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Factors Influencing Utilization of ICT Among Pre-service Teachers: A Review of the Literature

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Abstract

Global investment in information and communications technology (ICT) to improve teaching and learning in schools have been initiated by many governments. Investigation in the past decade revealed that ICT are effective resources for spreading educational opportunities. Many governments in the world have invested in ICT for improving teaching and learning in schools. Despite the huge investment of financial and human resources, communications building and innovations to facilitate ICT use in schools, the use of educational technology has been limited. This article is based on a review of journal articles that focused on pre-service teachers' utilization of ICT for academic activities. There were at least 61 articles reviewed. Of 61 articles 23 were on factors influencing pre-service teachers' utilization of ICT in their classrooms. The articles were empirical and meta-analysis reviews on the factors affecting utilization of ICT among pre-service teachers. The following study investigated the influence of relative advantage, complexity, compatibility, perceived ease of use, perceived usefulness, effort expectancy and performance expectancy of an innovation, on encouraging pre-service teachers' use of ICT in the classrooms. Comparison and analysis factors influencing pre-service teachers' utilization of ICT in their classrooms indicated that perceived usefulness, perceived ease of use of technology, and user's attitude to be significant in decisions and intentions to use ICT in the classroom.

Keywords

ICT Utilization, Pre-service Teachers, Perception

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1. Introduction

The rapid growth of ICT has affected all dimensions of daily life activities in general and education in particular. ICT supplies different chances for schools and universities to advance their educational systems, meet students' needs, and prepare the new generation for future challenges [1]. ICT helps higher education students to handle the knowledge that is especially for pre-service teachers [2]. Thus, if pre-service teachers do not adapt themselves to new technologies, they will face challenges [3, 4]. Through knowledge management, pre-service teachers would be able to share their experiences and resources and adopt best practice for more training [2]. Studies carried out by Chen [5] highlighted important roles of pre-service teachers. According to Fook, Sidhu, Kamar, and Abdul Aziz [6] the importance of ICT utilization in education has been substantially addressed by academics and policy-makers worldwide. Thus, if per-service teachers were to be equipped to compete in the global information society, education has to be transformed and ICT must be included in the teaching and learning process. For understanding the importance of this perspective, many governments took ICT investment to equip pre-service teachers with the technology knowledge and skills [6-8]. Indeed, pre-service teachers are the teachers of the future. They are expected to integrate ICT

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into their future classroom activities. Thus, it is important to identify their knowledge and use of ICT in education, and understand factors and conditions associated with that knowledge and use.

2. Background of Study

Although stakeholders in education, especially the ministry of education expected a high-level of ICT acceptance in the schools, ICT acceptance and use in training and learning procedure have been limited [9]. In other words, levels of ICT integration in many countries have often been low [7, 10-15]. As mentioned previously ICT only may not contribute significantly to education reform efforts without integrating ICT into education. Luan and Teo [16] investigated 245 Malaysian pre-service teachers' intentions to use computers. Findings indicated that student teachers are not being adequately prepared to integrate ICT into their classrooms. It was revealed that more than half of the teachers possessed only moderate levels of ICT capability and that the problem referred to their pre-service teacher education. In line with this idea Lei [17] conducted a survey on 55 participants in Syracuse University. Among the 55 participants, 9 were male and 46 were female. The result pointed out that although student teachers use ICT extensively, their ICT use has been generally focused on their social-communication and their learning activities as students. Doubtless, promoting ICT acceptance among pre-service teachers to increase student achievement has been recognized by governments and educational leaders. However, it should be noted that the increase in accessibility of technology at schools and pre-service teachers' knowledge using technology does not essentially lead to advanced ICT use in the classrooms. Because, a technology itself is not essentially a vehicle for varying and improving students' achievement. ICT integration can only be efficient by equipping its possible pre-service teachers with the necessary practical skills in using the ICT in the classroom [18]. So, a major question is which reasons influence pre-service teachers' use of ICT in the classrooms. Hence, we aimed at reviewing the literature on comparison and analysis factors influencing pre-service teachers' utilization of ICT in their classrooms.

3. Methodology

There were at least 61 articles reviewed. Of 61 articles 23 were on factors influencing pre-service teachers' utilization of ICT in their classrooms. The articles were empirical and meta-analysis reviews on the factors affecting utilization of ICT among pre-service teachers. The articles were mainly downloaded using University Putra Malaysia subscribed data bases. ProQuest, Science Direct, Springer, Scopus and Ebscohost were among the frequently used. In addition, Google scholar was also employed. The related journal articles on factors influencing pre-service teachers' utilization of ICT in their classrooms were downloaded with cut off limit from 1975 to 2018 only. The downloaded articles were then organized and summarized in the following sections.

4. Characteristics of an Innovation

Based on the literature, since the 1980s plenty of research on ICT acceptance has been carried out. Main sections of these investigations concentrated on exploring the factors influencing ICT acceptance among pre-service and in-service teachers. Many studies indicated factors affecting ICT acceptance in teaching and learning were categorized into four groups, namely: innovation characteristics, individual characteristics, organizational characteristics and environmental characteristics [5, 19, 20-24]. Innovation characteristics include effort expectancy, performance expectancy, relation advantage, complexity, compatibility, perceived ease- of-use and perceived usefulness. Researchers indicated that these factors can play a powerful role in ICT acceptance of pre-service teachers into their future classrooms [25-29]. Thus, if pre-service teachers distinguish the property of an invention (effort expectancy, performance expectancy, relation advantage, complexity, compatibility, perceived ease- of -use, perceived usefulness) this has a strong impact on of acceptance of an innovation in education and their prospective classroom. Doubtless, pre-service teachers play a significant role in the teaching and learning the process in their future classroom. Researchers believe that pre-service teachers must understand the role of technology in education. This paper reviews factors that impact student teachers' decisions to use ICT in their future classroom. It is expected that the findings from this study would benefit pre-service teachers in making a decision to use ICT in their future classroom.

5. ICT Acceptance Theories

It is commonly accepted that today's educators might take advantage of ICT tools to a great extent. Thus, failure in the acceptance or usage of technology is a significant subject. Therefore, it is essential to define the term 'technology acceptance' to decide the elements affecting the actual use of ICT in the schools [30]. Many theories have been suggested for the design, development, and acceptance of ICT and explained users' acceptance behavior for instance: unified theory of acceptance and use of technology UTAUT [31], social cognitive theory [32], technology acceptance model

TAM [33], theory of reasoned action [34], the innovation diffusion theory IDT [35], and theory of planned behaviour [36]. Among these models, the Unified Theory of Acceptance and Use of Technology (UTAUT; [31], Technology Acceptance Model TAM [33], and Innovation Diffusion Theory IDT [35] are considered to determine which factors influence pre-service teachers' acceptance of effective ICT integration into their classrooms.

5.1. Unified Theory of Acceptance and Use of Technology (UTAUT)

The newest theoretical models that have been proposed to describe users' acceptance behavior is the unified theory of acceptance and use of technology (UTAUT). This theory is a technology acceptance model formulated by Venkatesh et al. [31] to study ICT acceptance and usage of new technologies introduced within organizations. The theory aimed at explaining user purposes in using ICT; it suggests that four key factors (effort expectancy, social influence, facilitating conditions, and performance expectancy) are influencing the utilization intention and behavior to use ICT [31].

5.2. Innovation Diffusion Theory (IDT)

Another relevant theory and model with this study is Innovation Diffusion Theory (IDT). Rogers [35] developed the innovation diffusion theory (IDT). The theory explains why, how, and at what rate innovation and technology spread through societies. It is one of the important acceptance theories on innovation diffusion within societies at a global level [37]. Rogers [35] defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Also, Rogers noted that although there is a lot of diffusion research on the characteristics of the adopter categories, there is a lack of research on the effects of the perceived characteristics of innovations on the rate of adoption. Attributes of innovations include five characteristics: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability.

5.3. Technology Acceptance Model (TAM)

Besides, Davis [33] pointed out that when a person is offered with an innovation, different essentials influence their decision about when and how to use it. According to Stockdill and Moreshouse [38] content characteristics of user, managerial ability, and technological considerations are important factors that influence ICT acceptance and integration. In addition, Balanskat et al. [39] recommended that teacher-level, system-level and school-level influence ICT acceptance and integration. The Technology Acceptance Model suggests how users come to accept and use a technology. Moreover, this model points to that when users are offered with an innovation, a number of factors influence their decision about how and when to use the new technology that include: Perceived usefulness and Perceived ease-of-use [33].

6. Relationship Between (TAM), (IDT) and (UTAUT) Theories

There is a complementary relationship and similarity existing between unified theory of acceptance and use of technology, technology acceptance model, and innovation diffusion theory. For example, the relative advantage of the innovation in IDT is similar to the perceived usefulness in TAM, while the complexity of the innovation in IDT related to the perceived ease of use in TAM theory. Teo [19] investigated on TAM and IDT theories to examine student teachers' attitudes toward computer use. The finding of this study revealed that technical difficulty has a positive direct influence on perceived ease of use and a negative effect on perceived usefulness. Therefore, if an innovation is perceived to be complex to learn and use, it is probable to be perceived to be so boring and time-consuming that a lot of effort has to be expended in order to benefit from it. Moore and Benbasat [39] indicated that the relative advantage construct in invention diffusion theory is alike to the perceived usefulness, and the difficulty construct in innovation diffusion theory is alike to perceived ease of use. Furthermore, Teo [40] investigated relationship between innovation diffusion theory (IDT) and Unified Theory of Acceptance and Use of Technology (UTAUT). The results revealed that, facilitating conditions, attitude towards use, and perceived usefulness, have direct impacts on behavioral intention to use ICT. Moreover, facilitating condition has direct and indirect impact on behavioral intention to use ICT. When users perceived sufficient support to be available, accessible, and timely, they also perceived the use of ICT to be relatively free from effort and this could have strengthened their intention to use technology.

7. Factors Influence Pre-service Teachers' ICT Utilization

This review investigated pre-service teachers' ICT acceptance and identifies factors that impact on their determination to use ICT in the classroom. Review of the past literature suggested that several factors influence pre-service teachers' ICT acceptance and integration. The following sections discuss these factors by drawing on relevant studies on ICT utilization by pre-service teachers. This is because the bulk of

the article is devoted to discussion of these factors under separate sub-headings. These factors include effort expectancy, relative advantage, complexity, compatibility, performance expectancy, perceived usefulness, and perceived ease of use.

7.1. Perceived Usefulness

Davis defined this as "the degree to which a person believes that using a particular technology will enhance their job performance" [33]. In relation to this, Teo and Schaik [24] examined learning technology and attitude toward computer use among student teachers. They exposed that perceived usefulness has many influences in approach towards using a computer between student teachers in Singapore. Also, Sadaf, Newby, and Ertmer [41] studied factors that influence future teachers' intentions to use Web 2.0 in the schools. The result showed that perceived usefulness and positive attitudes are significant factors in pre-service teachers' intentions to use technologies. Wong, Teo, and Russo [13] investigated the impact of gender and computer teaching efficiency on computer acceptance among 302 Malaysian pre-service teachers. The findings of their study indicated that perceived ease -of -use, perceived usefulness, and attitude to use ICT have a significant influence on behavioral intention to use ICT. Furthermore, Ma, Andersson, and Streith (2005) conducted a study to examine pre-service teachers' perceptions of computer technology in relation to their intention to use computers. The study exposed that perceived ease- of- use, and perceived usefulness were the constituents that influence pre-service teachers' intention to use ICT. They concluded that student teachers need to feel comfortable to use computer technology and need to be shown how it can be helpful to them. In a similar study, Smarkola [26] used the TAM theory to examine pre-service and experienced teachers' computer use in the classroom. The study exposed that technology use intention was predicted by perceived usefulness, and perceived ease- of-use. The findings exposed that pre-service teachers and skilled teachers use technology mostly for association work. Additionally, perceived usefulness has a better influence on perceived ease-of- use.

7.2. Perceived Ease-of–Use

Perceived ease of use was defined by Davis as "the degree to which a person believes that using a particular system would be free from effort". "Perceived ease of use is considering the extent a person believes that using the system will be free of effort" [33], (p, 320). Many studies offer evidence that perceived ease of use has influence on the user intention to use and accept ICT. For instance, Luan and Teo [16] examined 245 Malaysian pre-service teachers' intentions to use computers in their classrooms. The result showed that perceived ease of use, perceived usefulness, and attitude towards computer use were found to be important in determining pre-service teachers' intentions to use computers.

Furthermore, findings indicated that technology-training programs must concentrate on increasing positive perceptions of ICT usefulness and its ease of use as well as encouraging positive attitudes toward ICT use among pre-service teachers. Besides, Teo et al. [23] explored student teachers' self-reported future intentions to use a computer with a sample of 495 Singaporean and Malaysian student teachers. The study indicated that attitudes to computers, perceived usefulness, and perceived ease of use, were important among Singaporean and Malaysian teachers' behavioral intention to use educational technology in their classrooms. According to Venkatesh and Davis [31] perceived ease-of-use influenced the perceived usefulness, because, when an innovation is easier to use and enables free-form effort it will be perceived as more useful. In addition, Luan and Teo [42] conducted a study on 245 Malaysian pre-service teachers' acceptance of computer technology. They found users' approach to use, perceived ease of use, and perceived usefulness of a technology to be important determinants of intentions to integrate computer technology into the classroom.

7.3. Relative Advantage

Relative advantage is the degree to which a new technology is more beneficial to the user than the competing brands. Rate of acceptance of a new technology offering depends on its relative advantage as perceived by its prospective user. Rogers defined this as "The degree to which an innovation is perceived as being better than its precursor" [35], (p. 15). Researchers continually indicated the relative advantages are important reasons that positively affect the users' intention to use a technology. For example, Alhawiti [43] examined intention and barriers affecting use of educational technology (online education initiative) among faculty members at Saudi universities. The results showed that faculty members did not use on-line training because of planning issues, substructure, and technical skill deficits. Furthermore, the relative advantage of a technology was an important character among faculty members to use an online education initiative. Similarly, Sahin (2012) who investigated student teachers' awareness of infusing ICT in education revealed that student teachers' perception positively increased about relative advantage and creativity and use of suitable technology in the teaching and learning procedure.

7.4. Complexity

Complexity is defined as "the degree to which an innovation is perceived being as difficult to understand and use" [33] (p.

16). Several studies suggested that complexity of innovation caused a negative influence on the user who intends to accept it. For instance, Teo [46] investigated the level of computer acceptance by 475 Singaporean student teachers. The result show that perceived usefulness, attitude towards computer use, and computer self-efficacy have direct effect on pre-service teachers' technology acceptance, whereas perceived ease of use, technological complexity, and facilitating conditions affect technology acceptance indirectly. In other words, the findings indicated the complexity of a computer has a negative influence on perceived usefulness, and a positive direct influence on perceived ease-of-use. Hence, if an innovation is to be difficult to use and learn, it is probable to be so uninteresting and taking much or too much time. Practically, there is a correlation among difficulty and utility of a technology. Thus when people are aware that an invention is difficult, they find the technology not as helpful in that it probably would be unlikely to be useful and efficient. Furthermore, Askar, Usluel, and Mumcu [56] examined perception of innovation characteristics among 416 teachers from 8 secondary schools in Ankara, the capital of Turkey. The findings in the study showed the difficulty of using multimedia during lessons and using computers for preparing instructional activities were common important factors that influence teachers' intention to use educational technology.

7.5. Compatibility

Compatibility is defined as "the degree to which an innovation is perceived as being consistent with existing values or past experiences" [35] (p. 16). Lai and Chen [47] conducted a study to examine factors that influence educator decisions about acceptance of blogs and the significance of using them. In this study, they used the comprehensive Innovation Diffusion Theory (IDT) that combines related factors from two sources: in the frame of individual ICT acceptance literature and in the frame of blogs research literature show the importance of knowledge sharing motivation. The results revealed those lecturers' decisions to accept use of blogs were strongly related to compatibility, perceived usefulness, and school support and perceived ease-of -use. In addition, Post [48] investigated the impacts of factors that influence a service-learning faculty to include e-learning in their curriculum. The participants in this study were 134 service-learning faculty from the United States colleges and universities. The results showed that compatibility had an important influence on perceived usefulness, and perceived ease-of-use.

The main effects of attitude and compatibility were statistically significant, indicating that they are important predictors of faculty behavioral intention to use e-learning technologies. Al-Taamneh [49] investigated elements that influence secondary teachers' decisions to accept Web 2.0 technologies to support classroom teaching and assessed secondary teachers' awareness of the benefit of using it in their classrooms. This study found that although the teachers were aware of the educational advantage of using these technologies in their classroom instruction, only a few of them often use Web 2.0 technologies in the classroom. In addition, behavioral intention, perceived ease-of-use, compatibility, self-efficacy, and perceived usefulness were important predictors of secondary teachers' use of web 2.0 technologies.

7.6. Performance Expectancy

Performance expectancy is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" [31], (p. 447). Many researchers [50, 45, 51] indicated that performance expectancy toward an innovation was a strong predictor of user purpose to use it. For example, Taiwo, Alan, and Downe [45] investigated 37 empirical studies that were directed to complement the experiential evidence. The result of the study has shown that the relationship between behavioral intention and performance expectancy is strong, while the relationships between behavioral intention and social influence, effort expectation, are weak. Similarly, Jong and Wang [51] modified the UTAUT theory to reason to accept web-based learning among university students. The findings showed that self-efficacy, social influence, simplifying conditions, attitude to use technology, and performance expectancy have an important impact on behavior intention. Furthermore, Lakhal, Khechine, and Pascot [50] directed a study on the Unified Theory (UTAUT) to explore factors influencing acceptance and use of the desktop video conferencing by university students. In this study, data were collected from 177 undergraduate business students. The results showed the key factors in using video conferencing were, in order of importance: general social influence, facilitating conditions, and performance expectancy.

7.7. Effort Expectancy

Effort expectancy is defined as "the degree of ease associated with the use of the system" [31], (p. 450). Effort expectancy is the extent of convenience perceived for using ICT. Similar constructs in other models and theories from semantic viewpoints are perceived ease of use (TAM), complexity (PC utilization model and innovation diffusion theory) [31, 33]. Previous research on UTAUT theory suggested that Effort expectancy was a strong predictor of user intention to use the technology. According to Birch and Irvine [52] who used Unified Theory (UTAUT) to examine the key factors that

impact on future teachers' acceptance of ICT to use in teaching, effort expectancy is the only significant forecaster of student teachers' attitude to use a technology in their future classrooms. In addition, age is the only important moderator. Fang and Liu [53] argued that effort expectancy, performance expectancy, and social influence forecast managers' intention to use Web 2.0.

8. Discussion and Conclusion

The utilization of ICT in teaching and learning has gained currency with the advent of ICT and the Internet in different permutations such as e-learning, learning Management System (LMS), blended learning, video conferencing and blogs, among others. This bears testimony to the premium accorded to ICT use in education. As such, the focus of this study addresses an area in education that is of interest and has gained currency among the academic community, i.e. the factors influencing pre-service teachers' utilization of ICT in the classroom. Although it takes the form of literature review, the inclusion of 31 studies lends breadth to the study with potential implications for analysis of trends and preferences among communities of pre-service teachers from different regions. The growth of ICT has complicated its acceptance and integration in classrooms by educators. Indisputable many reasons and elements influence successful ICT integration into teaching and learning. In this, the previous study has highlighted factors that positively and negatively impact pre-service teachers' ICT acceptance and use. These factors are relative advantage, perceived usefulness, complexity, compatibility, and perceived ease-of-use, effort expectancy and Performance expectancy. Furthermore, studies have shown that these factors are associated with each other.

On the perceived ease-of-use and perceived usefulness, several studies showed evidence of the influence of perceived ease of use and perceived usefulness on the intention to use and ICT acceptance. Research has shown pre-service teachers would be tending to use ICT if they are aware of ICT to be a significant way to work more efficiently, useful and free from effort, would directly affect student teachers' attitude [23, 29]. Therefore, when an innovation would improve their job performance and would be free from effort, pre-service teachers' approaches are positive for the use of ICT, then they can easily use it. On the relative advantage, complexity, compatibility a particular system, some studies indicated that this reason are key factors to diffusion and technology spread through societies. In addition, this factor had a significant influence on the intention to acceptance of the technology [46]. Thus, if a user distinguishes an invention as being consistent with past experiences or existing values and as being better than its precursor and does not be as difficult to understand. Therefore, this factors would be positively influence on the student's teachers' intention to use the ICT into their classrooms [44]. Finally, on the effort expectancy and performance expectancy, in previous ICT acceptance studies, indicated the effort expectancy and performance expectancy continuously was a strong predictor of intention to use. This factors, describe user intentions to use ICT and next usage behaviour [31, 45]. Hence, when an innovation or technology helps the user to improve in job performance, ease associated with the use of the system, will be significant predictor of pre-service teachers' attitude to use ICT in their classrooms.

Comparison and analysis factors influencing pre-service teachers' utilization of ICT in their classrooms showed that perceived ease of use, perceived usefulness of computer technology, and attitude to be a significant decision of intentions to use ICT in the schools [54]. Therefore, pre-service teachers need to be certain that ICT can create, enhance their teaching interesting; be free from effort; improve job performance; be consistent with user past experiences and existing values. In addition when an innovation is better than its precursor; more exciting for teachers and students; more motivating and more pleasing, then the teachers will accept it for use in their classrooms [55].

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