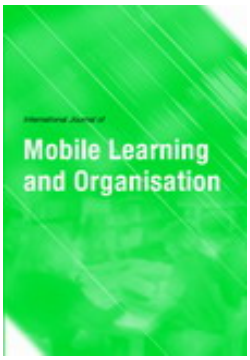

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Relationship between mobile application model and teachers' behaviour intention: evidence from emerging economy

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Relationship between mobile application model and teachers' behaviour intention: evidence from emerging economy

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Abstract: The current study applies the Gao model of a mobile application with its modified version among newly appointed teachers in Khyber Pakhtunkhwa Pakistan, through an induction program management system. For this purpose, data were collected from national testing services-based appointed teachers in District Bannu through stratified random sampling. Results were analysed through structural model assessment via AMOS. Findings revealed that context has a significant relationship with perceived usefulness and ease of use factors. In the current study, two additional features – perceived enjoyment and perceived innovativeness – have a significant relation with intention, proving that it has important attributes that were never explored. Both (perceived enjoyment and perceived innovativeness) possess significant

relation in shaping teacher behaviour for using mobile application for learning. However, perceived ease of usefulness did not have any evident relation with behaviour intention to use mobile for learning. The model of mobile applications can be better understood.

Keywords: mobile learning; Gao model of mobile application; management system; perceived enjoyment; perceived innovativeness; perceived usefulness; ease of use.

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1 Introduction

It is a fact that information communication technologies used in our daily routine are very common, and we use them for different purposes because they have become a necessity in our lives. The research work of Al-Emran et al. (2020), Almaiah and Alismaiel (2019),

Assaker (2020) and Qashou (2021), the research highlighted the use and adoption of technologies for various purposes. Information communication technologies have changed our lifestyle because of their abundant and pervasive application in our day-to-day lives, which is very common (Al-Turjman et al., 2022; Pan et al., 2020). Similarly, Gao et al. (2016) highlight the concept of mobile learning, which involves the use of new technologies such as mobile applications and other information communication technologies in our daily lives. According to Hamidi and Chavoshi (2018), the use of ICTs has become commonplace and necessary due to users' adoption. Additionally, several research studies describe the use of mobile learning for educational purposes (Al-Turjman et al., 2022; Assaker, 2020; Gao et al., 2016; Hamidi and Chavoshi, 2018; Pan et al., 2020; Qashou, 2021). Al-Rahmi et al. (2021) described mobile learning and the use of electronic learning in higher education, as well as the role of digital technology in educational formats. Mobile learning is highly beneficial in higher education because students at this level have access to digital and portable devices such as mobile phones (Assaker, 2020), laptops, and various online sources, including social media (Alam et al., 2023), which significantly influence their learning patterns.

Education is a key driver of social and economic change. However, higher education students often face issues with the coverage, relevance, and methodology of the educational process. This is where new information and communication technologies (ICT), as well as the development of applications for mobile devices, have brought about significant changes not only in education but also in other domains of society (Kalogiannakis and Papadakis, 2019). A growing number of higher education institutions have adopted tools to promote mobile learning (Al-Turjman et al., 2022; Assaker, 2020; Bernacki et al., 2020; Gao et al., 2016; Hamidi and Chavoshi, 2018; Kalogiannakis and Papadakis, 2019; Pan et al., 2020; Qashou, 2021). As a result, educators have been exploring the use of mobile technologies to facilitate the learning process and create new innovative learning opportunities for students (Almaiah and Alismaiel, 2019). New mechanisms such as mobile learning (m-learning) have emerged, which is one of the most useful tools in adopting and appropriating ICT in learning processes (Qashou, 2021). M-learning seeks to include the requirements of mobility, accessibility, and interactivity that traditional teaching mechanisms lack (Al-Emran et al., 2020; Al-Rahmi et al., 2021; Almaiah and Alismaiel, 2019; Qashou, 2021). Although mobile learning has multiple advantages and has rapidly evolved in different places around the world, studies that analyse the driving factors of m-learning adoption are limited. The use of technology in learning has significantly expanded the boundaries of learning. Technological advancements have led to the development of open and distributed learning (Pan et al., 2020) and driven learning initiatives like mobile learning to improve educational outcomes (Assaker, 2020; Qashou, 2021). While it is clear that mobile learning is useful and important, there are still no specific motivational rules or guidelines regarding the use of mobile devices to motivate learners to learn (Al-Emran et al., 2020). Similarly, in light of previous research studies, the use of mobile learning depends on the users (Gao et al., 2016; Saroia and Gao, 2019; Sun and Gao, 2020) also highlighted the same idea that the proper and successful application of mobile devices for learning purposes depends on users' demand. However, Bernacki et al. (2020) emphasised the importance of mobile learning and stated that it is highly beneficial for learners because it enables them to receive assistance and training. While studying the dynamic impact of using technologies and especially online networking, social media (Alam et al., 2023), and portable devices, the work (Gao et al., 2016; Saroia and Gao, 2019; Sun and Gao, 2020) in this regard is

very important because of it applicability to advance work context. However, also Gao et al. (2016) gave suggestions about the use of new theories about mobile learning and specify that trust and context are the attributes that needs to be investigated in order to understand the model of mobile application to educational activities. Similarly, Bernacki et al. (2020), Gao et al. (2016), Hamidi and Chavoshi (2018), Kalogiannakis and Papadakis (2019) and Pan et al. (2020) also highlighted the importance of mobile learning in this regard and stated mobile learning is a quite useful way of learning because it is helpful for learners and to share knowledge.

The quality of education in a private education system differs significantly from that of the government-owned education system. The government of Pakistan, specifically Khvber Pakhtunkhwa, has taken several steps to improve the quality of education in the government sector. The Induction Program Management System (IPMS) is one such initiative that aims to train government school teachers through mobile learning and transfer knowledge to government schools. In this program, teachers were provided with Lenovo Tabs for training, which is a form of mobile learning. The IPMS is a 9-month long training and testing program designed for newly hired NTS Teachers.

Number of recent research studies (Al-Rahmi et al., 2021) tries to investigate the relationship between mobile learning and performance in the work context of Higher education (Al-Adwan et al., 2018; Saif and Shaheen, 2022).

Results from the study of Al-Rahmi et al. (2021) are based on application of TAM as a base concept to understand the role of mobile learning for sustainable education. On the other side results from Al-Adwan et al. (2018) findings depict, that based on UTAUT model application for mobile learning in HEIs gender is evident as a significant moderator.

Previous research studies used different approaches for mobile learning, i.e., Gao Model of mobile learning (Hamidi and Chavaski 2018), TAM (Al-Rahmi et al., 2021; Saif et al., 2020) and UTAUT (Al-Adwan et al., 2018) in the work context of education across the globe. Similarly, the interconnection between various attributes (perceived ease of use and usefulness) of the mobile using context and behaviour intention is well explored by recent research studies (Al-Emran et al., 2020; Al-Rahmi et al., 2021; Qashou, 2021). Perceived ease of use attribute is widely explored by number of research studies (Al-Emran et al., 2020; Al-Rahmi et al., 2021; Al-Turjman et al., 2022; Almaiah and Alismaiel, 2019; Assaker, 2020; Bernacki et al., 2020; Gao et al., 2016; Hamidi and Chavoshi, 2018; Kalogiannakis and Papadakis, 2019; Pan et al., 2020; Qashou, 2021) and it is termed as "the degree to which a person believes that using a particular system would be free of physical and mental effort", while usefulness is coined as "the student's belief that adapting mobile learning methods will improve their performance" (Al-Rahmi et al., 2021). Similarly trust on information obtained through mobile learning is also one of the important contributor in understanding mobile learning approach in education setup and previous studies align trust of information with behaviour intention of adopting mobile technologies. Most of latest research studies (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Chavoshi and Hamidi, 2019; Hamidi and Chavoshi, 2018; Mirķe et al., 2019; Pan et al., 2020) indicate that individual personal characteristics play a significant role in shaping one's behaviour and inclination as well as intention for using mobile bases learning (Gao et al., 2021; Sun and Gao, 2020) in education work context (Castro and Tumibay, 2021; Khan et al., 2015) across the globe. In the literature of mobile technology, Alalwan et al. (2018) was able to support the role of innovativeness in the customers' intention to adopt mobile internet. It is also to be noted that customers could

find more intrinsic utilities by using a new system that is more innovative and novel (Sun and Gao, 2020). If the degree of innovativeness increases, customers will be motivated to use this system moreover they will also perceive more pleasure in using it (Alalwan et al., 2018a, 2018b; Lee, 2019).

In the current study the major attributes of Gao mobile learning will be merged with personal characteristics and trust on using mobile application in primary education sector. Gao Model of mobile application is applied by number of research studies (Al-Adwan et al., 2018; Gao et al., 2021, 2016; Saif and Shaheen, 2022; Saroia and Gao, 2019; Sun and Gao, 2020) however the current study tries to add additional features (perceived enjoyment and perceived innovativeness), recommended by Hamidi and Chavoshi (2018) in order to understand the mobile application and behaviour intention for better way of disseminating knowledge.

2 Literature review

2.1 Mobile learning

The mobile learning process has been investigated by number of research studies among developed and developing countries. However, in order to understand the concept of mobile learning and its impact on learning attitude of human in education sector, it is mandatory to differentiate it from electronic learning and distance learning. Although these two attributes are the part of mobile learning process, however their differences are elaborated below.

Electronic learning is also known as (e-learning) which plays an important role in the teaching-learning process and especially in distance and indirect informal learning (Brindley et al., 2004). Electronic or e-learning is successfully used in distance learning (Brindley et al., 2004). Similarly, Uğur et al. (2016) also described the importance of e-learning in modern learning styles and its facilitation in the learning process. Khalil et al. (2020) stated that electronic learning especially started in this regard to facilitate learners and save the time of learners in this regard. It is an easy method of getting information about the various topic and an accessible source of getting knowledge (Khalil et al., 2020).

Distance learning is also a method of learning like e-learning is also a famous method of learning in an informal way in which is also called programmed learning. In distance, learning instruction is done in a separate, different and individual environment (Carter et al., 2020). In distance learning communication from both sides, that is instructor and learner is necessary because distance learning is set in light of learner needs and requirements. However, in distance learning information communication technologies' role is dominant (Bozkurt, 2019). This method of learning is changed from e-learning but the computer role in distance learning is dominant and no one can deny the fact because the use of technology made distance learning easy and accessible for the learner to a greater extent (Castro and Tumibay, 2021; Gao et al., 2021, 2016; Sun and Gao, 2020).

Extensive use of mobile phones has opened new directions of teaching-learning for teachers and learners to get new knowledge, share knowledge and give proper feedback (Al-Rahmi et al., 2021). Similarly, Hamidi and Chavoshi (2018) stated that mobile education is useful not only in the distance and informal education but also informal education and direct learning. It means that the use of mobile phones for learning

purposes is not limited to information and distance education which is important for learners to a greater extent and may not be neglected. Khan et al. (2015) in "using mobile learning in the Middle East lessons learned from the advanced countries education" also described the importance of mobile learning and the use of technologies in the learning process. Previous studies also showed the importance of mobile learning in individual learning and self-learning process (Al-Adwan et al., 2018; Bernacki et al., 2020; Saroia and Gao, 2019). Individual learning style for training technologies and instructions for mobile learning is much affected and creating a motive for an individual success due to mobile learning process. The importance of mobile learning may not be neglected in this sense that it enables learners to reach the desired knowledge with a single click and get the desired information faster than ever before (Khan et al., 2015; Uğur et al., 2016). In distance learning and self-efficiency development as well as skills development the process of mobile learning is useful and facilitates learners to a greater extent. Mobile learning enhanced student's ability and skills due to self-learning procedures while using digital and mobile applications (Gao et al., 2021, 2016; Saroia and Gao, 2019; Sun and Gao, 2020).

Mobile learning is a widespread source of learning because in mobile-based learning there are multiple opportunities for learners to learn through self-device learning or learning which is free from a distance through electronic sources (Saroia and Gao, 2019). In higher education mobile learning was classified into seven main categories like ease of use (Gao et al., 2021), trust, characters and personal qualities, context, perceived usefulness (Al-Rahmi et al., 2021), behavioural intention (Bernacki et al., 2020), and culture of using a research model. The use of mobile learning has become a trend in the teaching-learning process especially in open and distance learning programs (Al-Adwan et al., 2018; Khan et al., 2015; Uğur et al., 2016). Hence the use of mobile learning is common because it is an easy and accessible means of getting knowledge from various sources.

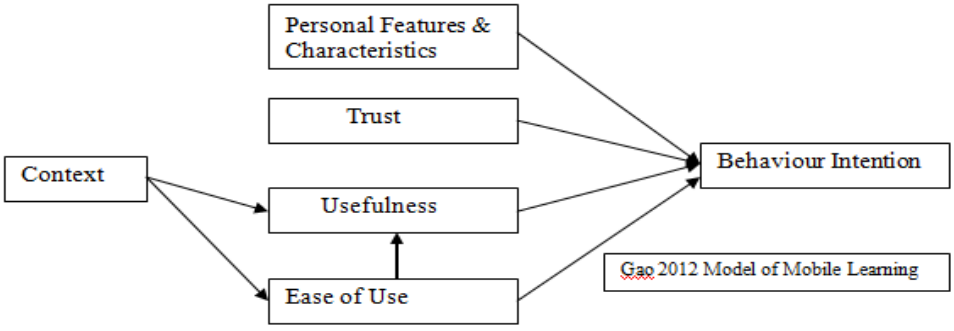
Mobile learning is an activity of conveying knowledge without any specific place and it may be connected from various networks (Kalogiannakis and Papadakis, 2019). Chavoshi and Hamidi (2019) also clearly highlighted the use of mobile learning and its process to provide opportunities to learners, in comparison to other means of getting knowledge. Mobile learning may be used for peer to peer interaction and modified learning. The importance of mobile learning is prominent in distance learning because it provides multiple opportunities to learners which are free from the border of place and time restrictions (Bernacki et al., 2020). It is an easy way to access knowledge and get an education in an effective way (Almaiah and Alismaiel, 2019). Al-Rahmi et al. (2021) and Mirķe et al. (2019) highlighted the importance of mobile learning and stated that mobile learning is an advanced approach for sustainable and online learning.

2.2 Theoretical models of mobile learning

Previous research studies used different approaches for mobile learning, i.e., Gao Model of mobile learning (Hamidi and Chavaski 2018), TAM (Al-Rahmi et al., 2021; Saif et al., 2020) and UTAUT (Al-Adwan et al., 2018) in the work context of education across the globe. Several studies from previous research have applied the mobile learning model to their results. In this regard (Al-Rahmi et al., 2021) worked on designing a learning environment through sustainable education for mobile education. Chavoshi and Hamidi (2019) investigate various factors (technological, social, and pedagogical). Sun and Gao

(2020) identify intrinsic motivation factors of students while using mobile application for learning. Gao et al. (2016) assess potential factors affecting user adoption of mobile learning for studying various plants. Kalogiannakis and Papadakis (2019) assess kindergarten teachers intest in using computer tablets for learning. Based on the above research articles most of the studies followed the Gao Model of mobile learning that is depicted in Figure 1.

Figure 1 Gao model of mobile learning



3 Context factor

Context means the setting of a word or event. You might say that you can't understand what happens without looking at the context. Thus, in mobile learning also context factor has a dominant role because it gives direction as well as the identification of situations to reach the actual statement. Similarly, in mobile-based learning, Al-Adwan et al. (2018) stated that context plays a pivotal role in influencing users' adoption. Context provides direction to adopt mobile learning and highlights its importance to a greater extent. Context refers to the use of particular application for learners. It also highlights the extant of using an application is connection to specific situation and demand (Almaiah and Alismaiel, 2019). Gao et al. (2021) and Sun and Gao (2020) mentioned users of mobile in functional context with a view that is associated with "kind of personal information that induce the feelings of motivation, while using the mobile internet". Likewise, the importance of context plays a significant role in success of applying any system, because context gives clear detail of the user. Pervious research studies (Al-Emran et al., 2020; Al-Rahmi, 2021; Almaiah and Alismaiel, 2019; Gao et al., 2016; Hamidi and Chavoshi, 2018; Saroia and Gao, 2019) focus on the importance of context factor while applying mobile application for learning at education institutes (Al-Adwan et al., 2018; Bernacki et al., 2020; Chavoshi and Hamidi, 2019; Saroia and Gao, 2019; Uğur et al., 2016). Latest research studies (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Hamidi and Chavoshi, 2018) using mobile based learning indicate that context of applying mobile for education purpose depend upon the usefulness (Uğur et al., 2016) and perceived ease of use (Khan et al., 2015) of mobile technology by all the stakeholders (Al-Adwan et al., 2018; Bernacki et al., 2020; Kalogiannakis and Papadakis, 2019; Khan et al., 2015; Saroia and Gao, 2019; Uğur et al., 2016) of education sector. Based on the literature it is hypothised that:

Hypothesis 1 Context has a direct and positive effect on the usefulness factor of using mobile for learning.

Hypothesis 2 Context has a direct and positive effect on the ease of use factor for using mobile for learning.

3.1 Trust factor

Trust is defined as having confidence, faith, or hope in someone or something. Trust factor indicates an individual performance in completion of any task or activity within the specified time while applying mobile applications (Gao et al., 2021; Sun and Gao, 2020). Saroia and Gao (2019) highlighted the importance of trust in adoption of internet-based services and depict that lack of trust may become a source of many hurdles. The importance of mobile learning discussed by Gao et al. (2021) as well other researchers (Al-Emran et al., 2020; Al-Rahmi et al., 2021; Gao et al., 2016; Hamidi and Chavoshi, 2018; Kalogiannakis and Papadakis, 2019) also highlighted the findings state that during the process of exchange of information's through mobile learning, the role of trust on medium, as well as information's sharing in very crucial. The information sharing and knowledge learning process strongly bonded through the active trust mechanism during online mobile learning. Once the learner's confidence (trust) on relaying information through mobile based approach is built, it directly influences individual behaviours as a result intention for using mobile learning will increases.

Hypothesis 3 The ease of use factor has a positive effect on the usefulness factor.

Hypothesis 4 Trust on mobile application for learning has positive relation with intention to use mobile for learning.

3.2 Personal character factor

In light of psychology, personality is the combination of characteristics or qualities that form an individual's distinctive character (Saif and Shaheen, 2022). It is the sum of an individual lifestyle his likes and dislikes, personal views, and behaviour (Alam et al., 2023). Gao et al. (2016) stated that personality traits vary from person to person that may be in personality traits, age, gender, educational background, social interaction. Personality traits reflect people's characteristic, patterns of thoughts, feelings, and behaviours (Tahira et al., 2019). Personality traits imply consistency and stability someone who scores high on a specific trait like Extraversion is expected to be sociable in different situations and over time (Alam et al., 2023; Tahira et al., 2019). Therefore, in technology adoption personal character also having great role while using any source through device like mobile or any other technology (Gao et al., 2016; Saroia and Gao, 2019; Sun and Gao, 2020). Mobile learning is also device-based learning (Gao et al., 2021) and having global importance because it has convert the traditional approach of learning free from place and time (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Mirķe et al., 2019). Most of latest research studies (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Chavoshi and Hamidi, 2019; Hamidi and Chavoshi, 2018; Mirķe et al., 2019; Pan et al., 2020) indicate that individual personal characteristics play a significant role in shaping one's behaviour and inclination as well as intention for using mobile bases learning (Gao et al., 2021; Sun and Gao, 2020) in education work context (Castro

and Tumibay, 2021; Khan et al., 2015) across the globe. Hence based on previous literature it is hypothised that:

Hypothesis 5 Character and personal attributes have a positive effect on the intention to use mobile for learning.

3.3 Perceived usefulness factor

Perceived usefulness refers to the factor that indicates users' perception of usefulness regarding using any medium for learning process. Similarly, usefulness is very important because it makes users adopt, accept and resist any change that is introduced to one learning process. Perceived usefulness is primarily related to performance, quality, and effectiveness of any activity. In the work context of mobile learning perceived usefulness is the approach that entails one's inclination toward using digital source for learning. Perceived usefulness is associated with information obtained and its relative importance of the procedure through which information's are generated. Recent researchers found that perceived usefulness of mobile learning can be validated through technology adaptation in different spheres of life, i.e., e-commerce (Zhao, 2023), distance learning, digital media (Karakose et al., 2021), zoom meeting (Linden and Gonzalez, 2021), social interaction (Alam et al., 2023; Saif and Shaheen, 2022), digital transformation (Sasmoko et al., 2019), digital leadership (Hamzah, 2021; Kunkel and Matthess, 2020). Previous research studies (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Hamidi and Chavoshi, 2018; Kalogiannakis and Papadakis, 2019; Mirķe et al., 2019) indicate that perceived usefulness attribute is one of the most important contributor to enhance individuals learning through mobile adoption (Al-Adwan et al., 2018; Bernacki et al., 2020) in education setup (Al-Adwan et al., 2018; Assaker, 2020; Bernacki et al., 2020; Brindley et al., 2004; Qashou, 2021; Uğur et al., 2016). Based on the literature it is hypothised that:

Hypothesis 6 Perceived usefulness has significant relation with intention to use mobile technology for learning.

3.4 Ease of use factor

Ease of use is also a very important factor related to the mobile learning process because if the process of handling is easy for the user to obtained desired information's. It will directly link to build one's intention to use digital source for accurate, quick, and reliable information through mobile technology (Bozkurt, 2019; Castro and Tumibay, 2021; Khan et al., 2015). Likewise, the ease of use factor refers to the individual use of a particular system without resistance or more effort. Gao et al. (2016, 2021), Saroia and Gao (2019) and Sun and Gao (2020) highlighted the importance of ease of use, especially in technology applications to get benefits from it quickly and accurately. Most of the research studies (Al-Adwan et al., 2018; Almaiah and Alismaiel, 2019; Bernacki et al., 2020; Chavoshi and Hamidi, 2019; Saroia and Gao, 2019) highlighted the positive link between Perceived ease of use and intention to use mobile application (Al-Rahmi et al., 2021; Gao et al., 2016; Hamidi and Chavoshi, 2018) in the work context of education (Al-Adwan et al., 2018; Khan et al., 2015; Uğur et al., 2016). Based on the previous research work it is hypothised that:

Hypothesis 7 Perceived ease of use has a positive effect on the intention to use of mobile technology for learning.

3.5 Culture factor

Culture for mobile learning process can be defining as the set of norms, rules, regulation in order to adopt technological changes to grab of the opportunities of digitalisation process. This aspect of using a particular system refers to the culture of using mobile phones or computer applications for learning processes (Gao et al., 2021, 2016; Sun and Gao, 2020). To adapt culture or environment of anything depend upon its easiness and effectiveness in that specific work context (Saroia and Gao, 2019). Latest researcher's (Almaiah and Alismaiel, 2019; Bernacki et al., 2020; Chavoshi and Hamidi, 2019; Saroia and Gao, 2019) views regarding mobile learning indicate that it's also influences learning process in education (Al-Adwan et al., 2018; Kalogiannakis and Papadakis, 2019; Khan et al., 2015; Uğur et al., 2016) work context. Based on the literature it is hypothised that:

Hypothesis 9 The culture of using the mobile application has a significant positive effect on behavioural intention for learning.

Personality traits imply consistency and stability someone who scores high on a specific trait like Extraversion is expected to be sociable in different situations and over time (Alam et al., 2023; Tahira et al., 2019). Therefore, in technology adoption personal character also having great role while using any source through device like mobile or any other technology (Gao et al., 2016; Saroia and Gao, 2019; Sun and Gao, 2020). Mobile learning is also device-based learning (Gao et al., 2021) and having global importance because it has convert the traditional approach of learning free from place and time (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Mirķe et al., 2019).

Personal features and characteristics of group of people form the voice of community, that enable and insist majority of group members to adopt specific attribute for learning. The joint culture is the outcomes of individual's characteristics. It is confirmed that personal characteristics and individual features leads to designed shared culture for using mobile technology for learning process. Hence based on previous literature it is hypothised that:

Hypothesis 8 Personal features and characters have a significant positive effect on the culture of using mobile for learning.

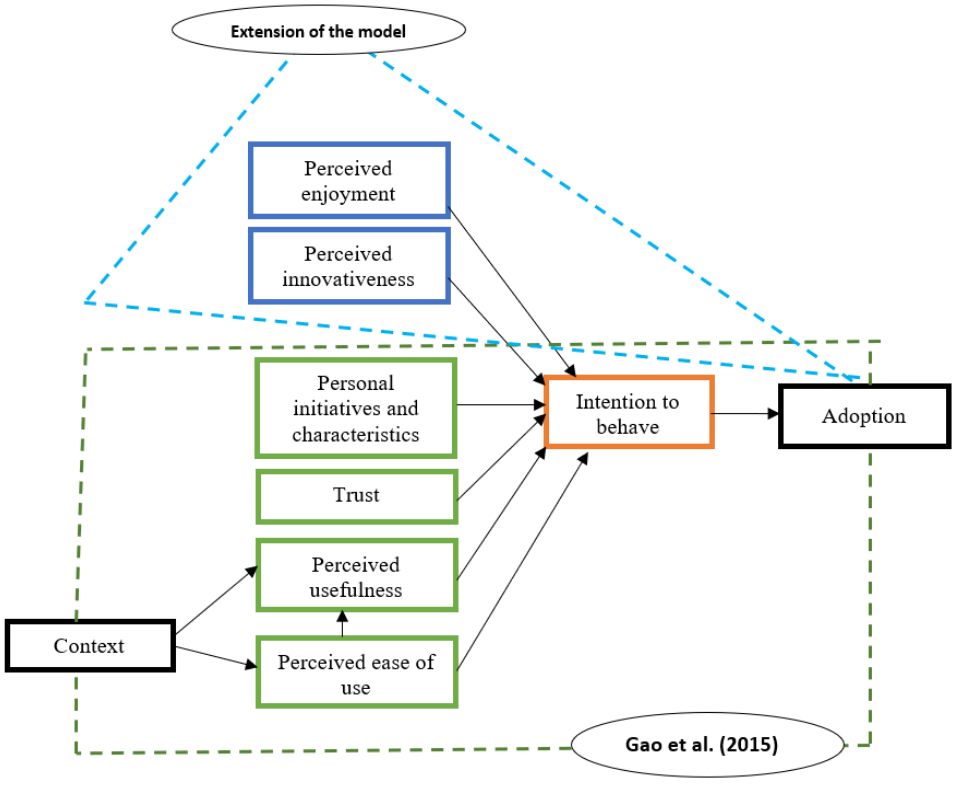
3.6 Perceived enjoyment

Sun and Gao, (2020) defines enjoyment as an intrinsic reward that is experienced due to the use of technology. Unlike perceived usefulness which is a form of extrinsic reward in getting desired results, while Perceived Ease of use is an intrinsic reward that refers to the pleasure of doing an activity itself (Gao et al., 2021, 2016). Alalwan et al. (2018a) considered mobile internet as new technology that can entertain its users with fun and enjoyment. In a study, it was statistically proved by Chin and Ahmad (2015) that customer intention to use technology is influenced by perceived enjoyment. In another study (Mohamad et al., 2021), it was found that there is a strong impact of perceived Enjoyment on customers' intentions for online hotel booking. Recent studies (Alalwan et al., 2018a; Chinomona, 2013; Zhonggen and Xiaozhi, 2019) indicate that perceived

Enjoyment enhance individual intention to adopt mobile technologies in education work context. Based on the literature it is hypothised that:

Hypothesis 10 Perceived enjoyments will positively influence teachers intention to adopt mobile technology in education work context.

Figure 2 The proposed model to validate the IPMS in Pakistan (see online version for colours)



3.7 Perceived innovativeness

Innovativeness could be classified under the personality factors that shape the extent, to accept and adopt new ideas, products, and systems (Alalwan et al., 2018a). People will be innovative if they are engaged with a process of acceptance and or usage of new technology (Alalwan et al., 2018a). In the literature of mobile technology, Alalwan et al. (2018a) was able to support the role of innovativeness in the customers' intention to adopt mobile internet. It is also to be noted that customers could find more intrinsic utilities by using a new system that is more innovative and novel (Sun and Gao, 2020). If the degree of innovativeness increases, customers will be motivated to use this system moreover they will also perceive more pleasure in using it (Alalwan et al., 2018a, 2018b; Lee, 2019). Based on literature it is hypothised that:

Hypothesis 11 Perceived innovativeness will positively influence teachers intention to adopt mobile technology in education work context.

3.8 Behavioural intention factor

The intention is simply defined as how hard persons are willing to try to how much determinations they are. Planning to use towards performing behaviourist is the use of certain behaviour on different occasions like people wishes like and dislikes Behavioural intention is the reflection of ease of use (Gao et al., 2021, 2016; Saroia and Gao, 2019), trust factor (Al-Emran et al., 2020; Al-Rahmi et al., 2021; Almaiah and Alismaiel, 2019; Gao et al., 2016; Hamidi and Chavoshi, 2018), usefulness (Gan and Balakrishnan, 2018), and personal qualities (Alalwan et al., 2018a, 2018b) that motivation Sun and Gao (2020) one to adopt specific behaviour using mobile application for education (Alalwan et al., 2018a; Chinomona, 2013; Gan and Balakrishnan, 2018; Lee, 2019; Zhonggen and Xiaozhi, 2019) under certain conditions.

4 Research methodology

4.1 Descriptive statistics

The major objective of the current study is to validate the extended version of Hamidi and Chavoshi (2018) and Gao et al. (2016) mobile application model (MAM) among the teachers that are using mobile application tools for preparing their lesson for the students and most importantly to examine the compliance of teaching cadre with digital gadgets. Results from Table 1 depicts that (210) participants were male while (35.48%) were female. The highest proportion (48.95%) from the sample having the age group (21–25 years) followed by 140 participants belongs to the age group of (26–30) years, while only one respondent having age below than 21 years. It depicts that most of the respondents having a young age group. From education background and qualification, findings indicate that 270 Participants are master degree holders with 16 tears of qualifications, followed by (12.41%) having MS/Phil degree holders with 18 years of qualifications. Subject specialisations indicate that most of the respondents belong to social sciences subject (129/320) followed by biological sciences (25.02%), while the lowest percentage belong to teachers having background specialisation in management sciences (3.11%). Response for computer and basic IT certificate indicates that (189) respondents have (3–6 months) certification in basic computer, while (71.03%) respondents have requisite information's about IPMS test for teacher's performance evaluation. Out of the total sample (91.25%) having smartphone facilities before entering teaching jobs. More than 64% respondent states that they spend (2–4) hour's daily mobile, while (70) respondents use it for (5–7 hours) daily. The response rate from the sample indicates that (71.77%) teachers use the internet facility for (2–4) hours on daily basis, while only (10.23%) use it for (5–7) hours daily. The response related to time spent on IPMS related videos for class preparation indicates that (64.41%) respondents use the IPMS based system for more than 10 hours in a week, while only (3.41%) use it for less than 1 hours in a week.

Table 1 Descriptive Information's about the respondents

Description	*Particulars*	*Frequency*	*Percentage*
Gender	Male	210	67.74
	Female	110	35.48
Age Group	Below than 21 years	1	0.322
	21–25 Years	159	49.68
	26–30 Years	140	43.75
	31–35 Years	15	4.682
	Above than 35	5	1.564
Marital Status	Married	109	34.63
	Unmarried	211	65.93
Education Level	Bachelor	7	02.11
	Master	270	84.35
	M.S/MPhil	41	12.81
	PhD	2	0.625
Education Background	Biological Sciences	80	25.00
	Numerical Sciences	65	20.31
	Social Sciences	129	40.31
	Business/Management	10	3.11
	Art/Humanities	36	11.25
Have you a computer/ICT certificate?	Yes	189	59.09
	No	131	40.93
Have you knowledge about IPMS Program?	Yes	230	71.87
	No	90	28.12
Do you have smart phone?	Yes	293	91.25
	No	27	8.43
Time spent on mobile phone	< 1 hours	20	6.85
	2–4 Hours	190	64.84
	5–7 Hours	70	23.89
	8–10 Hour	13	4.44
	> 10 Hours	00	00.00
Time spent on internet	< 1 hours	40	13.65
	2–4 Hours	210	71.67
	5–7 Hours	30	10.23
	8–10 Hour	3	1.023
	> 10 Hours	0	00.00
Time spent on IPMS learning videos/week	< 1 hours	10	3.41
	2–4 Hours	40	13.65
	5–7 Hours	30	10.23
	8–10 Hour	25	8.53
	> 10 Hours	188	64.41

4.2 Statistical sample and sample size calculation

The sample is the subset of the population and its findings can only be applied to the overall population if the sample size is determined based on statistical justification with having rules and regulation. In the case of the current study, the overall population is known, as the education department provides the detail of all the teachers selected based on NTS based recruitment policies. For the known population (Sekran, 1992) sample size chart indicates that in the case of the population between (1,500–3,000) the effective sample size of (310–350) is enough to generalise the results to the overall population. According to the rule of thumb indicate that 10% of the items to the entire construction must be applied to get the required number of sample size. In this regard, a 350 sample size is enough to get a response for further analysis. Researchers (Hair et al., 2017b; Sweeney, 2009) state that for data analysis and model fit measurement through structural equation modelling (SEM), a sample size of 200 is enough to analyse the data.

The population of the current study consists of all the teaching members performing their job in district Bannu and those who are selected based on national testing services (NTS) procedures. The reason behind the finalising of the NTS based teachers is based on the concept of their proper training of using latest mobile (computer tablet) gadgets for preparing their daily teaching assignments and their assessment through relevant education department top management. Total number of newly inducted male and female teachers during (2018–2022) are 3,500. Hence based on the finite population based sampling as recommended by Sekran (1992) total sample of 346 is required at (0.05) confidence interval. As the population consists of teaching cadre performing their jobs at primary education institutions of District Bannu KP Pakistan. Hence random sampling technique was applied to get the required response, and after distributing total 346 construct, researchers received 330 filled questionnaires with response rate of (95.37%).

5 Data collection method

In the current research paper, data collection was done by using a Likert scale questionnaire. The adapted questionnaire consists of a various number of items related to specific variables and used by different research studies. Different studies used 5- and 7-point Likert scale based upon the nature of the study as well as questions. In the current study, 5 points Likert Scale is applied i.e., 1 represents strongly agree, while 5 denote strongly disagree. The response is obtained for various variables namely perceived ease as well as usefulness, the context of the medium, along with personal features and characteristics adopted from Gao et al. (2016) model of mobile application, culture factor is measured based on Chavoshi and Hamidi (2019) and Hamidi and Chavoshi (2018). While the model is extended by adding two additional factors Perceived Innovativeness and Perceived enjoyment based upon the model of (KSA) (Alalwan et al., 2018a).

5.1 Measurements

The current study validates the models proposed by Gao et al. (2016), Chavoshi amd Hamidi (2019) and Hamidi and Chavoshi (2018) to interlink the relationship between respondents' attitudes toward mobile learning. For the measurement of characteristics as well as personal features of using the mobile application (Chavoshi and Hamidi, 2019;

Hamidi and Chavoshi, 2018) adapted questionnaire is used. For the measurement of trust factor of using a mobile application for learning skills items are adapted from the study of (Chavoshi and Hamidi, 2019; Hamidi and Chavoshi, 2018). Respondent's intention toward applying mobile technology, perceived ease of use, and usefulness is measured by adapted constructs of Alalwan et al. (2018a, 2018b) Response about Perceived enjoyment and perceived innovativeness are measured by an adopted questionnaire from the study of (Alalwan et al., 2018a) on 5 points Likert scale.

5.2 Data analysis

In the current study SEM by using Smart PLS software is applied to validate the structural model based upon theoretical integration (Hamidi and Chavoshi, 2018) and also validates cause and effect relationship between variables of the study. Previous studies. Gao et al. (2016), Chavoshi and Hamidi (2019) and Hamidi and Chavoshi (2018) indicate that SEM analysis is the best statistical tool than individual procedures regression and ordinary factor loadings. In the initial stage multicollinearity of all the independent variables was assessed by applying the Variance Inflation Factor. In the next stage Factor loading of items related to their respective factors is assessed by validating it through Cronbach alpha, composite reliability, and Average variance extracted indices. At the same time correlation between the variables is investigated through Forner Laker statistics, along with MSV and ASV values. Finally, the square root of AVE is also applied to check the discriminate validity. The structural model is assessed through prescribed fit indices recommended by Hair et al. (2017a). Finally, the meditational role of Culture between variables was assessed by Adnan et al. (2018) statistical procedure along with the bootstrapping procedure.

5.3 Results

Descriptive statistics through (mean, standard deviation, minimum, maximum values along with Skewness and Kurtosis) was measured by using SPSS. In the next stage Correlation between the variables and demographics was assessed. In the third step, the factors loading of relevant items to their respective construct were validated by performing confirmatory factor analysis (CFA). And SEM approach was applied to investigate the dynamic relationship between the variables deducted from the previous model as well inclusion of new variables to extend the model of mobile learning. Model fitness was analysed by evaluating the Chai Square value along with fit indices (CFI, GFI, AGFI, NFI, NNFI, RMSEA, etc).

5.3.1 Findings from the measurement model

After investigating the initial model with all the items, model fit indices were not in the range of acceptability because of poor factor loading of few items on their respective construct. As Item loading value for two items from context factor of Gao et al. (2021, 2016), Sun and Gao (2020) is ($0.288_{\text{CTX-10}}$ and $0.376_{\text{CTX-10}}$). That is below the standard value of (0.5 and > 0.5). Hence for better model fitness these items were removed from the final model consisting context factor with 4 items. Another item from trust factor ($0.311_{\text{TRS-23}}$) and two items from behaviour intention ($0.322_{\text{BIN-39}}$ and $0.352_{\text{BIN-40}}$) were also removed because of poor loading values on their respective construct. However

interestingly the items for newly added variable (perceived enjoyment and perceived innovativeness) loading values are higher than (0.5), and highest values belong to perceived innovativeness ($0.876_{PIN\text{-}35}$), while lowest value is related to perceived enjoyment ($0.876_{PEJ\text{-}28}$). In the overall model highest factor loading belong to personal characteristics and qualities ($0.911_{CPQ\text{-}2}$), while lowest value of estimates is related to perceived usefulness ($0.612_{PUF\text{-}17}$). After removing the entire problematic item loading the new model consist of fit indices that full fill the requirement for further analysis. In this regard results from Table 2 indicate that different items factor loading are greater than (0.5) on their respective construct, and the rules for establishing convergent validity are also fulfilled. The values from Table 2 depict that Average variance extracted values for ($AVE = _{CPQ\_0.604}$, $AVE = _{CTX\_0.551}$; $AVE = _{EOU\_0.510}$; $AVE = _{PUF\_0.502}$; $AVE = _{TRS\_0.522}$; $AVE = _{PEJ\_0.522}$; $AVE = _{PIN\_0.591}$; $AVE = _{BIN\_0.503}$; $AVE = _{ADP\_0.526}$) all the variables are higher than (0.5). Results also state that composite reliability value is greater than Average variance extracted ($CR = _{CPQ\_0.882} > AVE = _{CPQ\_0.604}$, $CR = _{CTX\_0.841} > AVE = _{CTX\_0.551}$; $CR = _{EOU\_0.879} > AVE = _{EOU\_0.510}$; $CR = _{PUF\_0.799} > AVE = _{PUF\_0.502}$; $CR = _{TRS\_0.821} > AVE = _{TRS\_0.522}$; $CR = _{PEJ\_0.818} > AVE = _{PEJ\_0.522}$; $CR = _{PIN\_0.832} > AVE = _{PIN\_0.591}$; $CR = _{BIN\_0.811} > AVE = _{BIN\_0.503}$; $CR = _{ADP\_0.813} > AVE = _{ADP\_0.526}$). Conditions for divergent reliability is also established by following the statistical recommendations of Hair et al. (2017a). In this regard the values of MSV, ASE, and ASV are measured. According to the table it is clearly evident that ($AVE = _{CPQ\_0.604} > MSV = _{CPQ\_0.170}$; $AVE = _{CTX\_0.551} > MSV = _{CTX\_0.422}$; $AVE = _{EOU\_0.510} > MSV = _{EOU\_0.281}$; $AVE = _{PUF\_0.502} > MSV = _{PUF\_0.271}$; $AVE = _{TRS\_0.522} > MSV = _{TRS\_0.262}$; $AVE = _{PEJ\_0.522} > MSV = _{PEJ\_0.276}$; $AVE = _{PIN\_0.591} > MSV = _{PIN\_0.291}$; $AVE = _{BIN\_0.503} > MSV = _{BIN\_0.221}$; $AVE = _{ADP\_0.526} > MSV = _{ADP\_0.267}$) all the constructs AVE vales are greater than MSV. Similarly second condition of divergent validity is that AVE values must be higher than ASV. Findings from the table indicate that ($AVE = _{CPQ\_0.604} > ASV = _{CPQ\_0.089}$; $AVE = _{CTX\_0.551} > ASV = _{CTX\_0.231}$; $AVE = _{EOU\_0.510} > ASV = _{EOU\_0.139}$; $AVE = _{PUF\_0.502} > ASV = _{PUF\_0.129}$; $AVE = _{TRS\_0.522} > ASV = _{TRS\_0.133}$; $AVE = _{PEJ\_0.522} > ASV = _{PEJ\_0.141}$; $AVE = _{PIN\_0.591} > ASV = _{PIN\_0.122}$; $AVE = _{BIN\_0.503} > ASV = _{BIN\_0.141}$; $AVE = _{ADP\_0.526} > ASV = _{ADP\_0.128}$).

Results from Table 3 indicate the values of Fournier Lacker's correlation lies between the variables. Each value designated through parenthesis at the diagonal represents the square root of AVE, while other values represent the correlation between the variables. Researchers (Forner and Lackers, 1981) state that the inter-correlation values must be lower than the square root of AVE. In case if the inter-correlation between the variable is higher than the square root of AVE, it will lead to poor model fit. Results indicate that inter-correlation between all the variables are lower than diagonal values (ρvc values). However, the highest correlation exists between trust and context factors (r = 0.811) followed by behaviour intention and perceived enjoyment (r = 0.785). While the lowest correlation exists between the ease of use factor with perceived usefulness (r = 311). Results for overall model fit during CFA indicate that almost every index after removing problematic item seems in a better range. The nine factor CFA results of a modified version (after removing items having loading value lower than 0.5) of Gao et al. (2008) model of a mobile application to education had a good fit, i.e., (CMIN/Df = 1.768, RMSEA = .056, GFI = .961, AGFI = .891, TLI = .906, CFI = .961, and $\chi^2/df = 1.98$).

Table 2 Descriptive Statistics with reliability through CFA

Variable	*Coding*	*Cronbach alpha*	*T-value*	*Item loading*	*P*	*CR*	*AVE*	*MSV*	*ASV*
CPQ	CPQ1	0.798	--------	0.733	---	0.881	0.604	0.170	0.089
	CPQ2		14.771	0.911	***				
	CPQ3		13.231	0.877	***				
	CPQ4		12.289	0.799	***				
	CPQ5		10.411	0.687	***				
CTX	CTX6	0.801	---------	0.804	----	0.841	0.551	0.422	0.231
	CTX7		17.77	0.811	***				
	CTX8		12.455	0.802	***				
	CTX9		10.301	0.643	***				
	CTX10		11.342	0.722	***				
	CTX11		11.309	0.731	***				
EOU	EOU12	0.832	-------	0.622	---	0.829	0.510	0.281	0.139
	EOU13		10.411	0.733	***				
	EOU14		8.678	0.609	***				
	EOU15		9.557	0.701	***				
	EOU16		10.143	0.776	***				
PUF	PUF17	0.802	-------	0.612	---	0.799	0.502	0.271	0.129
	PUF18		11.402	0.741	***				
	PUF19		9.608	0.619	***				
	PUF20		10.557	0.801	***				
TRS	TRS21	0.782	-------	0.602	---	0.821	0.522	0.262	0.133
	TRS22		11.422	0.801	***				
	TRS23		8.617	0.622	***				
	TRS24		10.334	0.799	***				
	TRS25		9.331	0.811	***				
PEJ	PEJ26	0.844	-------	0.32	---	0.818	0.522	0.276	0.141
	PEJ27		10.221	0.767	***				
	PEJ28		9.608	0.669	***				
	PEJ29		10.527	0.722	***				
	PEJ30		11.173	0.777	***				

Notes: CPQ = Personal characteristics and qualities, EOU = Ease of use,
PUF = Perceived usefulness, TRS = Trust, PEJ = Perceived enjoyment,
PIN = Perceived innovativeness, BIN = Behaviour intention, ADP = Adaptability of mobile application, CTX = Context. CR = Composite reliability
AVE = Average variance extracted, MSE = ASV

Table 2 Descriptive Statistics with reliability through CFA (continued)

Variable	*Coding*	*Cronbach alpha*	*T-value*	*Item loading*	*P*	*CR*	*AVE*	*MSV*	*ASV*
PIN	PIN31	0.878	-------	0.656	---	0.832	0.491	0.291	0.122
	PIN32		10.322	0.803	***				
	PIN33		9.678	0.709	***				
	PIN34		9.557	0.743	***				
	PIN35		10.143	0.876	***				
BIN	BIN36	0.866	-------	0.701	---	0.811	0.503	0.221	0.141
	BIN37		11.404	0.833	***				
	BIN38		9.221	0.643	***				
	BIN39		9.342	0.692	***				
	BIN40		10.143	0.744	***				
ADP	ADP41	0.861	-------	0.677	---	0.813	0.526	0.267	0.128
	ADP42		11.301	0.821	***				
	ADP43		9.797	0.771	***				
	ADP44		9.447	0.721	***				
	ADP45		11.109	0.874	***				

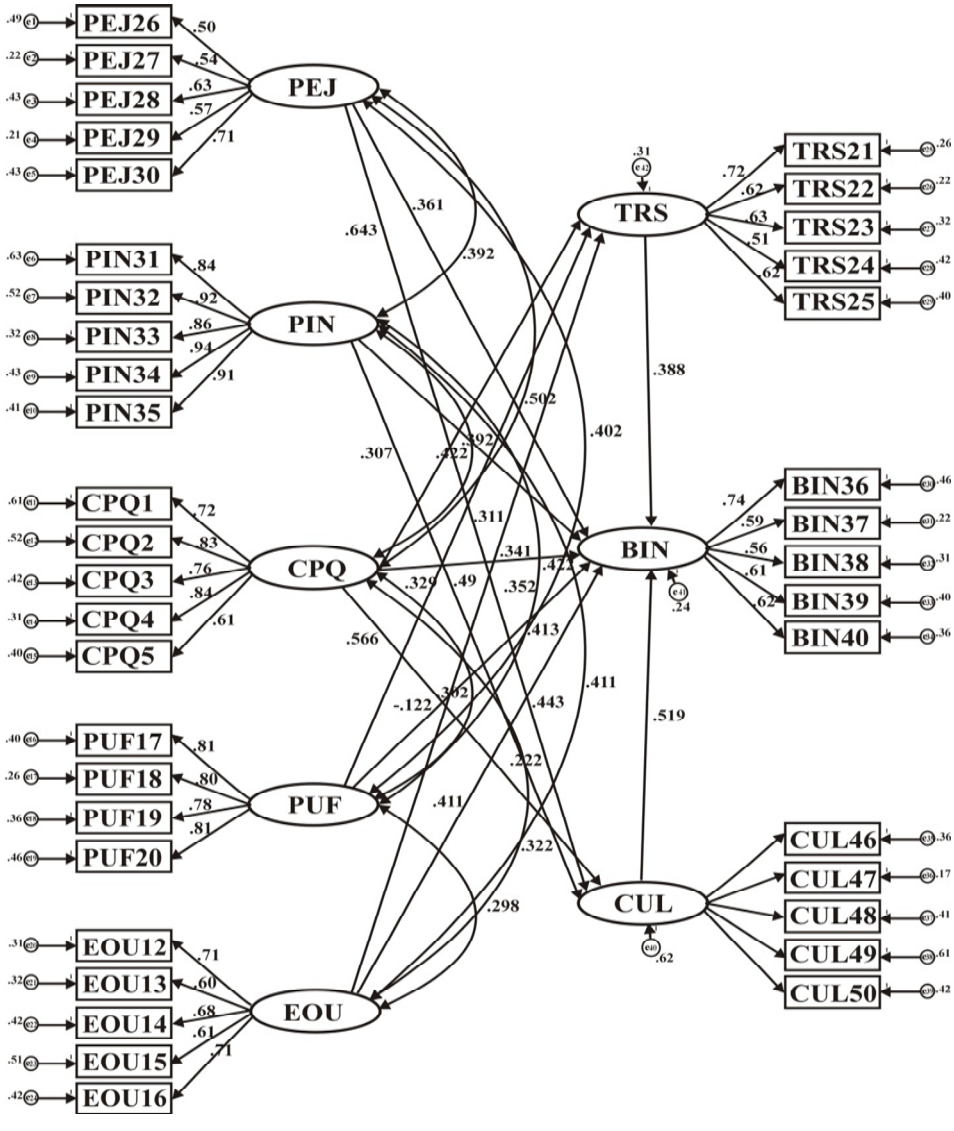
Notes: CPQ = Personal characteristics and qualities, EOU = Ease of use,
PUF = Perceived usefulness, TRS = Trust, PEJ = Perceived enjoyment,
PIN = Perceived innovativeness, BIN = Behaviour intention, ADP = Adaptability of mobile application, CTX = Context. CR = Composite reliability
AVE = Average variance extracted, MSE = ASV

Table 3 Forner Lacker correlation

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	CPQ	*0.878*								
2	CTX	0.711	*0.821*							
3	EOU	0.720	0.688	*0.844*						
4	PUF	0.729	0.733	0.741	*0.816*					
5	TRS	0.802	0.811	0.766	0.733	*0.836*				
6	PEJ	0.671	0.633	0.792	0.722	0.802	*0.855*			
7	PIN	0.744	0.731	0.677	0.766	0.734	0.789	*0.866*		
8	BIN	0.639	0.813	0.747	0.788	0.733	0.785	0.805	*0.881*	
9	ADP	0.785	0.801	0.771	0.746	0.736	0.720	0.728	0.748	*0.877*

Notes: CPQ = Personal characteristics and qualities, EOU = Ease of use,
PUF = perceived usefulness, TRS = Trust, PEJ = Perceived enjoyment,
PIN = Perceived innovativeness, BIN = Behaviour intention, ADP = Adaptability of mobile application, CTX = Context. TRS = Perceived Trust, CUL = Culture

Figure 3 Structural model for the outcome



5.3.2 Results from the structural model

After analysing the model for construct validation and to assess the role of respective items loading on their respective factors. The next step is to measure the overall model for hypothetical relationship validation by using SEM analysis. Results from Table 4 indicate the fit indices value and evidence that all the values are in an acceptable range.

Table 4 Model fit indices

Model fit value	*Threshold level*	*Current model value*	*Hamidi and Chavoshi (2018)*
CMIN/DF	< 3	1.562	1.821
RMSEA	<.05	0.032	0.052
PNPI	>.80	.813	0.776
GFI	>.90	.982	0.886
AGFI	>.90	.892	0.858
NFI	>.90	.903	0.891
NNFI	>.80	.791	0.962
CFI	>.95	.963	0.974
RFI	>.90	.931	0.874
IFI	>.90	.920	0.948

While Table 4 depict information's about estimates, standard error, composite reliability, and significance level with path coefficient values of the proposed hypothesis.

Table 5 Results of Significant values of hypothesis

Hypothesis	*Estimates*	*SE*	*CR*	*P*	*t-value*	*Path coefficient*	*Results*
H1	0.211	0.065	3.044	.001	8.44	0.33	Accepted
H2	0.644	0.091	6.669	***	11.32	0.48	Accepted
H3	0.331	0.064	5.344	***	5.66	0.59	Accepted
H4	0.388	0.169	2.517	**	6.77	0.55	Accepted
H5	0.341	0.074	5.411	***	5.71	0.61	Accepted
H6	–0.122	0.104	–1.134	.211	0.33	0.14	Rejected
H7	0.411	0.171	2.887	.010	6.45	0.67	Accepted
H8	0.566	0.359	5.448	**	7.78	0.67	Accepted
H9	0.519	0.349	4.051	**	7.22	0.58	Accepted
H10	0.361	0.071	5.411	***	5.73	0.59	Accepted
H11	0.643	0.094	6.671	***	11.41	0.51	Accepted

Note: *** p value < .01; ** p value < .05; * p value < .10.

According to the findings context factor of mobile usage has a significant association with perceived usefulness ($\beta = 0.33$, SE = 0.065; t = 8.44; $p < 0.05$) of using mobile for information processing. Hence, hypothesis one (H1) is accepted. Context affect on perceived ease of use ($\beta = 0.48$, SE = 0.091; t = 11.32; $p < 0.05$) and EOU affect toward perceived usefulness ($\beta = 0.59$, SE = 0.064; t = 5.66; $p < 0.05$) also denote significant association for using a mobile application for learning and enhancing skills. Similar results were evident by Chavoshi and Hamidi (2019) and Hamidi and Chavoshi (2018) among higher education setup. Hence, our hypotheses (H3) and (H2) are also supported by the findings, which indicate that trust in using a mobile application for obtaining information has a significant relationship with shaping one's intentions/behaviours towards using electronic devices. Therefore, H4 is also accepted. Respondents' trust in the reliability and accuracy of the information provided by the IPMS team in accordance with the course structure is positively valued. Hence, to obtain accurate information in a shorter time frame, the IPMS video materials are more reliable than searching through different sources. This also confirms the abilities of IPMS management experts in

designing the course structure materials for students/teachers' learning, which can be trusted and verified. Similarly, personality traits and personal interests are also evident in shaping one's behaviours towards mobile learning while obtaining any information through the state-supported IPMS team. Therefore, H5 is also accepted in the current work context of Pakistan.

However, interestingly, perceived usefulness did not show any association with the behavioural intention of the respondents towards using a mobile application for data/information requirements. Based on the findings, it is evident that H6 is rejected. However, most of the previous studies (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Chavoshi and Hamidi, 2019; Gao et al., 2016; Hamidi and Chavoshi, 2018) indicate that perceived usefulness has a strong association with behavioural intention. One possible reason may be that in the Pakistani work context (specifically, the sample understudy), the use of mobile technology is not accepted among female teachers due to cultural barriers and the ethos of using mobile phones by females. As female respondents make up almost 33% of the study, it is possible that cultural barriers, family structure, and ethos may be the reasons behind the insignificant relationship between perceived usefulness and the intention to use mobiles.

Results for the table indicate that perceived ease of use attitude also an influential factor in shaping one's intention for electronic gadgets to use for the learning process. Hence based upon the findings ($\beta = 0.411$, SE = 0.171; $t = 6.45$; $p < 0.05$), Hypothesis 7 is accepted. Findings for the relationship between personal characteristics and feature and culture also indicate significant association ($\beta = 0.566$, SE = 0.359; $t = 7.78$; $p < 0.01$), while culture effect on behaviours intention to use mobile application for the learning process is also significant ($\beta = 0.519$, SE = 0.349; $t = 7.22$; $p < 0.01$), that leads toward the acceptance of H8 and H9. In the Gao et al. (2016) as well as Hamidi and Chavoshi (2018) model of model application two additional paths are added to enhance the existing information. In this regard, H10 indicates the direct relationship between perceived enjoyment and behaviour intention toward using a mobile application for the learning process. Findings indicate that PEJ is strongly associated with behaviour intention and a 1% change in PEJ level enhances 36% behaviour modelling for adopting mobile gadgets for learning. Similarly, another factor that is added to existing models has perceived innovativeness (technique/ study material/ methodology) of IPMS system enhance employees' attitude toward using mobile application tool for the learning process. Findings from Table 5 indicate that 1% change in PIN increase 65% usage of IPMS system among teachers to not only learn the right lesson but also boosts their capabilities to deliver the material to the students in a more appropriate way.

Table 6 indicates the comparison of two existing models of using mobile applications for learning attitude among faculty of different universities. In Uğur et al. (2016) model of a mobile application for education, the only previous model of Gao et al. (2016) was applied, while Chavoshi and Hamidi (2019) enhance the MAM of Gao et al. (2016) as well as Uğur et al. (2016) by adding culture factor to understand the procedure of teachers' behaviour intention for mobile usage in university faculty members. However, the current study moves one step forward to not only validate the previous models of a mobile application to educational setup but also enhance the (Chavoshi and Hamidi, 2019; Gao et al., 2021, 2016; Saroia and Gao, 2019; Sun and Gao, 2020; Uğur et al., 2016) models by adding additional features of perceived enjoyment and perceived innovativeness.

Table 6 Comparison of path coefficient and t-values with previous models

Hypothesis	*Relationship*	*Uğur et al. (2016)*		*Hamidi and Chavoshi (2018)*		*Current model*	
		Path coefficient	*t-value*	*Path coefficient*	*t-value*	*Path coefficient*	*t-value*
H1	COX → PUF	0.56	7.64	0.34	8.64	0.33	8.44
H2	COX → EOU	0.77	11.68	0.49	12.33	0.48	11.32
H3	EOU → PUF	0.31	4.11	0.57	5.63	0.59	5.66
H4	TRS → BIN	0.60	7.05	0.58	6.98	0.55	6.77
H5	CPQ → BIN	0.01	0.11	0.13	0.31	0.61	5.71
H6	PUF → BIN	0.02	0.19	0.14	0.12	0.14	0.33
H7	EOU → BIN	0.11	1.25	0.15	0.32	0.67	6.45
H8	CPQ → CUL	---	---	0.6	7.96	0.67	7.78
H9	CUL → BIN	---	---	0.58	7.85	0.58	7.22
H10	PEJ → BIN	---	---	---	---	0.59	5.73
H11	PIN → BIN	---	---	---	---	0.51	11.41

Notes: CPQ = Personal characteristics and qualities, EOU = Ease of use, PUF = Perceived usefulness, TRS = Trust, PEJ = Perceived enjoyment, PIN = Perceived innovativeness, BIN = Behavior intention, ADP = Adaptability of mobile application, CTX = Context. TRS = Perceived trust, CUL = Culture

6 Conclusions

Currently, the world is changing faster than ever before, and due to computer-human interaction (Al Mahdi et al., 2019), humans are facing multidimensional challenges. As a result, the work structure (Chin and Ahmad, 2015; Mohamad et al., 2021; Zhonggen and Xiaozhi, 2019) is rapidly adopting modern-day requirements. The learning system and particularly educational institutions are facing rapid changes in their course content to align with modern education systems. In this regard, the role of stakeholders (government officials, education policymakers, the teaching community, and district education administration) is crucial in applying modern tools and techniques to education.

Mobile learning (Alalwan et al., 2018a; Chinomona, 2013; Gan and Balakrishnan, 2018; Guerrero et al., 2009) provides a platform for a self-centric approach, an independent learning attitude, content selection based on interest, studying without space, location, and time hurdles (Al-Rahmi et al., 2021; Gao et al., 2021; Sun and Gao, 2020), lesson preparation based on student intelligence level, explanation of complex ideas via audio-visual lectures (Chin and Ahmad, 2015; Gan and Balakrishnan, 2018; Mohamad et al., 2021; Zhonggen and Xiaozhi, 2019), a collaborative learning attitude, enhancing student skills through emotional intelligence tests, rapid feedback, as well as effective evaluation/monitoring of student and teacher performance (Assaker, 2020; Bozkurt, 2019; Brindley et al., 2004; Kalogiannakis and Papadakis, 2019; Qashou, 2021; Uğur et al., 2016) in a more idealised way.

Mobile learning not only influences the performance of teachers in the educational setup, but it also applies to multiple performance evaluations of employees in medical, sales promotion jobs, higher education institutions (Al-Adwan et al., 2018; Al-Rahmi et al., 2021; Chavoshi and Hamidi, 2019; Hamidi and Chavoshi, 2018), and the banking sector (Chin and Ahmad, 2015). However, the primary and secondary education setups require more attention to design such a strategy that not only enhances the communication capabilities of teachers but also boosts student learning attitudes. Based on these challenges and building upon previous theories related to mobile learning, the bigger challenge is to design a suitable/best way of learning. With the importance of mobile learning and its easy way to communicate with a larger group through different training sessions, the mobile application is an appropriate strategy to cope with the frequent changes of the 21st century in the workplace environment.

As in Pakistan, Khyber Pakhtunkhwa is trying to revolutionise the primary and secondary education setup by adopting and applying international standards. In this regard, primary and secondary education institutions face multiple challenges, i.e., increased enrolment, diverse community, archaic teaching methods, aged teachers, courses translated to English medium instead of the local language, teachers' lower performance for newly designed courses, lack of advanced tools, lower levels of interest in preparing lessons, and many more.

The survey was based upon a personally administrated questionnaire through newly inducted teachers that use official mobile gadgets/tablets for lesson preparation and acquiring as well as transforming knowledge through advanced tools in classrooms. Based on detailed literature and theoretical underpinning of mobile learning additional features (perceived innovativeness and perceived enjoyment) were added (Chavoshi and Hamidi, 2019; Gao et al., 2021, 2016; Hamidi and Chavoshi, 2018; Saroia and Gao, 2019) model of mobile learning. Uğur et al. (2016) model is based upon Gao et al. (2016) basis, while Chavoshi and Hamidi (2019) add two additional features culture for using

mobile and personal characteristics/features to extend the concept of Gao et al. (2016). However, the current study extended the model of Hamidi and Chavoshi (2019) and use additional features of mobile learning as a tool of an innovative way to understand the desired lesson by expert videos available online. Similarly, the perceived level of enjoyment attached to using mobile for learning is also added as another feature to understand the respondent's affiliation with online learning. Based on the findings out of 11 hypotheses 10 are accepted in the current study. Perceived usefulness denotes an insignificant association with respondent behaviours intention to use mobile as a tool for learning. Based on the findings it is evident that H6 is rejected. However most of the previous studies (Al-Emran et al., 2020; Almaiah and Alismaiel, 2019; Chavoshi and Hamidi, 2019; Gao et al., 2016; Hamidi and Chavoshi, 2018) indicate that perceived usefulness has strong association with the behaviours intention. One of the possible reasons may be that in Pakistani work context (specifically sample understudy) the use of mobile technology is not accepted among female teachers specifically due to the cultural barriers as well as ethos of using mobile phone by females. As female respondents are almost 33% of the study, hence the possibility is that cultural barriers, family structure and ethos may be the reason behind the insignificant relationship between perceived usefulness and intention to use mobiles.

Another possible reason behind the insignificant relation may be that the newly hired teachers are mostly highly qualified as they were recommended based on external testing agency evaluation. Secondly, they have to prepared their lesson from this advanced technology as after an interval of 2 months these teachers appear in state-level examination and test is conducted to not only evaluate their performance, but other fringe benefits are also attached with the results of these test. Hence, it does not matter either these advanced tools/techniques are useful or not these teachers have to apply advanced technology to prepare themselves for upcoming challenges. Results of the current study denote that context is strongly associated with PUF and EOU factors. Similarly, perceived ease of Use is also significantly associated with the PUF factor. Culture denotes significant strength with behaviour intention of using mobile learning application, at the same time CPQ also denote a significant relationship with culture attribute. Hence it can be deduced that the culture of using a mobile application for learning purposes is also attached to an individual's characteristics/qualities for developing their abilities to overcome multiple challenges. In the current study, information was obtained from only newly inducted teachers through NTS. Hence it cannot generalise to other teachers that are performing their jobs for a long time. The research study focuses on various factors associated with accepting mobile technology among teachers of Primary and secondary education in district Bannu Pakistan. Hence the findings of the current study will be helpful to evaluate the NTS-based teachers hired in more than 15,000 teachers from 23 districts of Khyber Pakhtoonkhwa Pakistan. Findings will be also helpful to the policymaker to understand the challenges and opportunities with an adaptation of mobile/online learning among new teachers to tackle the modern-day challenges in a more effective way. However, the current model can be utilised by comparing it with previous mobile learning models in different education setup of developed and developing countries. The model can also add other social and economic issues to strengthen the understanding related to the diverse nature of online/mobile learning attitude.

7 Limitations and future prospective

One of the major challenges in applying mobile application systems to education teachers is its requirement of internet facilities, advanced knowledge, and provision of appropriate tools. In this regard KP government offers tablet gadgets with designed modules of proper lesson planning, relevant videos are installed in advance, and offer an offline solution to the learners. Hence internet facility is not too much required in the case of automated videos, however as most of the teachers belong to the far-flung area of Bannu and consistent load-shedding question the ability of teachers to prepare their daily lesson from these online sources. Secondly, as these digital gadgets automated videos consist of a single video for each topic, hence in case if further knowledge is required than the availability of the internet via mobile is essential to avoid confusion in that particular topic. Hence without the facility on mobile along with online data access the system couldn't prevail to produce desired results.

The current study is conducted in NTS based teachers from district Bannu KP Pakistan and to apply it to other private sector schools. As the work culture, technology-related knowledge of teachers, work ethics, organisation standards; leader's attitude and student-teacher interaction are different among government and private schools. In the current study, mobile application impact on the performance of teachers is evaluated, while in the future the response from a student regarding teachers may also be investigated. Another limitation of the study is that information was collected from only one district that is situated in the southern zone of KP Pakistan that is not technologically advanced. In the future information from different districts based upon zonal allocation may be collected to get detailed insights. The similar model may be applied to other countries of the region to understand the dynamic attributes of mobile learning on primary school teachers effectiveness.

The current study provides detailed foundations to apply the TAM model in the educational set up through the mobile application system to boost the capabilities of teachers, and to face the challenges of 21 centuries with an effective strategy. In the current ear education institution equipped with proper technological/mobile application can offer better solutions for the community to promote education in remote areas of the world. However individual interest in applying mobile technology for self-development may be spurring through providing advanced training opportunities. In this regard, successful TAM-based case studies result from developed and developing countries may be share with district education officers to heighten the motivation of teachers for applying these advanced tools to improve their capabilities. Further researchers that are interesting in applying mobile applications to education institutions may focus on video lesson display during the classroom, pre, and post-test analysis after playing videos on laptops/ mobiles for promoting brainstorming and focus on designing videos in the local language (Localisation) to enhanced understandings of the student. It can become a good option to intermingle technology/mobile applications, human subject knowledge, and localisation option to offer the best solutions to the students for learning capabilities. Hence the researcher should think in detail about these factors for the digitisation of education through computer and human interactions.

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