Research Status and Trend Analysis of Influencing Factors of Mobile Learning

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Abstract: Since mobile learning plays the significant role in the epidemic period and post-epidemic era, exploring its influencing factors is indispensable to improve the effectiveness of mobile learning. Massive amounts of previous studies and researches at home and abroad were analyzed in this research, and it was found that previous studies on influencing factors of mobile learning mainly focus on TAM model, but ignore learners' internal psychological cognition, which might be the most important subjective factor during the process of mobile learning. It is well known that any learning process is inseparable from learners' psychological and cognitive activities, and mobile learning is no exception. When learners take the advantage of novel technological instruments in the process of mobile learning, stimulation will lead to changes in learners' mindsets and organisms, which in turn brings changes in their responses and behaviors. Therefore, in the future, the combination of UTAUT model and SOR model might be beneficial for scholars to explore learners' psychological changes in the process of mobile learning profoundly, to improve learners' continuous willingness for mobile learning behaviors effectively, and to enhance the effectiveness of mobile learning.

Keywords: Mobile Learning; Influencing Factors; TAM Model; UTAUT Model; SOR Model

1. Introduction

Under the background of educational informatization, mobile devices not only provide personalized services for individuals in all areas of life, but also bring fundamental changes to the field of education, which has been deeply concerned by educators and learners. With the outbreak of COVID-19 in many countries, mobile learning based upon those mobile devices has become an essential way for global learners to accomplish assignments with quality and quantity during and after the epidemic or pandemic. Learners can proceed learning behaviors anywhere and anytime via mobile devices and their relative applications [1,2].

Therefore, dimensions and factors involved in influencing factors of learners' continuous willingness to proceed mobile learning have attracted much attention from scholars at home and abroad. By analyzing previous studies at home and abroad in details, the research status and trend analysis of influencing factors of mobile learning were illustrated and clarified in this study. Moreover, characteristics of existing literature were explored in multiple dimensions, and the trend of future researches was scientifically predicted, with a desire to improve the continuous willingness of mobile learning and enhance its ultimate effectiveness.

2. Literature Review

In 2014, Keengwe et al. pointed out that the number of people who own mobile devices has increased sharply in recent five-running years [3]. In March 2020, according to Cisco's annual Internet Report (2018-2023), almost three quarters of the population in the world will have the access to a mobile phone by 2023. In addition, data from INEC (Instituto National de Estadistias y Censos) show that at least 76.8% of the population in Ecuador has access to a smartphone. Hence, it can be summarized that with the accelerated development of information and technology, mobile devices have become an indispensable equipment in our lives and have a monumental impact on our daily lifestyle and production.

Nowadays, mobile devices not only provide convenient services for people in all areas of life, but also bring profound changes to the teaching mode or learning mode, which is favored by educators and learners. Many

foreign scholars believe that mobile applications based upon learners' needs and promoted by educators can effectively improve the learning performance of learners and produce positive results for those learners [4-6]. Chinese scholars named Guo Man and Fu Xiaoli also pointed out that mobile learning enabled by mobile technology can significantly enhance the learning interest of learners, strengthen the autonomous learning ability of learners, optimize the learning habits of learners and ultimately improve the English listening proficiency of learners [7].

However, Aristovnik et al. found that almost 50% of learners who have accepted the survey and investigation stated that mobile learning based upon mobile devices and their relative applications not only made it difficult for them to concentrate, but also rarely help them understand teaching contents and accomplish assignments [8]. What's worse, some learners even claimed that mobile learning does not imply the occurrence of real learning behaviors [8].

Moreover, Kuhfeld et al. believe that in the process of mobile learning, the lack of extracurricular activities and interpersonal interactions may bring greater psychological pressure to learners [9]. At the same time, because educators cannot keep track of the mental state of learners online, learners' psychological issues tend to become worse and worse [9]. Therefore, educators need to make use of new technological methods to regulate factors that are able to affect learners' continuous intention of mobile learning, to reduce learners' psychological pressure of mobile learning, to lower learners' cognitive burden of mobile learning, and to enhance learners' motivation and efficiency in order to improve learners' effectiveness of mobile learning [10].

With the purpose of analyzing the current research status of influencing factors of mobile learning, the first step of this study is to quantify the previous literature. China National Knowledge Infrastructure was regarded as the source of literature and the search formula "subject = mobile learning and subject = influencing factors" was designed. Finally, a total of 171 papers were retrieved, focusing on mobile learning under the background of educational informatization. The specific distribution of previous literature is shown in Figure 1.

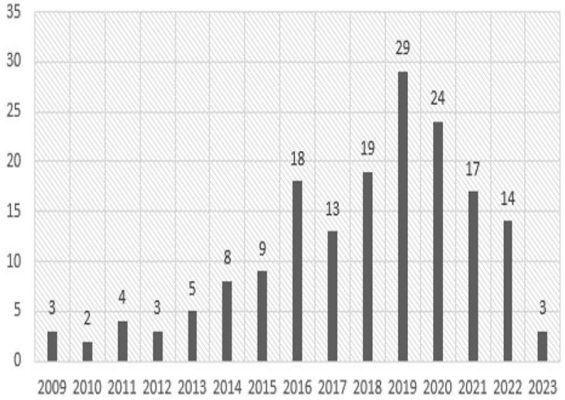

Figure 1. Distribution of Previous Literature Related to Influencing Factors of Mobile Learning

As is known to all, the total number of papers that have been publicly published in various journals, meetings or papers is one of the important indicators to measure the development of a certain field. According to Figure 1, the number of published papers shows the sign of significantly increasing in 2016 and 2019. Although the number of papers closely related to those influencing factors of mobile learning shows the sign of declining from 2020, the total number of published papers from 2019-2023 is 87 papers, accounting for half of the total number of published papers from 2009-2023. And it has exceeded the total number of publications in the previous 10 years. On the whole, although scholars' research in this field has fluctuated to some degree, the importance of this field has gone without saying in recent years. Therefore, even though the research connected with the mobile learning in higher education is still in its infancy phase, and only a limited number of scholars have attached the importance to factors affecting the willingness of mobile learning, researches on this topic are on the rise due to the crucial role of mobile learning in the global post-pandemic era.

In order to explore influencing factors of mobile learning, 171 published papers were analyzed in details and it was found that previous studies on influencing factors of mobile learning mainly focus on TAM model and UTAUT model.

2.1 Studies Related to TAM Model

Huang et al. added two variables named the perceived value and perceived interest to TAM model. By delivering questionnaires to 313

college students and analyzing the data with statistical tools, Huang et al. discovered that both variables of the perceived value and perceived interest can have an impact on the mobile learning of learners [11]. In 2009, on the basis of TAM model, Akour added new variables including preparation, accessibility, service quality, and school support to conduct a survey and research on freshmen, and concluded that new variables were strongly correlated with learners' willingness of mobile learning [12]. Liu Aijun et al. conducted the investigation on learners' acceptance of mobile learning and its influencing factors with the aid of TAM model, and found that although mobile learning has been widely accepted by learners, the prominent problems of insufficient learning resources and low learning efficiency are still obstacles and bottlenecks to the continuous improvement of learners' willingness of mobile learning [13].

In 2015, Zhu Jing applied TAM model to investigate graduate students in normal universities. Through descriptive and inferential analysis of questionnaires, it was discovered that variables including perceived entertainment, social influence and resource optimization positively affect the attitude of participates for mobile learning, but perceived usefulness has no effect on the participates' attitudes towards mobile learning [14]. Based on TAM model, Jiang Bingqian probed into influencing factors related to learners' mobile learning via WeChat from the perspective of behavioral intention and satisfaction. The results show that a certain number of variables may have evidently positive effect on learners' behavioral intention and satisfaction, such as perceived usefulness, perceived ease of use, perceived entertainment, and social influence [15]. Kemp et al. extended the TAM model to identify those decisive factors of promoting the usage of mobile learning applications among learners. The experimental results display that the resistance to changes in novel learning styles and the attachment to traditional learning styles have a monumental influence on participates' diverse behaviors of mobile learning [16].

2.2 Studies Related to UTAUT Model

The earliest study on UTAUT model in CNKI is *A Study on Users' Acceptance Behavior on Mobile Internet Usage* published by Wu Xuefei in 2008. Based on the UTAUT model, Wu Xuefei proposed the model of users' acceptance of mobile internet and analyzed the relationship among various variables through statistics [17]. Venkatesh et al. also made use of the UTAUT model to explore influencing factors connected with learners' mobile learning. They discovered that the perceived data quality, the perceived similarity, the perceived trust, the perceived awareness, the perceived sufficiency of self-preparation and the perceived security are the main factors affecting learners' acceptance of mobile learning [18]. He Huimin and Zhang Hui believe that although TAM model and UTAUT model are both classical models in the field of information acceptance system, UTAUT model has more specific external regulating variables and also has higher explanatory power compared with TAM model [19].

On the basis of UTAUT model, Wen Shufeng et al. illustrated and clarified the detailed impact of four factors including perceived ease of use, perceived usefulness, perceived entertainment and personal innovation on the intention to employ mobile learning applications, and summarized that all the other three factors had a positive effect on the intention to employ mobile learning applications compared with the insignificant influence of perceived ease of use on learners' intention [20]. Azawei et al. also regarded the UTAUT model as the foundation to compare the motivation of learners in Saudi Arabia and Iraq in mobile learning and probe into influencing factors of their mobile learning in Saudi Arabia and Iraq. It was summarized that there are significant differences in learners' perception, behavioral intention and motivation for mobile learning [21]. By making use of the UTAUT model, Feng Yonghua and Zhang Senwei compiled a questionnaire survey on influencing factors of mobile learning. They found that learning motivation and behavioral intention directly and positively affect mobile learning behaviors, while performance expectancy, effort expectancy, learning resources and social influence indirectly and positively influence mobile learning behaviors [22].

3. Discussions

After analyzing previous studies at home and abroad in details, the author summarized that the existing literature related to influencing

factors of mobile learning mainly focuses on the application of objective information technology and external moderating variables, but ignores the most important subjective factor of learners' internal psychological cognition.

It is common knowledge that any form of learning cannot be separated from the learners' internal psychological cognitive activities, and mobile learning is no exception. When learners applied novel technological media in mobile learning, stimulus may bring changes in mindsets or differences in learning organizations, which in turn resulted in changes in their specific learning behaviors or behavioral responses.

Therefore, in further studies, the integration between UTAUT model which is the acronym of Unified Theory of Acceptance and Use of Technology model and SOR model which is the acronym of Stimulus Organism Response model will not only help scholars to profoundly detect learners' psychological changes and their attitudinal tendency in the process of mobile learning, but also help scholars systematically analyze the main factors affecting learners' continuous intention of mobile learning, scientifically construct the structural model of influencing factors of mobile learning, deeply analyze the mechanism of various factors, correctly explore specific channels and paths to improve learners' continuous intention of mobile learning, and ultimately put forward recommendations for the high-quality mobile learning.

With regard to the UTAUT model, three regulating variables and four foundational variables can be regarded as the main structure in future studies. Venkatesh et al. believe that performance expectancy, effort expectancy, social influence and facilitating conditions are the four foundational variables that affect users' willingness to accept information technology and that influence users' behaviors [23].

When this concept is transferred to online education, performance expectancy refers to the degree to which learners maintain that their learning performance will be improved after using mobile devices in the process of mobile learning. Similarly, effort expectancy refers to how easy it is for learners to employ mobile devices in the process of mobile learning. Social influence refers to the extent to which learners state that surrounding groups including educators or peers influence their usage of mobile devices in the process of mobile learning. Facilitating conditions refer to the degree to which learners claim that mobile devices or terminals will support their learning activities in the process of mobile learning.

In addition to the four foundational variables discussed by Venkatesh et al., the UTAUT model also consists of four control variables named gender, age, experience and voluntariness. Scholars may explore the impact of four control variables on learners' behavioral intention and specific behaviors of mobile learning after strengthening or weakening the four control variables. However, since mobile learning has been considered as a necessary part of many courses in the post-pandemic era, the voluntariness of learners should no longer appear in influencing factors of mobile learning.

In terms of the SOR model, learners' self-efficacy and subjective well-being will be considered as the main structure in future studies. Yang et al. pointed out that SOR model not only helps to explain learners' psychological cognitive changes and learning intention responses in the process of mobile learning, but also helps to illustrate individuals' internal psychological changes caused by the environmental stimuli [24].

According to SOR model, all behaviors consist of the necessary process of integration between internal and external factors, that is, internal psychological procedures are combined from the interaction between people and the external environment [25]. Specifically, the process of interaction between human beings and the external environment involves social dimensions including perception and connection, which might affect the integration between environment and individuals, and meanwhile change the concrete behaviors of individuals [25]. Therefore, in the process of mobile learning, the stimuli perceived by learners can be regarded as stimuli of the external environment, which is closely related to the internal psychological processes generated from mobile learning, such as self-efficacy and subjective well-being.

The definition of self-efficacy has been extensively discussed in various stages of education in order to explore the positive

influence of psychological cognition on learners' learning behaviors. Tims et al. have demonstrated that if the self-efficacy of individuals is higher, it will be more possible for them to work harder to obtain abundant learning resources and meanwhile they will be encouraged to actively participate in diverse learning activities [26]. What's more, subjective well-being is the sense of happiness or satisfaction when an individual feels successful or capable of handling the pressure. Subjective well-being is crucial to learners' mobile learning, because it can not only promote learners' active learning and active participation, but also improve their critical thinking capacity and their psychological health.

Hence, based on the integration between the UTAUT model and SOR model, the hypothesis of influencing factors of mobile learning in Table 1 can be shown in future relevant studies.

Table 1. Hypotheses of Influencing Factors of Mobile Learning Based on UTAUT-SOR Model

Orders of Hypotheses	Contents of Hypotheses
Hypothesis One	Gender plays a moderating role in learners' willingness to proceed or carry out mobile learning.
Hypothesis Two	Age plays a moderating role in learners' willingness to proceed or carry out mobile learning.
Hypothesis Three	Experience plays a moderating role in learners' willingness to proceed or carry out mobile learning.
Hypothesis Four	Perceived usefulness in facilitating conditions has a positive and energetic influence on learners' performance expectancy.
Hypothesis Five	Perceived ease of use in facilitating conditions has a positive influence and energetic on learners' effort expectancy.
Hypothesis Six	Learners' performance expectancy has a positive and energetic influence on their willingness to proceed or carry out mobile learning.
Hypothesis Seven	Learners' effort expectancy has a positive and energetic influence on their willingness to proceed or carry out mobile learning.
Hypothesis Eight	Learners' performance expectancy has a positive and energetic influence on their subjective well-being reciprocally.
Hypothesis Night	Learners' effort expectancy has a positive and energetic influence on their self-efficacy reciprocally.
Hypothesis Ten	Social influence has a positive and energetic influence on learners' subjective well-being.
Hypothesis Evelen	Social influence has a positive and energetic influence on learners' self-efficacy.
Hypothesis Twelve	Learners' subjective well-being has a positive and energetic influence on their willingness to proceed or carry out mobile learning.
Hypothesis Thirteen	Learners' self-efficacy has a positive and energetic influence on their willingness to proceed or carry out mobile learning.
Hypothesis Fourteen	Social influence has a positive and energetic influence on their willingness to proceed or carry out mobile learning.

4. Conclusions

With the advent of the post-epidemic era, discussions related to influencing factors of mobile learning at home and abroad are on the rise. However, a detailed illustration of those potential and underlying influencing factors of mobile learning is the focus of future researches. Due to the variety of potential influencing factors and intense cross-disciplinarity, scholars are required to sift through the massive amount of literature and relevant researches. Additionally, the construction of an effective model related to influencing factors of mobile learning is a salient challenge in the future.

The construction of the model will directly determine the scientificness and effectiveness of the entire research, so scholars at home and abroad should constantly propose the innovative model to explore those underlying influencing factors of mobile learning. The

empirical data can further promote scholars to explore channels and paths of willingness to mobile learning, so as to make mobile learning an effective learning mode, which definitely will be conducive to the development of "ubiquitous learning" and "fragmented learning" in the post-pandemic era.

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