et al (2012), in terms of technology and pedagogy, studying with personal computers or smartphones is still relatively new, but it is fast evolving. As a result, young primary school children need a new method of positive instruction by using mobile technology which has the potential to transform the extensive learning framework.

According to the findings of the following studies, there is a lack of a robust theoretical framework for guiding appropriate instructional design and evaluating the quality of courses that strongly focus on mobile technology (Park, 2014). Due to this issue, the classification scheme is developed to assist instructional designers and instructors in more effectively formulating and executing m-learning. This finding is supported by the finding of Chachil et al. (2015) mentioned in the study that there is an issue in the design of the features and functionality, such as the search function to allow users to find some preferred words or phrases. This is very important for linguistic educational application.

Apart from that, most M-Learning implementations were implemented unsuccessfully due to a lack of correct approach to software testing and end-user participation (Khan et al., 2016). Clearly, this shows that the effective approach needs to apply in the pedagogical and functional usability, and in the field that might impact end-user acceptance depending on the application context. According to the finding by (Alhajri, 2016), there are three types of challenges in design in implementing m-learning in the educational environment, they are instructional design, interface design, and screen design. These designs are affecting the development and implementation of m-learning to satisfy the requirements and specifications that suit the devices and also users.

Besides, lack of pedagogical consequences of the m-learning implementation when learners may seem to be ready for m-learning, but administrators and teachers may not be willing to learn Hussin et al. (2017). In essence, further study with a larger sample from similar higher learning institutions would give a better and clearer insight into the issue of the readiness to use m-learning approaches, is required. Correspondingly, similar findings have been reported in the research findings by Cochrane et al. (2017) which argued an issue occurred also because of the lack of focus from teacher-directed pedagogy to student-directed pedagogy and the framework of learning and teaching towards collaborative learning. In conclusion, this issue requires many supports and contributions from the instructional designer, learning designer, academicians, and researcher to involve in this field. This can be achieved by examining all aspects related to education and mobile technology and requires validation from the expertise related to this field.

M-learning Frameworks and Models

Framework for Mobile Learning

Framework for mobile learning is developed by Liu et al (2008) based on the research finding from the Nokia Mobiledu Project that they conducted. The framework consists of the four elements which are: (1) requirement and constraint analysis, (2) mobile learning scenario, (3) technology environment design, and (4) learner support services design. Figure 3 illustrates the framework.

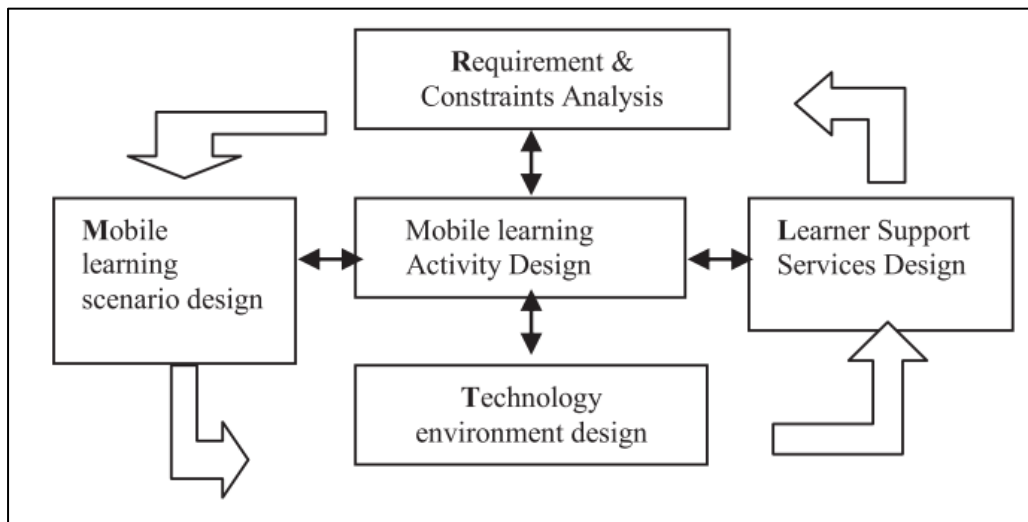


Figure 3: Framework for mobile learning

Mobile Framework for Lifelong Learning

The mobile framework for lifelong learning was developed by Nordin et al (2010) is based on the finding by Parsons et al (2007). The framework also explored similar key elements done by Parsons et al (2007), alterations have been made to fit the content’s purpose for lifelong learning. The mobile framework for lifelong learning was formulated based on four elements: (1) theorized of learning, (2) generic mobile environment, (3) mobile learning context, (4) learning experience and objectives. Figure 4 illustrates the framework.

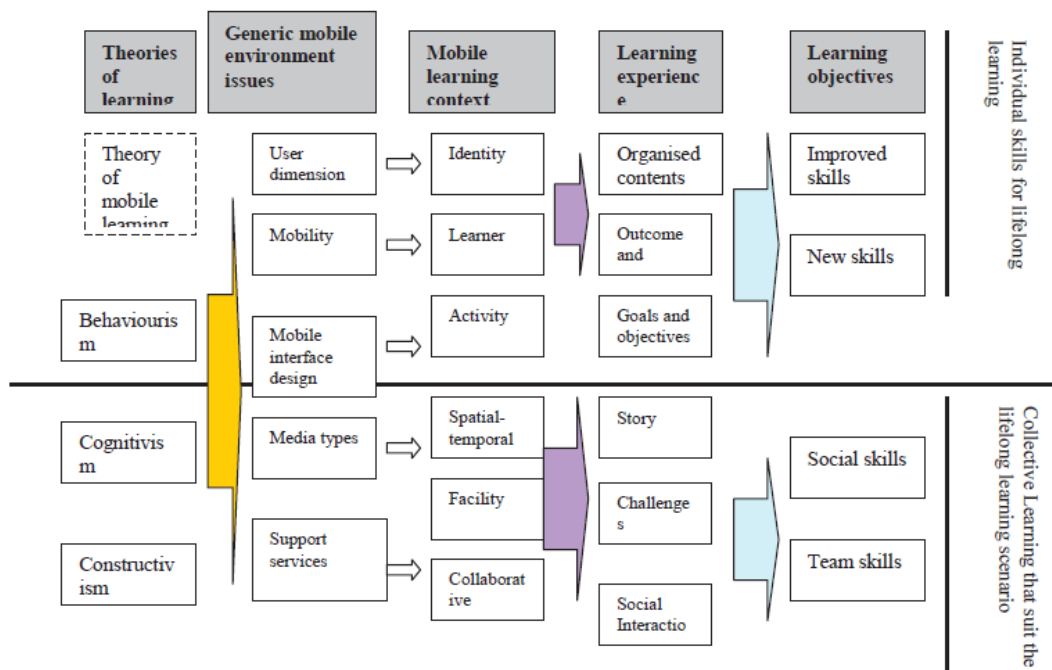


Figure 4: Mobile Framework for lifelong learning

DeLone and McLean’s Model

The research was conducted by the Udanor and Nwodoh (2010) indicates that the elements affect user satisfaction and are included in the model: Information Quality, System Quality, Perceived Value, Users’ Satisfaction, and Intention to Reuse. This same factors affect each other in an indirect way: Information Quality, User Satisfaction, System Quality, Perceived Value, and Intention to Reuse. The research attempted to resolve the recontextualize e-commerce model of DeLone & McLean’s Perceived Usefulness measure. The research is being applied in new areas such as m-learning and the up to date IS model that assists users in choosing an m-learning platform. Figure 5 illustrates the DeLone and McLean’s Model.

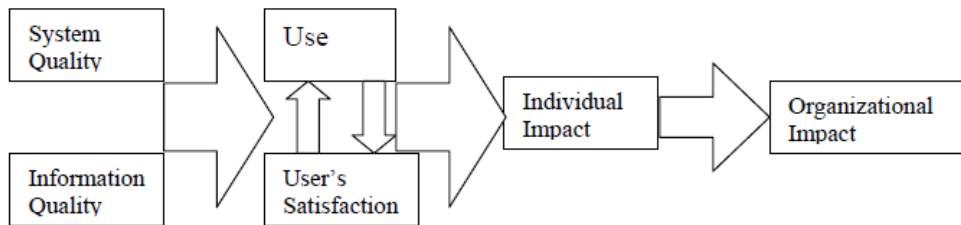


Figure 5: DeLone and McLean's model 1992

Updated DeLone and McLean's Information System (IS) Model

DeLone and McLean (1992) conducted a complete analysis on Information Systems (IS) to organize the multiplicity of variables connected with the diversity of information systems and developed the notion of the IS success model. The following research studies by Ghandour et al. (2008) supported the studies by DeLone and McLean (2003) mentioned that the new model (hence referred to as the 'updated D&M IS Success Model') found six interconnected dimensions of IS success. The quality of the content, as well as the IS's system and service, is thought to influence users' desire to use, and also their real use and satisfaction with the IS. They are more likely to use the IS if they are satisfied with it, which determines the benefits they receive. Users' desire to use, actual use, and contentment with the IS are all boosted as a result of the benefits.

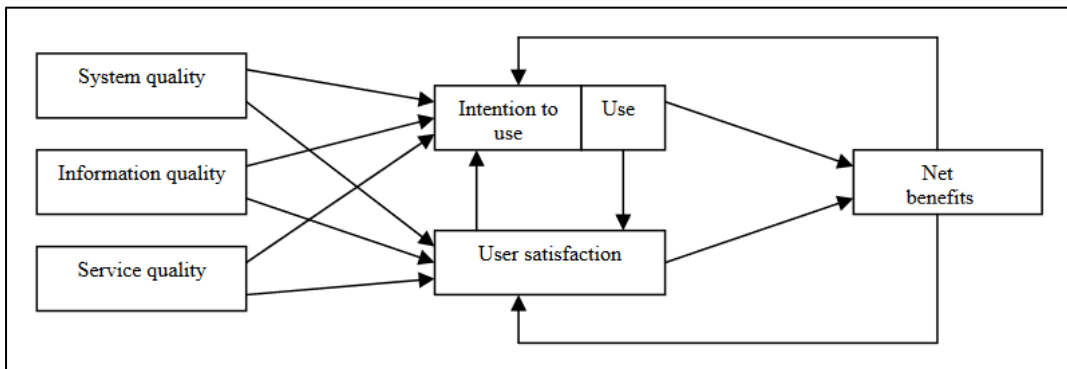


Figure 6: Updated DeLone and McLean's information system (IS) model

FRAME Model

Several studies by Koole and Ally (2006) mentioned that the FRAME model was created to better understand the mobile learning process. It was designed to teach people how to use a variety of mobile devices as remote learning tools. The FRAME model's context is information. Information can be

provided either from learner's various sources, such as personal, social, technical, or environmental stimuli. All of these elements contribute to the learning environment. The FRAME model is represented in the Venn diagram as shown in Figure 7.

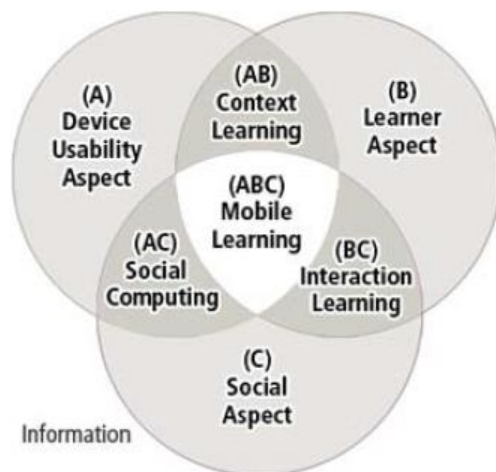


Figure 7: The FRAME model

Mlearning Integration Framework

Research has also been carried out by Crompton (2017), showed that the Mlearning integration framework is based on Bronfenbrenner (1979) Ecological Framework for Human Development which studies the circle of the development of the child by various systems. The educator is at the centre of this ecological framework, and the concentric circles represent the numerous systems which govern how well that educator incorporates technology. This comprises social ecology, or how people interact with one another, along with environmental characteristics such as the physical environment, which includes technological resources. The educator's innermost layer contains the structures with which he or she interacts directly. Educators' use of technology is influenced by their immediate surroundings, such as a school and its resources and social connections. The mesosystem depicts the interconnectivity of the educational system's structures. To put it another way, the many arrows depict how all of the elements are linked together. The school district is the exosystem. This approach is widely used to select funding for technologies and technical support workers, along with textbook and curriculum adoptions. The outer ring's macrosystem demonstrates how a country's social, religious, and cultural norms, and also standards and internet connectivity, influence technology integration. Figure 8 shows the M-learning integration framework.

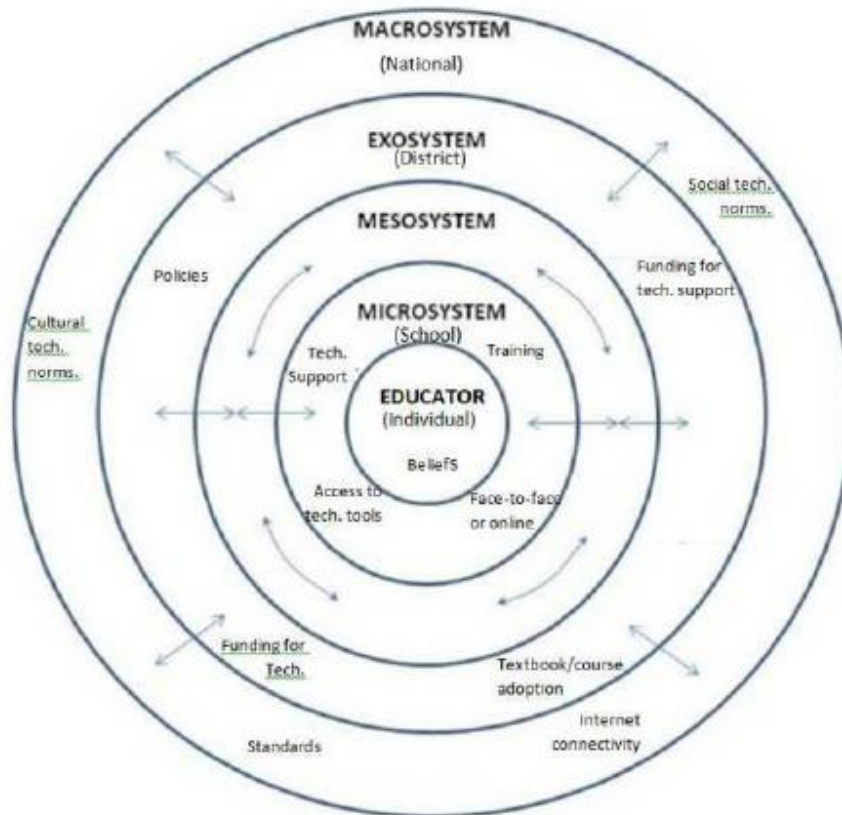


Figure 8: M-learning integration ecological framework

Mobile Learning Framework for Assessment Feedback

Another framework presented by Bikanga Ada (2018), Mobile Learning Framework for Assessment Feedback (MLFAF) is approaches and strategies in cases when students' failure to engage with their formative assessment is obvious and/or where students do not react to the evaluation they have received. Educators are frequently irritated and disillusioned by both of these concerns. MLFAF should be used to seek all the appropriate questions, gather data, critically examine what's required and what is really occurring, ultimately reflect according to what wants to improve. MLFAF could be used in any variety of mobile learning contexts. It's an excellent starting point for developing large-scale mobile learning initiatives that support long-term rather than brief formal/informal techniques. It entails making certain behaviours the standard throughout time when including them into the curriculum, rather than trying things couple of times and would then dismissing them. The MLFAF is divided into three sections: needs assessment, development/implementation, and outcomes. Figure 9 illustrates the MLFAF.

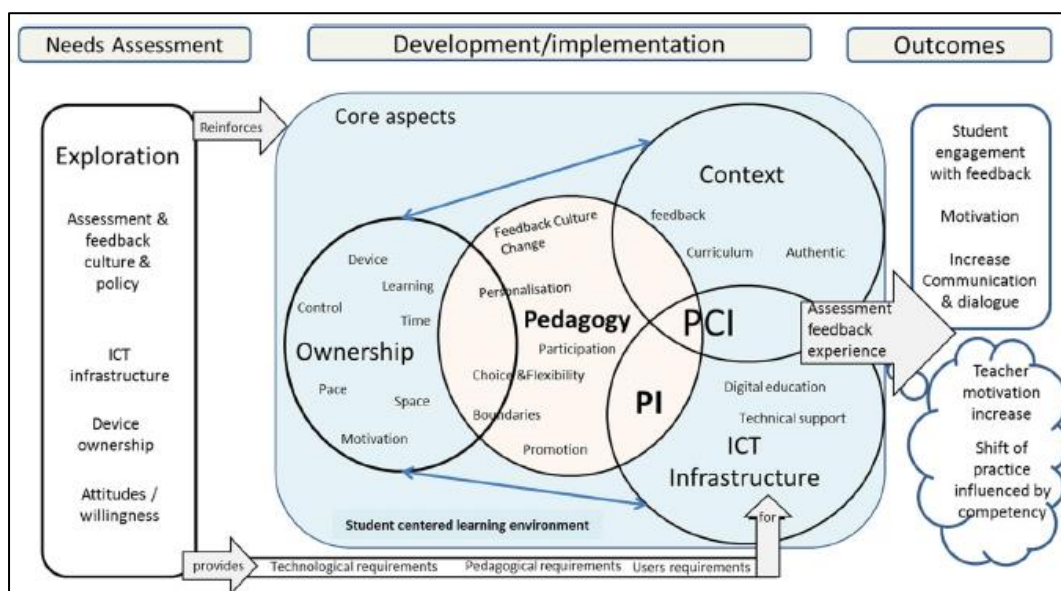


Figure 9: Mobile learning framework for assessment feedback

Mobile Learning Strategic Management Framework

The latest m-learning framework is proposed by Moya and Camacho (2021) which uses technologies to facilitate effective teaching and learning for 21st-century skills. Leaders, teachers, students, families, and community people were designated as critical stakeholders. These major pillars have been considered separately, but they are always in contact with one another. The impact of mobile learning on each of the pillars determines their roles and duties. Principals, heads of schools/faculties, school managers, administrators, and program coordinators all fall into the leader’s category. Leaders are in charge of steering the school as new cultural issues, environmental needs, resources, and expectations arise. Teachers' primary role has shifted from class leader to facilitator Bikanga Ada (2018). Teachers are responsible for both the development of learning designs and their professional development. The goal of learning design is to create educational techniques that maximize resources. SAMR, TPACK, BYOD, and the flipped classroom are examples of educational methodologies and concepts that can be adapted to mobile learning (Koole, 2009; Ng & Nicholas, 2013; Rikala, 2015). Figure 10 illustrates the framework.

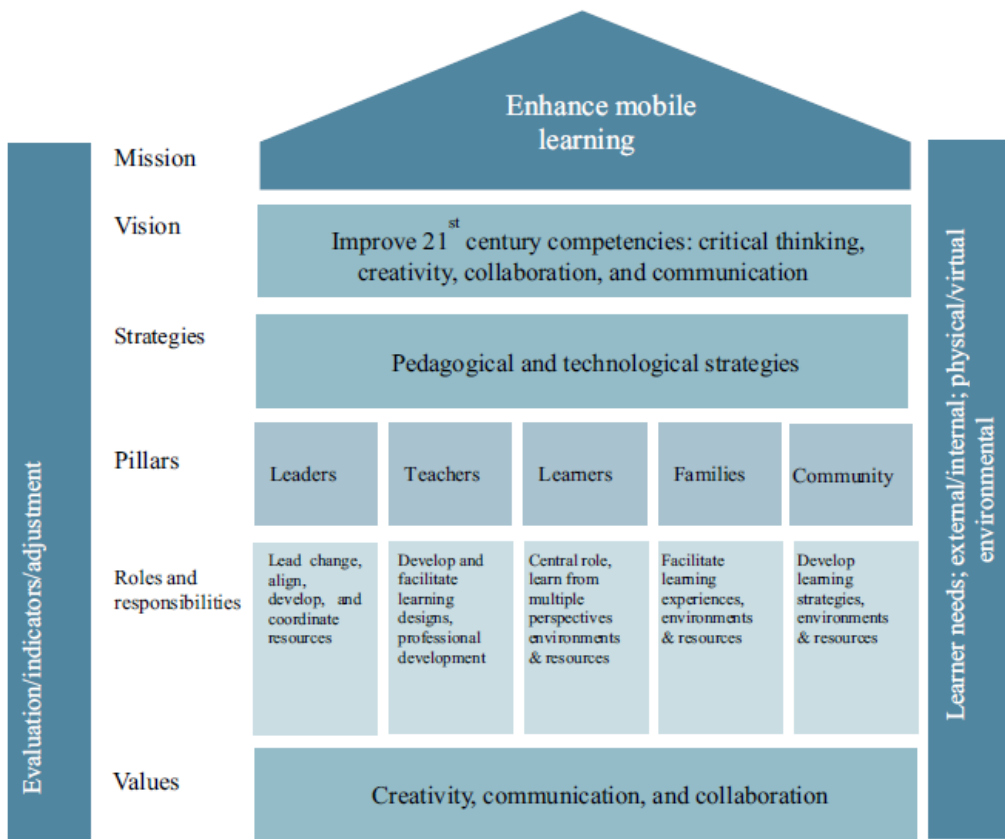


Figure 10: Mobile learning strategic management framework

Characteristics of Generation Z

Generation Z is a generation that was born between 1995-2012 and is known as “Digital Natives”, “Me Generation” and “Generation N” (Salleh et al., 2017). According to Turner (2015), Millennials are the first generation to be revealed to digital media like facebook and twitter and an abundance of information on the internet in a broad and explicit way. The study by Singh (2014) stated that this generation is different from the generation before it. Digital technology and social networking make them trendy users, productive generation, and creative. Whereas Dolot (2018) mentioned that, generation Z can conveniently access and verify the information they need. They are also sharing information with others very quickly. Communication processing is continuous among them because they use a wide range of communication devices or social networks. Table 1 shows the characteristics of generation Z. Apart from that, gen Z’s behavioral characteristics are far different from the previous generation. Table 2 shows the cohort generation.

Table 1: The characteristics of generation Z

Characteristics of Generation Z	Authors
Tech-savvy	(Singh, 2014; Wahab et al., 2018)
Prematurely mature	(Singh, 2014)
Pampered	(Singh, 2014)
Empowered	(Singh, 2014)
Risk-averse	(Singh, 2014)
Hypertext mindset	(Salleh et al., 2017)
Protected	(Salleh et al., 2017; Singh, 2014)
Lack of communication skills	(Salleh et al., 2017)
Instant gratification	(Salleh et al., 2017)
Demand fast response	(Wahab et al., 2018)
Used to social media	(Wahab et al., 2018)
Highly connected	(Wahab et al., 2018)
Prefer visual form	(Wahab et al., 2018)
Low attention time	(Wahab et al., 2018)
More entertainment	(Wahab et al., 2018)
Fast acquisition of knowledge	(Wahab et al., 2018)

Table 2: The differences cohort of generation and their dominant behavioral characteristics

Generation	Born year range	Dominant behavioral characteristics
Traditionalists	1900 – 1945	Loyal and discipline
Baby Boomers	1946 – 1964	Responsible, strong work ethics
Generation X	1965 – 1980	Independent thinker, efficient
Generation Y	1981 – 1994	More social, confident, less independent
Generation Z	1995 – 2012	Poor verbal communication skills, extensively engaged in technology
Generation Alpha	2012 – the mid-2020s	Expected to be wealthiest, most highly- educated, and technologically-connected group to date.

However, the increased use of mobile technology has more likely triggered parents' awareness and worrying trends. According to Judi et al (2013), generations Z are prone than adults to be frequent users of technology devices. The researchers found the impacts of both the advantages, challenges, and strategies to mitigate the negative impact. Table 3 shows the impact of technology device usage among generation Z, whereas, Table 4 shows the factors to overcome the issues.

Table 3: The impact of mobile technology device usage among generation Z

Positive impact	
Gain knowledge and skills	The widely used ICT enhances the generation z to retrieve the information access to gain knowledge, learn more independently without full guidance from teachers/tutors, lead to academic success and improve professional skills.
Better social skills	The users of social media help to overcome the depression issues among generation z when they are attached to social support. This aspect is useful for those who are suffering from loneliness and who are not so easily attached to people around which leads them to stay connected to others and build up self-esteem.
Be empowered	Motivate generation z through positive influencer's medium, online forum, a platform that re-exposes the traditional methods of delivering treatment interventions, improve cognitive, social, and physical development.
Negative impact	
ICT addiction	The excessive use of ICT allowed addiction issues whereas the young generation experiences uncomfortable without the presence of ICT in routine life.
Bad influence of online interaction	Uncontrolled access to ICT may lead to bad influence among the young generation. For instance, the wrong site access by the young generation is more likely to harm the mindset of the young generation and may lead to the behavior of the young generation.
Illegal, immoral	Open of freedom access without parental control and staying connected to the World Wide Web are more likely to create a backdoor for the youngster to access the harmful media and may lead to cyberbullying.

Self-detachment	The desperation and addiction to ICT usage may lead to depersonalization disorder among youngsters, which they refuse face-to-face interaction with outsiders.
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M-learning Teaching and Learning Strategies for Generation Z

One probable reason for using m-learning as a platform for learning and teaching is that the traditional approach of delivering lectures is ineffective in this 21st-century learning environment. (Wahab et al., 2018). Table 4 shows the teaching and learning strategies based on generation Z characteristics.

Table 4: M-learning teaching and learning strategies based on generation Z characteristics

Gen Z characteristics	M-learning teaching and Learning strategies
Used to social media	Interactivity - To incorporate social and community learning elements.
Highly connected	Connectivity - To be accessed anytime, at any place using the internet.
Tech-savvy	Portability and flexibility - To be accessed using a smartphone or PC.
Prefer visual form	Interactivity - To incorporate graphic images, videos, pictures.
Low attention time	Simplicity - Lectures are divided into small sections. Using only short videos.
More entertainment	Personalization - To include game-based learning.
Fast acquisition of knowledge	Simplicity - Use the essence of lecture notes, explain the key concepts.
Demand fast response	Informative - To facilitate online discussion.

Issues and Challenges of Implementing M-learning among Generation Z

Many obstacles have to transcend to augment the m-learning potency towards generation Z. A study by Haw et al (2017) mentioned that there is still an insufficient knowledge among generation Z towards the use of mobile technologies in teaching and learning. By improving the m-learning application platform and adding on the game-based learning and edutainment application, it will help to attract the attention of Generation Z, by making it more interactive and convenient to use anytime and anywhere. Apart from that, Ramachandiran and Jomhari (2018), also argued due to the chosen learning style and vernaculars, it is difficult to keep the learners among the youngsters from the digital age, especially generation Z, to engage with the teaching and learning via m-learning as they prefer much more diverse learning style. For 21st century learning, transforming the VLE into M-learning and Augmented Reality (AR) is effective and more efficient rather than a traditional learning method.

The finding by Poláková and Klímová (2019) supported the aforementioned findings, which is the data reveal that becoming a generation Z learner somehow doesn't automatically reflect a desire to use mobile applications for linguistic. This is simply due to the fact that a considerable proportion of students still prefer to learn languages in the traditional manner. Meanwhile, there is a different finding by Çetin and Halisdemir (2019) which mentioned that every generation has its own set of educational and learning qualities. The current generation learns differently than earlier generations, according to the findings, however this study also indicates, school administrators who adhere to a traditional approach to teaching seem unable to react accordingly to the diverse student characteristics.

As a consequence, educators must contribute to the diversity and distinctiveness of learning styles, as well as use a variety of learning methodologies to satisfy the requirements and expectations of today's students, especially generation Z.

CONCLUSION

This study has conducted a critical review based on existing m-learning definitions, benefits, issues, challenges. The study was also conducted by taking into consideration the existing m-learning frameworks and models from previous years until the latest years, such as Framework for mobile learning, Mobile Framework for Lifelong Learning, DeLone and McLean's model 1992, Updated DeLone and McLean IS success model, FRAME Model, Mlearning integration ecological framework, Mobile Learning Framework for Assessment Feedback, and Mobile learning strategic management framework. From the preceding discussion, it is obvious that m-learning frameworks are mostly composed of students, educators, technology, and supports. The issues and challenges, such as increasing the awareness of m-learning among generation z, are have not found the solution yet. It is suggested that future research identify the learning design and instructional design in m-learning that meet the expectations of generation Z based on their characteristics.

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