Implementing IoT in the Classrooms by Pre-Service Teachers

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Abstract—

Finding out what factors encourage aspiring teachers to think about using IoT systems in the classroom was the driving force for this study. The technology acceptance model (TAM) was used in an online learning environment to study pre-service teachers' views of the IoT's usefulness, ease of use, attitudes toward using it, and the influence of these attitudes on student behavior. The 47 participants were selected using a systematic random selection approach; they are all in their last year of pre-service teacher training. A regression approach was used for quantitative analysis of the data. Pre-service teachers' opinions about integrating IoT in the classroom were significantly influenced by TAM-related factors, such as the perceived usefulness and simplicity of use of the technology. But their outlook on the IoT didn't change their likelihood of really using it. Opinions on the usefulness of the IoT had the greatest impact on the future use or dedication of pre-service participants to it. Consequently, we take a close look at a plethora of pedagogical consequences that lie ahead for the field of teacher education. Several suggestions for moving ahead are made possible by this study.

Keywords—

important factors, online education, future teachers, the web of things, and the tech adoption model.

Introduction

The IoT is state-of-the-art Internet technology that bridges the gap between the physical and digital worlds [1]. In such a short amount of time, the proliferation of IoT devices has profoundly impacted billions of people across all aspects of their lives [2]. By definition, the Internet of Things (IoT) is "the worldwide infrastructure for the information society that may permit joining all sorts of items, such as physical and virtual things based on the provided communications protocols and technologies," as stated by the Global Standards Initiative on the Internet of Things [3]. page 914. The Internet of Things (IoT) is an analytics and automation system that combines technology such as networks, sensors, big data, and artificial intelligence to provide service systems that are free of errors [4]. The Internet of Things (IoT) simplifies and enhances daily life by connecting devices, locations, and people [5]. The Internet of Things (IoT) causes massive changes to the technical and digital future of our children [6]. By 2025, experts predict that the number of Internet of Things (IoT) devices will have surpassed 75 billion [7]. A more flexible, adaptive, and efficient educational system is quickly emerging as a result of the Internet of Things [3]. Internet of Things technology will undoubtedly affect our educational institutions. Internet of Things (IoT) technology has the potential to make "anytime, anywhere" education a reality, which would significantly improve the way we teach and learn [8]. Few studies have concentrated on utilizing the IoT in education, particularly in the setting of impoverished countries [9], and educational adoption of the IoT is still in its early stages [3]. Take the Internet of Things (IoT) as an example; according to a recent comprehensive research, its adoption and possible use in the field of education are still rather rare. This is especially the case in developing countries like Saudi Arabia. Academics now have a plethora of chances to study the obstacles to the educational applications of the Internet of Things, particularly in less developed countries. Academic research in this field is still in its infancy. Immediate evaluation of the preparedness, openness, and motivation of Saudi pre-service teachers to employ technology (such the Internet of Things) in their future classes is necessary due to the digital transformation of these educators. To address this knowledge vacuum in the existing literature, this study is being conducted.

Research into Existing Works

Connected Learning Environments

The favorable impacts on student engagement and learning are driving the rapid adoption of the Internet of Things (IoT) in the sphere of education [10, 14]. The use of IoT in the classroom has the potential to boost efficiency for both instructors and students [14, 15]. The ability for instructors to interact with students on an individual basis is a major perk of using the Internet of Things (IoT) in the classroom. Improved communication between instructors and students, as well as between students and digital and physical classroom resources, has many advantages [8] [11]. Thus, learning environments built on the Internet of Things (IoT) might significantly affect the workload of educators and students alike [3]. Several studies have shown that students' academic performance is enhanced when the Internet of Things (IoT) is used in the classroom. As an example, in [16], researchers used 50 students in an engineering class to test how the Internet of Things (IoT) may improve instruction and raise students' performance in the class. They found that by linking physical things to digital ones, the Internet of Things allows for the use of real-world objects as learning resources, which leads to more data and better learning overall. The experimental remote learning tool for architectural design that was created and used in [17] is another example of an IoT-based technology. Internet of Things technology has the potential to improve academic performance for both students and teachers, according to the results. An IoT-based teaching management system was created by [18], and it was shown to have a favorable impact on students' learning processes for higher education. Research comprising 244 pupils and 4 instructors in Thailand was also investigated in [9] to determine the impact of sensor-based IoT on children's motivation to study. In comparison to more conventional forms of education, the Internet of Things enabled by sensors considerably enhanced both the quality of instruction and the level of participation from students.

Proposed theory and its theoretical underpinnings

One of the best-known theoretical frameworks for studying how people feel about different kinds of technology is the Technology Acceptance Model (TAM), which was first proposed by [33]. The TAM was proposed by [33] to help identify and understand the factors that impact how people utilize information technology systems. The number 35. To what extent the TAM's users embrace the IT system depends on their behavioral motivation to use it (Figure 1) [36]. User evaluations of a technology's usefulness and ease of use are the most crucial factors in deciding its level of adoption, according to the Technology Acceptance Model (TAM). As opposed to perceived ease of use, which is the extent to which an individual thinks a system would be effortless to use, perceived usefulness measures the extent to which an individual thinks a system would enhance their performance on the job [33]. page 320. To rephrase, if individuals dislike the characteristics and functions of a new technology, they are less likely to embrace it [38].

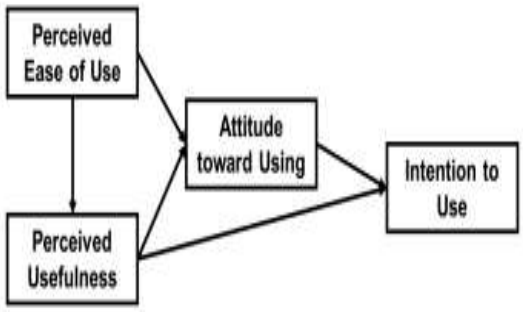

Fig. 1. The TAM [33]

Perceived usefulness and ease of use influence users' attitudes and intentions for using the technology [39]. Here "attitude" means "user's assessment on use of the system" [36], which is a contraction of the full phrase. On page 194. Variables related to TAM "seem to be able to account for 40 percent to 50 percent of user acceptability," according to [40]. page 150.

Methodology

We employed a quantitative descriptive research approach to look at the TAM factors that impact future teachers' choices to use (adopt) the IoT in the classroom.

A case study and history

A total of 47 male and female seniors in their last year of the Bachelor of Computer Teacher program at the School of Education's undergraduate division were recruited for the study using a purposeful sampling method [42]. In this instructional software design course, which ran for 14 weeks, students worked on assignments that complemented what they learned in class each week. In this course, students were given the opportunity to choose and use one IoT application (such Google Lens or Goggle Assistant) for a range of purposes, including research, reporting, and hands-on design work. Tasks such as scanning barcodes or text recognition inside the app, translating text, and doing direct searches (using the app's built-in search bar) were given to students. The course objectives, which include preparing students for careers as teachers, were closely related to the duties.

Results

The validity and reliability of the survey items were determined using Cronbach's alpha. The degree of relationship between the independent and dependent variables was determined using Pearson's correlation, and descriptive statistics were reported for each. The outcomes of the basic regression were then followed by two multiple linear regressions.

Analyzing how true and correct something is

Cronbach's alpha coefficient (in the event of an item deletion) and correlation coefficients (item-total correlation) were used to determine the internal consistency between the items of each construct and hence the reliability of the survey, which consisted of four measures (variable). Table 3 shows that all item-total correlation coefficients are statistically signiThe internal consistency between the items of each construct and the reliability of the survey were determined using Cronbach's alpha and item-total correlation coefficients. The survey consisted of four variables, and each item measured a different construct. The high levels of internal consistency and dependability shown by all survey questions are supported by the statistically significant item-total correlation coefficients (=0.01), as shown in Table 3. Between 0.844 to 0.893, Cronbach's alpha was found for the four research variables: perceived ease of use, perceived utility, attitude, and intention to use [44]. The items of the instrument were deemed reliable since all item correlation coefficients (adjusted item-total correlation) were meaningful at the 0.05 levelficant (=0.01), indicating that all survey items have high levels of internal consistency and dependability. The Cronbach's alpha for the whole study's four variables (perceived ease of use, per ceiled usefulness, attitude, and intention to use) was between 0.844 to 0.893 [44]. All item correlation coefficients (adjusted item-total correlation) were statistically significant at the 0.05 level, indicating the reliability of the instrument's items.

Table 1. Coefficients of survey reliability and validity

Constructs	Items	M (SD)	Cronbach's Alpha (if Item Deleted)	Item-Total Correlation	Corrected Item-Total Correlation	Cronbach's Alpha
Perceived ease of use (6) items	PEU1	3.99 (.69)	.796	.849*	.741*	.854
	PEU2		.817	.753*	.652*	
	PEU3		.800	.823*	.733*	
	PEU4		.813	.780*	.659*	
	PEU5		.807	.660*	.480*	
	PEU6		.803	.814*	.707*	
Perceived usefulness (6) items	PU1	3.74 (.76)	.893	.734*	.599*	.893
	PU2		.866	.844*	.774*	
	PU3		.880	.786*	.678*	
	PU4		.853	.897*	.839*	
	PU5		.869	.830*	.747*	
	PU6		.881	.765*	.667*	
Attitude toward use (4) items	AU1	3.79 (.74)	.856	.742*	.549*	.844
	AU2		.774	.864*	.744*	
	AU3		.748	.899*	.794*	
	AU4		.816	.795*	.646*	
Intention to use (3) items	IU1	3.74 (.72)	.905	.809*	.626*	.863
	IU2		.711	.937*	.837*	
	IU3		.772	.906*	.777*	

Note: *Correlation is significant at the 0.01 level.

Correlation and descriptive analysis

Table 3 shows that the four research constructs had means ranging from 3.74 to 3.99, showing that the participants who were pre-service teachers had somewhat positive views on the Internet of Things (IoT) in relation to these four characteristics.

Table 2. Relationships between the two sets of data (independent and dependent)

Hypotheses	Dependent Variable	Independent Variable	Pearson Correlation	p-Value
H1	Perceived usefulness	Perceived ease of use	.690	.000*
H2	Attitude	Perceived ease of use	.742	.000*
H3	Attitude	Perceived usefulness	.668	.000*
H4	Intention of use	Perceived usefulness	.656	.000*
H5	Intention of use	Attitude	.545	.000*

Note: *Correlation is significant at the 0.01 level.

We first determined the Pearson's correlation coefficient between the dependent and independent variables for each hypothesis before doing the regression analysis. Every pair of factors, including perceived ease of use and perceived usefulness, had a positive and statistically significant association (r=.690, p<.001), as shown in Table 4.

Conclusion

Saudi Arabian academics sought to understand future teachers' perspectives on the Internet of Things (IoT) and their reasons for wanting to work in the field. As a result, we laid up and evaluated TAM-related criteria, including the following: pre-service teachers' expectations for the use of IoT, its perceived usefulness, and their attitude toward using it. Because of its apparent usefulness and ease of use, we anticipated that the study's pre-service teachers would have a positive view of IoT technology and be more inclined to adopt it in their future work. We used a simple regression as well as two multiple linear regression analyses to examine the participants' intentions to use the IoT. Research has shown that the perceived ease of use of the Internet of Things (IoT) has a positive effect on future teachers' views of the technology's value.

The perceived ease of use of the IoT was the most important component in shaping attitudes, but the perceived usefulness of the IoT was also extremely influential. Future teachers' plans to use IoT in their classrooms were positively and significantly impacted by their perceptions of the technology's utility. The students' feelings about the Internet of Things (IoT) in the classroom were considered, although it did not significantly impact their intentions to utilize it. Finally, participants' intentions to adopt IoT in future classes were predicted by two factors: the perceived ease of usage and the perceived value of the technology. Based on the findings, teacher preparation programs should prioritize the incorporation of IoT technologies into course materials and syllabi, and pre-service teachers should get additional training on how to use these tools effectively in the classroom.

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