



Technology Acceptance Model (TAM) as an Underpinning in Understanding Teachers' Intention Impact of Data Show Projector

By

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Abstract

The present study focuses on highlighting the extent to which the TAM is applicable. A random sample consisting of 6480 teachers was randomly selected for the study. For data collection, the author used a questionnaire, which was derived from relevant literature. The employment of Data Show Projectors in teaching Mathematics is influenced by a variety of factors, which chiefly include what is known as computer anxiety (abbreviated as CA). The study shows that CA has a negative effect on PE. Moreover, results of the study also show that there is a positive correlation between actual use (abbreviated as AU) and intention to use (abbreviated as IU). However, results show that perceived usefulness (abbreviated as PU) is not significantly correlated with IU. This means that teachers are more interested in how easy the use of projectors is to them, as opposed to the extent to which it is useful in their work. The study proposes an expansion of the TAM model that takes into consideration the contexts of AU, IU, PU, PE, and CA. Findings show that the proposed TAM model expansion shows positive correlations with AU, IU, PU, PE, and CA. The expanded model shows success in achieving the research objectives. The present study is a contribution to the research efforts for supporting the adoption of projectors in mathematics classes.

Keywords: Computer Anxiety-Mathematics Teachers-Data Show Projector-Technology acceptance model (TAM)-Structural Equation Modeling (SEM)

(TAM) نموذج قبول التكنولوجيا كأساس لفهم تأثير نية المعلمين على جهاز عرض البيانات**المستخلص باللغة العربية:**

كان تركيز هذا البحث على معالجة قابلية تطبيق TAM. تم اختيار مجموعه ٦٤٨٠ معلمًا ومعلمة من عينة طبقية بشكل عشوائي، وتتكون من ٣١٥٩ معلمًا و ٣٣٢٥ معلمة. تم تطوير الأداة لجمع البيانات؛ وكانت الأداة عبارة عن استبيان تم اعتماده من أربع دراسات سابقة. ووجد انه يتأثر استخدام المعلمين لجهاز عرض البيانات في تدريس وتعليم الرياضيات بعدة عوامل منها القلق من استخدام الحاسب الآلي (CA). سيؤكد هذا البحث أيضًا أن القلق من استخدام الحاسب الآلي عند المعلمين والمعلمات يرتبط ارتباطًا سلبيًا بسهولة استخدام جهاز عرض البيانات. وجدت الدراسة أن نية استخدام جهاز عرض البيانات (IU) أثرت على استخدام المعلمين الفعلي (AU) لجهاز عرض البيانات في المدارس. ولكن يبدو أن الفائدة المتصورة من استخدام جهاز عرض البيانات (PU) لا تؤثر على نوايا المعلمين والمعلمات لتطبيق جهاز عرض البيانات في المدارس. ومن المرجح أن يهتم المعلمون والمعلمات بسهولة الاستخدام لجهاز عرض البيانات في اتخاذ القرارات لاستخدام التكنولوجيا في التدريس، على عكس الطريقة التي يسهل بها استخدام جهاز عرض البيانات التعليم والتعلم بشكل أفضل. اقترح البحث امتدادًا لنموذج قبول التكنولوجيا TAM الذي يراعي استخدام النموذج الموحد في سياقات قلق الحاسب الآلي CA وسهولة استخدام جهاز عرض البيانات PE والفائدة المتصورة من استخدام جهاز عرض البيانات PU ونية استخدام جهاز عرض البيانات IU والاستخدام الفعلي لجهاز عرض البيانات AU. أظهرت النتائج أن هيكل TAM يؤثر بشكل مباشر على المتغيرات. وتوضح هذه النتائج نجاح التمديد المقترح في تحقيق أهداف هذه الدراسة. وستساهم هذه الدراسة في اتخاذ القرار لنشر اعتماد جهاز عرض البيانات بين معلمي ومعلمات الرياضيات في المدارس وهي مفيدة للمتخصصين في تدريب المعلمين والمعلمات والمسؤولين عن تدريبهم لاستخدام جهاز عرض البيانات.

الكلمات المفتاحية: قلق الحاسب الآلي - معلمي ومعلمات الرياضيات - جهاز عرض البيانات - نموذج قبول التكنولوجيا - نموذج المعادلة الهيكلية.

1-Introduction:

ICTs have become an essential element of modern life. Over the last few decades, ICT has drastically changed the way that activities in many fields, such as governance and business, can be carried out (Noor-UI-Amin, 2013).

Technology is currently viewed as an important force that can be harnessed for achieving transformation in educational fields, as it is commonly believed that the adoption of ICTs will mostly lead to improvements and positive impacts. As a result, not only has ICT witnessed major advancements, but it has also become increasingly adopted and used in educational contexts (Player-Koro, 2012).

ICTs have deeply impacted education. In the contemporary world, ICTs, especially internet technologies, play a significant role in adding technological elements to learning experiences. The significance of the role of ICTs in improving learning experiences stems from its ability to achieve the following outcomes (Kaware & Sain, 2015, 29):

- 1- Learning becomes student centered rather than teacher centered.
- 2-Support of the process of knowledge construction (constructivist approach of learning).
- 3-Fostering students' motivation to learn.
- 4-Improving metacognitive thinking abilities.
- 5-Promoting problem-solving skills.
- 6-Foster students' interest in learning.

With the rapid development of ICTs, technological devices have improved, in terms of several aspects, such as usability, quality of screens, and processing power. These advancements gave ICTs advantages over traditional learning methods. ICTs can improve the quality of learning experiences due to the use of multimedia (i.e., various formats of the learning content), hypermedia (i.e., nonlinear access to the learning content), and interactivity (i.e., ability to interact with the learning content). As a result of these advancements, educational institutions worldwide have directed more attention toward the development of ICT-based educational tools and materials (Karagiannidis et al., 2014, v).

This has resulted in the emergence of the need for appropriate adoption of technology in education. However, this process is not a simple one. In fact, successful adoption of technology in education requires adopting a proper practical approach that is designed with clear

and specific educational goals. Educational technology is not merely a process of adding technological elements into learning experiences, but it is a systematic approach for integrating both technological and human resources in learning experiences in order to address educational issues. The inputs of educational technologies include ideas, devices, and people, which are organized together in order to apply and assess new instructional practices that can improve students' learning outcomes (Ajani, 2013, 18).

Moreover, Mndzebele et al. (2014) emphasised the need for providing teachers with adequate training in order to impart them with favourable perceptions of the idea of adopting technological innovations in work practices. One of the ways by which this may be achieved is by training teachers on the use of games in their work. Not only does this help in instilling positive attitudes among teachers toward the use of technology, but it also can foster the belief that the adoption of education innovations in an educational necessity.

According to Alsswey and Al-Samarraie (2019), the main challenges preventing the adoption of ICT-based educational solutions in the Arabian Gulf area include challenge of access to services (e.g., control functions, high-speed internet), technical skills (e.g., use of media and devices and accessing information online), ICT infrastructure, and inadequate investment in ICTs.

Other challenges of adopting technology in education might arise from potential cultural clash between the nature of ICT-based educational content and the culture of the Saudi society. The implementation of ICT-based educational solutions often requires the use of educational material from western sources, whose cultures differ significantly from the culture of Saudi Arabia. Successful use of technology requires consistent and reliable access to internet services in order to access these sources. However, the use of the internet for learning leaves students constantly exposed to the risk of encountering contents that do not conform to the conservative cultural norms of the Saudi society (Almalki & Williams, 2012).

According to Kusumaningrum et al. (2019), teachers play a critical role in the educational process. Being the main agents of change in education, teachers are responsible for adapting educational experiences to the changes arising from constantly occurring changes. This requires that teachers acquire and develop more complex knowledge and skills.

Therefore, the provision of necessary professional development opportunities is important for enabling teachers, in turn, to contribute to increasing the quality of educational experiences.

Moreover, instructional technology has the potential for fostering collaboration and innovation among students. Of course, teachers are responsible for harnessing the capabilities offered by this technology. Furthermore, the use of instructional technology helps in promoting students' critical thinking, innovation, creativity, and problem solving (Mdingi, 2020).

Data Show Projectors are an essential requirement for the adoption of technology in education. Shelly and Vermaat (2012) presented a number of definitions for Data Show Projectors. According to Hollander (2010), Data Show Projector is a tool used for displaying information using numbers or letters. In fact, Data Show Projectors are used for a variety of purposes including education and serving learners with special needs.

Al Qassim is a large city located in the Kingdom of Saudi Arabia. The total number of primary school teachers in the city is approximately 6480. Primary schools located in the city serve children aged 6 to 12. Schools in Al Qassim have been increasingly integrating instructional technology. This is mainly attributable to the efforts exerted by the Saudi Ministry of Education awareness of the role of adopting educational technology, including Data Show Projectors, in improving students' learning outcomes, including in Mathematics. The Ministry has embarked on disseminating the adoption of educational technology for improving educational experiences through allocation resources for training teachers on the use of computers and Data Show Projectors. Moreover, educational leaders and authorities in Al Qassim encourage teachers to adopt Data Show Projectors in their work.

The present study aims to investigate the use of Data Show Projectors among Mathematics teachers in Al Qassim, Saudi Arabia. The present study targets primary public schools, in specific. In order to attain positive development outcomes in education, it is important to investigate the pertinent challenges and propose appropriate suggestions for educational development.

2. Conceptual framework

2.1. TAM

As Akella et al. (2021) indicate, the technology acceptance model (abbreviated as TAM) is a model used for finding explanations for the factors driving or leading people to adopt and use new technologies. The model assumes that individuals' decisions to adopt new technologies are not automatic but are influenced by certain factors, which mainly include perceived usefulness and perceived ease of use.

According to Dimitrijević and Devedžić (2020), a significant criticism of the TAM is that it is considered too generic. In fact, the use of TAM might fail to yield consistent results because of lack of variables related to the context in which adoption patterns are investigated. This has resulted in efforts for developing extensions and adaptations for TAM that incorporate additional variables linked to the nature of the context under investigation (e.g., contexts of e-learning).

In essence, TAM aims to explain the factors influencing the acceptance of technology, while highlighting the differences of behaviours across different groups and technologies (Davis, 1989). The TAM is a theory on information systems theory that is interested in explaining the behaviours of acceptance and use of technology. The TAM was first introduced by Davis (1986). The model suggests that many factors have effects on the behaviours of using newly introduced technologies.

In its original form, TAM consists of two main constructs, which are the perceived ease of use (abbreviated as PE) (Masrom et al., 2008), which is the extent to which an individual perceives a technological innovation as easy to use, and perceived usefulness (abbreviated as PU), which is the extent of mathematics teachers' perception of projectors as appropriate tools for improving the quality of educational experiences (Masrom & Hussein, 2008). PE and PU have an effect on Teachers' intention to use (abbreviated as IU) (Masrom et al., 2008), which is the extent to which a mathematics teacher intends to use projectors in teaching mathematics, and actual use (abbreviated as AU), which is a measure of both the frequency and volume of using projectors in teaching.

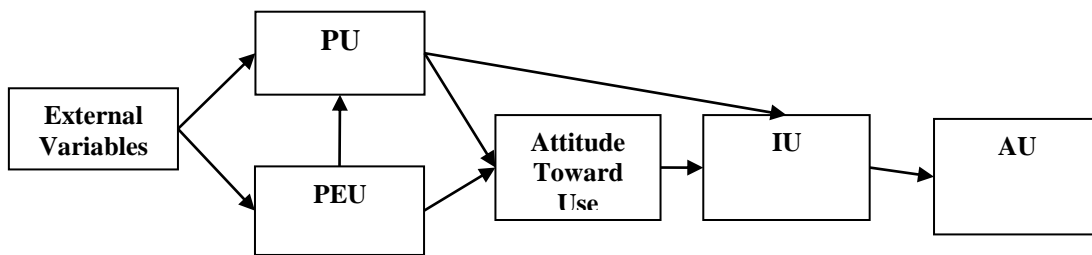
In spite of the advantages of TAM, such as ease of use and usefulness, it is criticized for its inadequacy in explaining the patterns of

using more complex technologies, in particular the technologies used for educational purposes. Critics argue that the adoption of in educational contexts cannot be explained in the light of only two constructs, namely PE and PU. In fact, relevant research shows that the use of projectors for educational purposes is influenced by various factors, which mainly include computer anxiety among teachers. According to Ang, Davies & Finlay (2001), the interest in the investigation of the role of management in adopting technology is a proof of the validity of this argument.

With regards to computer anxiety, Venkatesh (2000) argues that it negatively influences PE, whereas computer anxiety has a positive impact on both PU and PE (Yi & Hwang, 2003).

Figure 1: TAM.

Source: (Davis, Bagozzi & Warshaw, 1998)



2.2 Questions Of The Study

1. Is Al Qassim Mathematics Teachers' AU of Data Show Projectors affected by IU with regards to Data Show Projector?
2. Is Al Qassim Mathematics Teachers' AU of Data Show Projectors affected by PE and PU?
3. Is Al Qassim Mathematics Teachers' PU of the use of Data Show Projector affected by computer anxiety and PE?
4. Is Al Qassim Mathematics Teachers' PE of using Data Show Projector affected by computer anxiety?

2.3. Computer anxiety

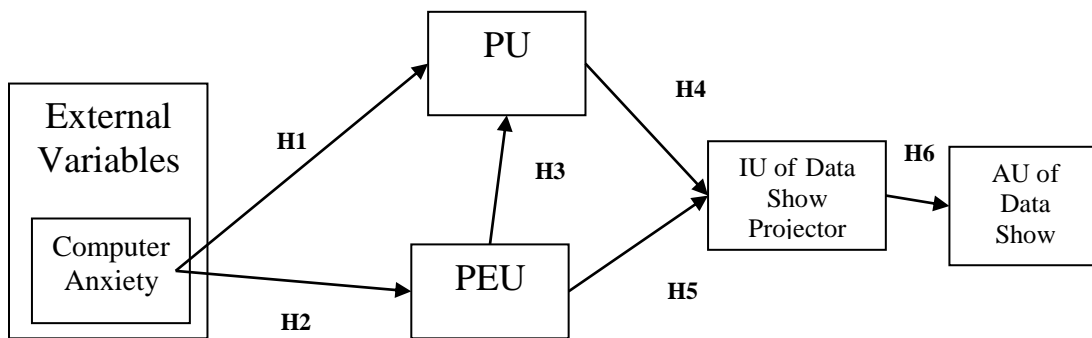
This view is congruent with that adopted by Mac Callum et al. (2014), who indicated that the idea of using computers may generate feelings of fear and anxiety among some people, and that is as a result of worrying about things such as the possibility of damaging a piece of hardware or looking incompetent while using devices.

According to Compeau, Higgins & Huff (1995), computer anxiety is the likelihood of having uneasy, phobic, and apprehensive feelings about

current or future use of technology. Computer anxiety is noted to be negatively associated with PE (Venkatesh, 2000). Igarria & Iivari (1995) indicated, through relevant evidence, that computer anxiety negatively influences PU. Accordingly, the present study suggests that computer anxiety impacts the use of projectors in mathematics education.

Figure 2 illustrates the present study's research model, which focuses on AU and IU as well as explaining the adoption of projectors in primary schools in Al Qassim.

Figure 2: COMPUTER ANXIETY OF THE DATA SHOW PROJECTOR ACCEPTANCE



The present study suggests six hypotheses to explain the relationships among several factors, which are PE, computer anxiety, PU, IU, and AU. These hypotheses are listed below:

- Hypothesis 1: PE positively influences IU.
- Hypothesis 2: PU positively influences IU.
- Hypothesis 3: PE positively influences PU.
- Hypothesis 4: Computer Anxiety negatively influences PE.
- Hypothesis 5: Computer Anxiety negatively influences PU.
- Hypothesis 6: IU positively influences AU.

3. Methodology

3.1 Data collection and sampling procedures

The sample includes a number of public education teachers working in Al Qassim, Saudi Arabia, at schools supervised by the Department of Education in the city. A questionnaire is used for data collection from sample members.

The study research is quantitative, adopting a cross-sectional design in data collection. The data collected from a random sample recruited from a population consisting of 6480 teachers. The motive for adopting a cross-sectional approach is to acquire data from sample members at a certain point in time.

Participants include 350 teachers; this numbers represents approximately representing 40% of the target population. The sample size for the study was defined based on Morgan & Krejcie's (1970) sample size table, wherein for a population numbered at 900, the size of the selected sample should be no less than 269. Thus, the size of the sample selected for the present study is adequate. Stratification is only based on gender. Participants are selected randomly in order to recruit a representative sample. However, (i) participants must be Mathematics teachers working at primary-stage schools in Al Qassim, Saudi Arabia and (ii) The participants must be not from the same sample recruited for the pilot study.

The questionnaire used in the present study is derived from four relevant studies, which are the study of Alshammari (2015), the study of Masrom et al. (2008), the study of Chatzoglou, Sarigiannidis, Vraimaki & Diamantidis, 2009, and the study of Davis (1989). The questionnaire measures five main variables, which are as follows: (i) computer anxiety, (ii) PU, (iii) PE, (iv) IU, and (v) AU. 37 items, divided on 5 research variables, are included in the questionnaire.

4. Findings and analysis

4.1 CFA *Table 1: Variables and their and operational definitions.*

Variables	Operational definition	Items	Sources
Computer Anxiety	Mathematics teachers' likelihood to have phobic, apprehensive, and uneasy feelings toward the use of technology, including Data Show Projectors, both in the present and the future.	5	Chatzoglou et al., and (2009) Compeau et al., (1995).
PU	The extent of Mathematics teachers' belief that the use of Data Show Projectors can improve the quality of their teaching practices and student learning outcomes.	6	Masrom et al., and (2008) Davis (1989).
PE	The extent of Mathematics teachers' belief that that the use of Data Show Projectors is easy.	5	Masrom et al., and (2008) Davis (1989).
IU	The extent to which Mathematics teachers intend to adopt Data Show Projectors.	7	Masrom et al., and (2008) Davis (1989).
AU	A measure of how frequent Mathematics Teachers' use Data Show Projectors as well as the volume of this use.	6	Davis (1989).

Collected data was screened in order to be analyzed before carrying out the SEM. Scores were based on 5-point Likert scales. The range of mean scores was between 1.75 and 4.71. The standard deviations ranged from .798 to 1.702, indicating a narrow spread of items around the means. The Cronbach's alpha (internal consistency) for the 29 items based on the 9 variables was .92.

4.2 Metric Model

The SEM approach adopted in this study encompassed two steps. The author used the AMOS software package (version 20.0). First step involved assessing the validity of the measurement models. These processes required performing a CFA of each of the variables, which are computer anxiety, PU, PE, and IU. The second step of the approach involved the use of a full-fledged SEM in order to examine the good-fit.

The full-fledged model was estimated using MLE. Following the estimation of the model, the good fit was examined using specific recognized criteria. The criteria used for the estimation process included the following: (i) the model is consistent with data, (ii) estimations are reasonable, and (iii) the effect of exogenous variables on endogenous variables (Nur, 2012).

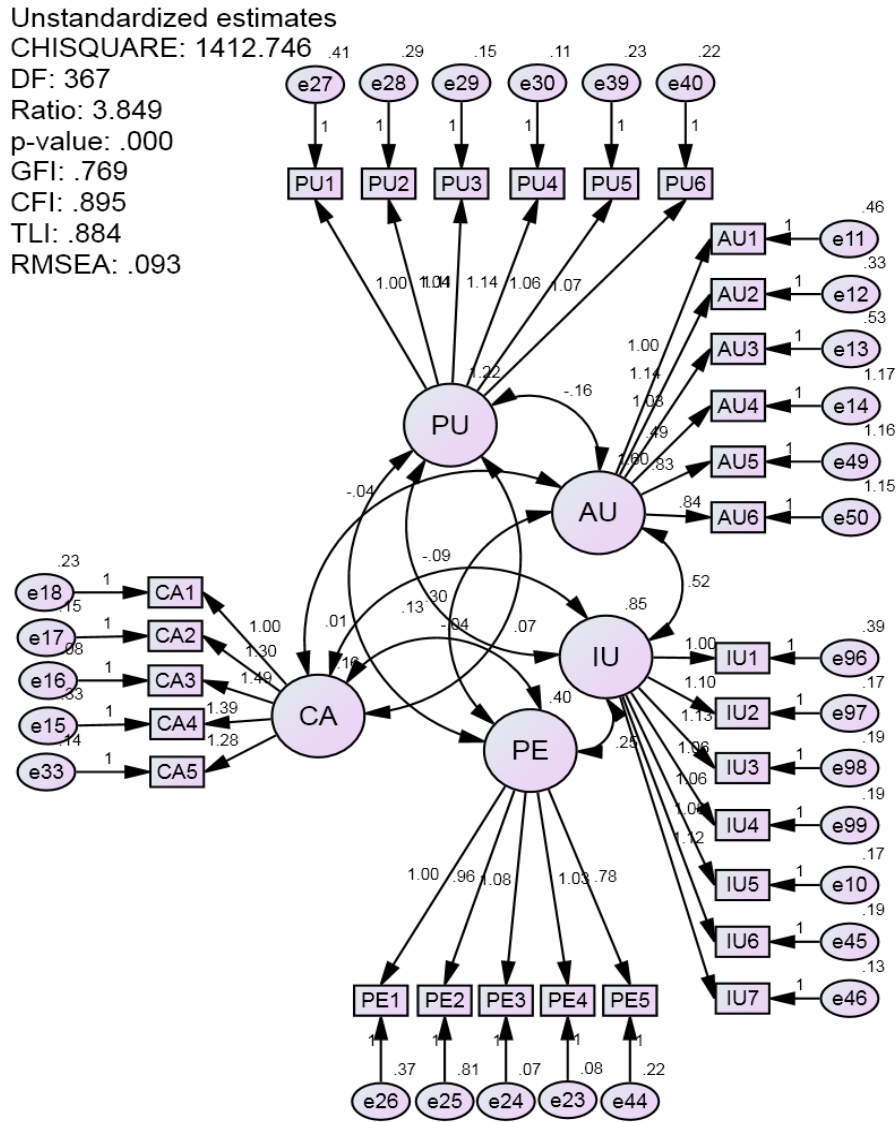
In the present study, the analyses processes were undertaken based on single-group SEM and CFA analyses of the data collected from sample members. CFA was implemented for investigating the correlations among variables and also for validating the models of measurement.

A full-fledged SEM was derived based on results of the CFA analysis of the models of measurement. The author implemented two-phase modeling in SEM analyses. In order for this to be achieved, before the use of the full-fledged SEM, the measurement model was specified and fitted. Hair et al. (2006) argue that this makes the process of fitting the model easier. the Latent variables' measurement model is illustrated in Figure 3.

First Step: Sem Involves Cfa Testing Of Mathematics Teachers' Acceptance Of Data Show Projectors

Assessment of the findings was performed by the comparison of values against a criteria set. The value of the chi-square was 1412.746, the value of TLI was .884, the value of DF was 367, the value of CFI was .895, and the value of RMSEA .093.

Figure 3: CFA Testing of Mathematics Teachers' Acceptance of Data Show Projectors

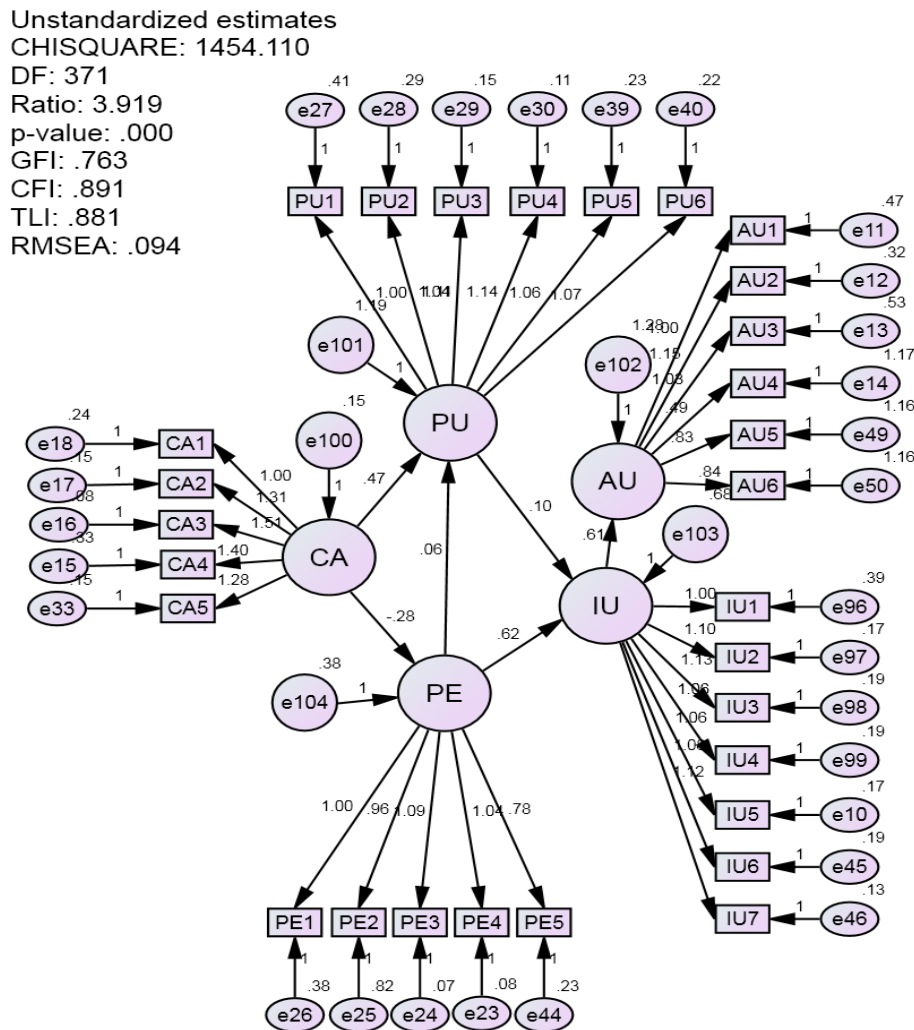


Second Step: Creating The Model For Measuring Mathematics Teachers' Acceptance Of Data Show Projectors

The estimation of the model was carried out using the Structures Analysis (using the AMOS software package, V 20.0) and applying MLE on data. Assessment of the results was carried out using estimates of parameter reasonableness and indices of fit goodness. This was followed by the examination of SMC of indicators.

Assessment of the findings was performed by the comparison of values against a criteria set. The value of the chi-square was 1454.110, the value of TLI was .881, the value of DF was 371, the value of CFI was .891, and the value of RMSEA .094.

Figure 4: The Model of Mathematics Teachers' Acceptance of Data Show Projectors



Third Step: The Model For Measuring Mathematics Teachers' Acceptance Of Data Show Projectors

Assessment of the findings was performed by the comparison of values against a criteria set. The value of the chi-square was 461.451, the value of TLI was .948, the value of DF was 1183, the value of CFI

was .955, the value of Ratio was 2.522, and the value of RMSEA was .068.

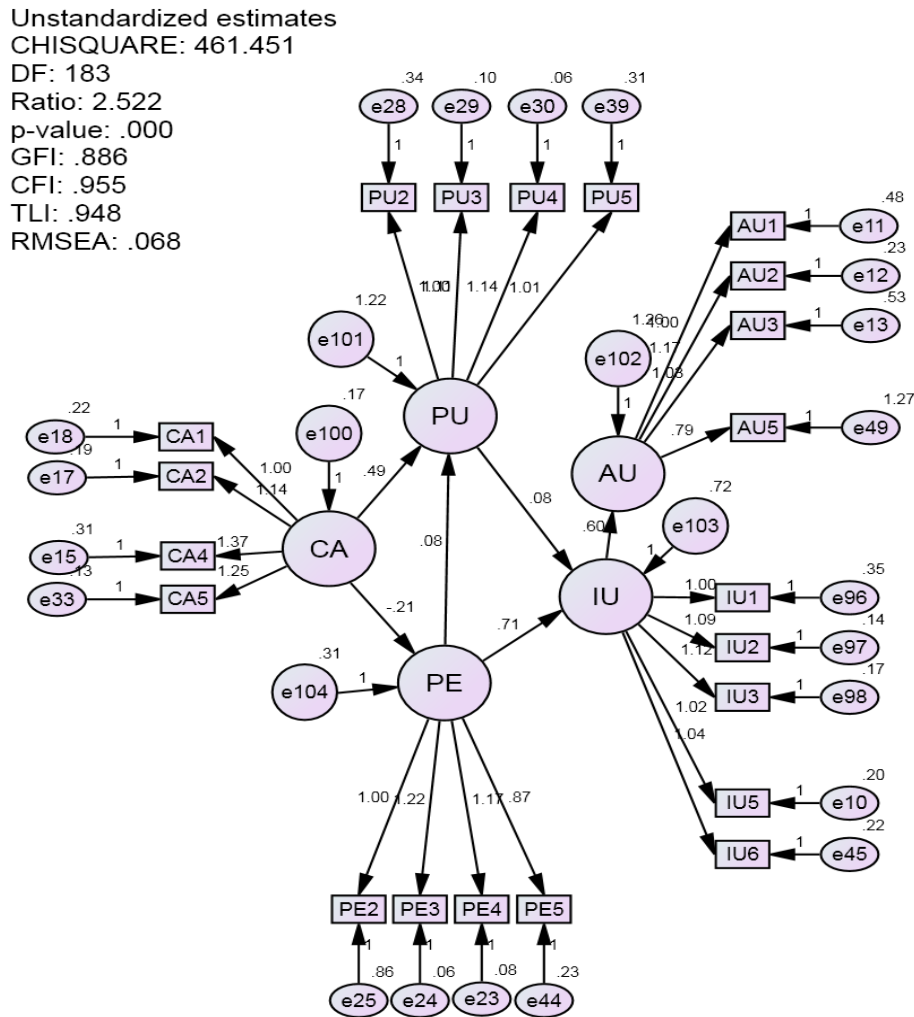
The results show that the model is consistent. Thus, the model is fit. Using the model, estimations of path coefficients and assessments of parameters were made. The structural model was used to analyze path relationships.

The estimation of the model was carried out using the Structures Analysis (using the AMOS software package, V 20.0) and applying MLE on data. Assessment of the results was carried out using estimates of parameter reasonableness and indices of fit goodness. This was followed by the examination of SMC of indicators. With the measurement model fitting, the process of structural model fitting becomes easier. Using the theoretical framework, an assessment is made of the fitness of the latent variables to the measurement model. The test is used for examining the statistical significance of the model.

The results were carefully assessed. This was done by comparing the values obtained from the analysis with the set of recommended criteria. The results produced a chi-square value = 461.451, $df=183$, Ratio of 2.522, TLI value of .948 and CFI of .955 were above the threshold of .90, but the RMSEA value of .068 was slightly above the accepted value of $< .05$. Furthermore, the model modifications indicated the existence of cross-loading and error covariance. The MI results revealed 8 items with a high value of error covariance.

Assessment of the findings was performed by the comparison of values against a criteria set. The value of the chi-square was 461.451, the value of TLI was .948, the value of DF was 183, the value of CFI was .955, the value of Ratio was 2.522, and the value of RMSEA was .068. The values of CFI and TLI exceeded the .90 threshold. RMSEA exceeded .05, which is the accepted value. Moreover, error and cross-loading covariance is found through model modifications.

Figure 5: Structural model of the study



The results show that the model is consistent. Thus, the model is fit. Using the model, estimations of path coefficients and assessments of parameters were made. The structural model was used to analyze path relationships. Results of the analysis of the structural equation model are presented in Table 2.

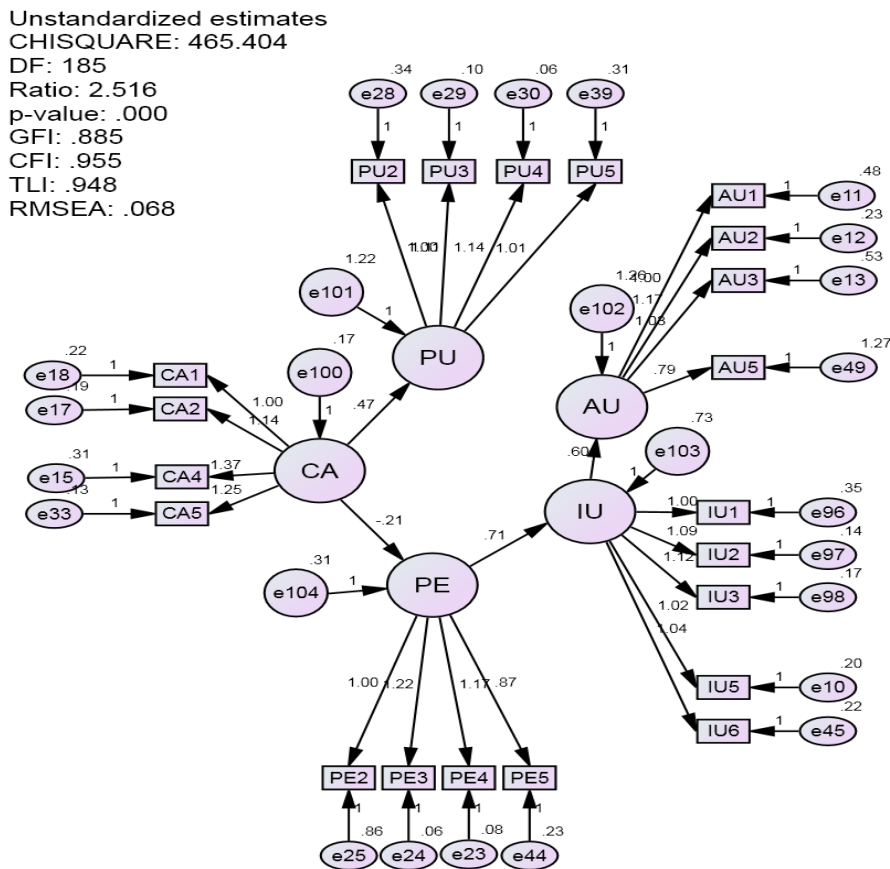
Table 2: Residuals, Correlations, and Direct Effects for the Structural Model of Mathematics Teachers' Acceptance of Data Show Projectors

Hypotheses	Variable	Standardized Estimation	Critical Ratio	Remarks
H1	CA --> PU	.169	2.889	Accepted
H2	CA --> PE	.087	-2.388	Accepted
H3	PE --> PU	.115	.733	Dropped
H4	PU --> IU	.044	1.824	Dropped
H5	PE --> IU	.113	6.280	Accepted
H6	IU --> AU	.075	8.044	Accepted

CA refers to "Computer Anxiety", PU refers to "Perceived Usefulness", PE refers to "Perceived Ease of Use", IU refers to "Intention to Use", AU refers to "actual use".

The values of path coefficients show the lack of significant changes compared to estimation. In the final model, illustrated in Figure 6, the path relationships between PE and PU and between PU and IU have been removed.

Figure 6: Final Model



4.3. Discussion

Moreover, computer anxiety is negatively correlated with IU and lower tendency toward technology adoption, and this correlation is attributable to possessing negative attitudes toward technological applications and tools in general (Huang et al., 2021). Moreover, computer anxiety may promote beliefs that drive users to be convinced that the use of ICT is not a useful choice. For example, it may lead to lower levels of self-efficacy, especially if the user perceives the use of ICT as too difficult (Vroman et al., 2015).

The perceptions of PE influence the perceptions of usefulness of the technologies and the intentions to use the technologies (Lubua & Semlambo, 2017).

Another study that supports these findings is the study of Chinomona (2013), which shows that the IU toward modern ICTs (such as mobile applications) is positively influenced by the levels of PE and trust. Thus, increasing the level of PE is important for increasing teachers' IU toward technology in their teaching practices.

Findings show that PE affects teachers' IU towards Data Show Projectors. It is shown that the factors are significant practical and statistical determiners of teachers' IU, with the value of the path coefficient with intention to use resting at (.113). However, PU was found to have no effect on teachers' IU. Based on the coefficients, teachers' decisions to use Data Show Projectors can be explained through PU more than PE. These findings may be attributable to the following: teachers are generally more interested in usefulness than in ease of use. It is possible that teachers have this preference due to the requirement from them to attain educational goals with any appropriate means.

With regards to computer anxiety, one relationship was shown as valid. A negative relationship was found between computer anxiety and PE. This finding corroborates the findings of the study of Igbaria & Iivari (1995). Many teachers experience fear and anxiety concerning using Data Show Projectors, and this is an outcome of difficulty of use.

With regards to PE, it is positively associated with IU. Several studies support that conclusion, such as the study of Liu & Wei (2003) and the study of Moon & Kim (2001). According to these findings, once training has led to making the use of the technology easy, this will help the user in understanding the technology's usefulness (Chatzoglou, et al., 2009). However, the correlation between computer anxiety and PE is

statistically significant. Noteworthy is that the strongest correlation is between PE and IU (6.280). The second strongest correlation is between IU and AU (8.044), and the third strongest correlation is between PE and IU (6.280).

Since Data Show Projectors offer potential advantages in teaching, Mathematics teachers would be eager to employ them despite the requirement of additional efforts. The findings of the present study show the effectiveness of TAM, which indicates that PE influences IU regarding the use of Data Show Projectors in teaching. The findings are in line with the findings of previous relevant on computer anxiety and its effects on IU regarding web-based training. Additionally, goal orientation was found to be the most influential factor on IU (Chatzoglou et al., 2009). The correlations between PE and PU on one hand and IU on the other reflect statistical significance (Chatzoglou et al., 2009).

From the coefficients, it is found that IU explains Al Qassim teachers' opinions of Data Show Projectors in terms of usefulness and effectiveness. The finding is in line with findings of relevant studies indicating a positive effect of computer anxiety on perceived usefulness of technology (Davis, et al, 1992; Yi et al., 2003). This means that teachers would not view Data Show Projectors as capable of improving their performance without the existence of some measure of computer anxiety that would discourage schools to find solutions for integrating Data Show Projectors into instructional activities. However, on the long run, the absence of support from schools would likely lead to lower perceptions of usefulness among teachers, as the advantages of using Data Show Projectors would not be achieved.

Implications can be derived from results of the present study, in the practical, methodological, and theoretical areas. With regards to the theoretical aspect, the study presented an extension to the TAM model based on the findings regarding the effects of the investigated variables on teachers' use and acceptance of technology. The study proposes an extended model that incorporates computer anxiety alongside the main constructs of the model, namely PE, PU, IU, and AU, which have been shown through the study's findings to influence the adoption of Data Show Projectors.

Second, findings of the study present valuable implications for empirical analysis and practice; with regards to practice, the findings of the study showed the feasibility of the TAM model in a non-western

context. The present study supports the validity of the measures of the TAM model and also supports the validity of the interrelationships among the measures.

With regards to empirical analysis, the present study made research contributions. The study used an analysis technique based on a structural equation that allows for assessing the conceptual and measurement models. The study used the CFA for validating the measurement model, with the research model containing a higher-order structure. The present study utilized two forms of SEM: the covariance and mean structure analysis and the use of covariance structure analysis in order to estimate the structural weights invariance, with the purpose of investigating the effects of moderating factors on the study's research model.

Findings show that computer anxiety is a factor that influences PU, PE, IU, and AU in the model; in other words, computer anxiety influences AU among technology users. The extension of the TAM has resulted in constructing an improved holistic and comprehensive interpretation of factors influencing the use of Data Show Projectors by teachers. The findings presented in previous relevant studies show that, absence of support from schools and low confidence among teachers are significant obstacles to the use of technology by teachers. The present study examined these factors, with the assumption that the elimination of these factors would lead to higher levels of use and acceptance of technology. The study's findings prove the validity of this assumption; they show that computer anxiety and support by schools influence the acceptance of Data Show Projector. The study's results provide an extended understanding of the adoption of Data Show Projectors beyond the limits of the variables of the original version of TAM.

The study used the SEM technique for the analysis of the research model. The study used an SEM analysis technique with two steps: the first step involved examining the factorial validity of the variables before the process of examining the structural model, and the second step involved examining the extent to which the structural model is adequate. The analysis of the measurement model analysis allowed for the identification of the latent variables' main indicators, with the examination the model's compatibility with the use of the collected data. The SM technique was not only capable of the analysis of the variables' factorial validity, but it also tested direct effects of PE and PU on IU.

With regards to the measurement of technology as a construct, the study suggested an operational definition of Data Show Projectors, which captures a variety of benefits related to instructional requirements for teachers. Relevant literature mostly investigated teachers' utilization of certain technologies, thereby lacking findings on teachers' use of Data Show Projectors. Effective instruction in primary school requires the use of a variety of technologies. The examination of only a certain group of technologies would not provide a clear perspective on teachers' adoption of all instructional technologies. Thus, the study has made a contribution for providing a more comprehensive understanding of the adoption of technologies, particularly Data Show Projectors, by teachers.

5. Recommendations and Conclusion

5.1. Conclusion

This section discusses how the study achieved its objectives, while taking into consideration the findings discussion and the context of the study, which encompasses primary schools located in Al Qassim, Saudi Arabia.

The study presented an extended version of the TAM model that takes into consideration the factors including AU, IU, PU, PE, and CA. The findings showed that the TAM model is positively correlated with AU, IU, PU, PE, and CA. Based on the findings, it was found that the extended model was successful in attaining research goals.

This study focused on assessing the validity of the TAM in a non-western context. There is a common assumption that, due to coming mostly from developed countries, modern technologies are more tailored to the needs of people in developed societies (Straub, Loch, & Hill 2001). This issue may create challenges in adapting new technologies to the needs of societies with different cultures.

5.2. Recommendations

Roostika (2012) indicates that computer anxiety is an important consideration in designed educational technologies, as it is significantly and positively linked to perceived value among students. Thus, the affective elements in design should be considered in adopted educational applications.

The study's results corroborate those presented by Chao (2019). According to this study, computer anxiety is a significant external factor that influences TAM's implementation. It is a predictor that positively

influences several factors in TAM, and these factors include PU, PE, and IU.

In the light of the findings, the study presents a number of research recommendations. The study suggests conducting further research on the use and adoption of Data Show Projectors, with the incorporation of additional variables. Examples of such variables include cultural norms, schools, political intervention, and teachers may be valuable in explaining aspects of the variances that were not considered in the present study. The investigation of various variables would provide an improved of factors that affect teachers' adoption and use of Data Show Projectors.

The implications of the present study include that the extended TAM model is appropriate not only in western contexts but in non-western contexts as well. However, there is need for new studies that explore different variables that may help in arriving at more comprehensive explanations of teachers' use of Data Show Projectors in non-western contexts.

The present study used a cross-sectional survey to collect structured data from sample members. Legris, Ingham & Collette (2001) indicate, for certain factors, the intention to utilize technology varies across various phases of application. The study recommends conducting further longitudinal research for deeper investigations of Data Show Projectors. Further research may provide more scrutinized examinations of the variables incorporated in the research model adopted in the present study.

Future studies may investigate how Data Show Projectors are currently utilized in classrooms and the extent to which teachers possess the needed competencies for using Data Show Projectors mathematics instruction. The mere availability of Data Show Projectors and relevant competencies in teachers does not fully guarantee teachers' adoption, let alone effective use, of Data Show Projectors. Finally, it would be of value to investigate the role of teachers' traits as factors influencing the adoption and use of Data Show Projectors.

Appendix 1: Items of the Questionnaire

Computer Anxiety (CA):	1= Strong Agreement to 5= Strong Disagreement
1	I feel anxious regarding the use of Data Show Projectors.
2	I feel anxious regarding the use of computers.
3	I feel anxious regarding the use of PPT Slides for presentation.
4	I feel hesitant about using computers due to fearing to make mistakes that I'm not aware of whose solutions.
5	The use of computers is intimidating to me.
Perceived Usefulness (PU):	1= Strong Agreement to 5= Strong Disagreement
1	The use of computers in Mathematics instruction allows me to do more in less time.
2	The use of Data Show Projectors enhances my ability to explain concepts to students.
3	The use of Data Show Projectors makes my teaching more effective.
4	The use of Data Show Projectors facilitates the teaching of mathematics.
5	Data Show Projectors are beneficial in instruction.
6	The use of Data Show Projectors is helpful for me in achieving educational goals.
Perceived Ease of Use (PE):	1= Very Easy to 5= Very Difficult
1	I find it easy to use Data Show Projectors.
2	Doing what I intend using Data Show Projectors is easy for me.
3	Data Show Projectors are flexible for me.
4	The use of Data Show Projectors is easy for me.
5	I find it easy to deal with Data Show Projectors in the classroom.
Intention to Use Data Show Projector (IU):	1= Daily to 5= Never
1	I intend to utilize Data Show Projectors for the creation of educational materials.
2	I intend to utilize Data Show Projectors to enhance my teaching practices.
3	I intend to utilize Data Show Projectors to make teaching more effective.
4	I intend to utilize Data Show Projectors to facilitate the comprehension of Mathematics for students.
5	I intend to utilize Data Show Projectors to increase the quality of instruction.
6	I intend to utilize Show Projectors in order to be more capable to attain the educational goals.
7	I intend to utilize Data Show Projectors to improve learning outcomes for students.
Actual Use of Data Show Projector (AU):	1= Daily to 5= Never
1	I utilize Data Show Projectors for creating education content.
2	I utilize Data Show Projectors for teaching Mathematics.
3	I utilize Web 2.0 technologies Mathematics instructions.
4	I utilize the Internet for searching for information to be used for instruction.
5	I utilize the Data Show Projectors for making presentations in instruction.
6	I utilize PowerPoint Slides to be employed in presentations.

References

- Alshammari, K. A, (2015). *The Influence of Management Support, Computer Anxiety and Enjoyment on Science Teachers' Perception of the Use Teachers' Use of Digital Technologies in Hail Primary Schools*, Saudi Arabia. Institute of Education, International Islamic University Malaysia. May 2015
- Ajani, S. T. (2012). Application of Theory and Practice of Educational Technology to the Teaching and Learning of Islamic Studies. *Journal of Education and Human Development*, 2(1), 18-29.
- Akella, D., Rolla, K. P., Sharma, L. S. (2021). Reflections of Faculty Teaching Online During the COVID-19 Pandemic. In L. Kyei-Blankson, J. Blankson, & E. Ntuli (eds.), *Revealing Inequities in Online Education During Global Crises*. IGI Global.
- Almalki, G., & Williams, N. (2012). A Strategy to Improve the Usage of ICT in the Kingdom of Saudi Arabia Primary School. *International Journal of Advanced Computer Science & Application*, 3(10), 42-49.
- Alsswey, A., & Al-Samarraie, H. (2019). M-learning Adoption in the Arab Gulf Countries: A Systematic Review of Factors and Challenges. *Education and Information Technologies*, 24(5), 3163-3176. <https://doi.org/10.1007/s10639-019-09923-1>
- Ang, C. L., Davies, M. A., & Finlay, P. N. (2001). An empirical Model of IT usage in the Malaysian Public Sector. *Journal of Strategic Information Systems*, 10, 159-174.
- Chao, C. M. (2019). Factors Determining the Behavioral Intention to Use Mobile Learning: An Application and Extension of the UTAUT Model. *Frontiers in Psychology*, 10, 1-14. <https://doi.org/10.3389/fpsyg.2019.01652>
- Chinomona, R. (2013). The Influence of Perceived Ease of Use and Perceived Usefulness on Trust and Intention to Use Mobile Social Software. *African Journal for Physical, Health Education, Recreation & Dance*, 19(2), 258-273.
- Chatzoglou, P. D., Sarigiannidis, L., Vraimaki, E., & Diamantidis, A. (2009). Investigating Greek employees' intention to use web-based training. *Elsevier*, 53(2009), 877-889.
- Dimitrijević, S., & Devedžić, V. (2020). Usability Factors in e-Learning Acceptance Models. *Information Society of Serbia*.
- Davis, F. D. (1989). *Perceived usefulness, perceived ease of use, and user acceptance of information technology*. *MIS Quarterly*, 13 (3), pp. 319-

340.

- Davis, F. D., Bagozzi, R., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace¹. *Journal of Applied Social Psychology*, 22(14), 1111-1132.
- Huang, R. T., Jabor, M. K., Tang, T. W., & Chang, S. C. (2021). Examine the Moderating Role of Mobile Technology Anxiety in Mobile Learning: a Modified Model of Goal-Directed Behavior. *Asia Pacific Education Review*, 1-13. <https://doi.org/10.1007/s12564-021-09703-y>
- Igbaria, M. & Iivari, J. (1995). The Effects of Self-Efficacy on Computer Usage. *Omega: International Journal of Management Science*, 23(6), 587-605.
- Karagiannidis, C., Politis, P., & Karasavvidis, I. (2014). Research on e-Learning and ICT in Education. In C. Karagiannidis, P. Politis, & I. Karasavvidis (eds.), *Research on e-Learning and ICT in Education: Technological, Pedagogical and Instructional Perspectives* (pp. v-xii). *Springer Science+Business Media* New York.
- Kaware, S. S., & Sain, S. K. (2015). ICT Application in Education: an Overview. *International Journal of Multidisciplinary Approach & Studies*, 2(1), 25-32.
- Kusumaningrum, A., Suharno, & Triyanto. (2019, September 14-15). Professional Development of a Teacher in the ICT Era. *International Seminar on Language, Education, and Culture* (ISoLEC 2019), Malang, East Java, Indonesia.
- Lubua, E. W., & Semlambo, A. (2017). The Influence of the Ease of Use and Perceived Usefulness to the Adoption of Mobile Money Services in SMEs in Tanzania. *Information Technologist (The)*, 14(2), 131-141.
- Legris, P., Ingham, J., & Collerette, P. (2001). Why do people use information technology? A critical review of the technology acceptance model *Information&Management*, Volume 40, Issue 3, January 2003, Pages 191-204
- Mac Callum, K., Jeffrey, L., & Kinshuk. (2014). Comparing the Role of ICT Literacy and Anxiety in the Adoption of Mobile Learning. *Computers in Human Behavior*, 39, 8-19. <http://dx.doi.org/10.1016/j.chb.2014.05.024>
- Mdingi, X. (2020). In-service Teachers' Integration of Instructional Technology into Curriculum Delivery at Primary Schools on the Cape Flats [Unpublished master's thesis]. Cape Peninsula University of Technology.

- Mndzebele, N., Gama, T., Mavuso, N., Ndzimandze, F., Nkambule, L., & Tfwala, S. (2014). Attitudes of non-ICT Teachers. *International Journal of Innovative Research in Technology & Science (IJIRTS)*, 4(6), 59-62.
- Masrom, M., & Hussein, R., (2008). *User acceptance of information technology understanding theories and models*. Venton Publishing.
- Moon, J. & Kim, Y., (2001). Extending the TAM for a World Wide Web Context. *Information & Management* (38), 2001, pp. 217-230.
- Morgan, D. W., & Krejcie, R. V., (1970). *Determining Sample Size for Research Activities*. University of Minnesota, Duluth.
- Noor-Ul-Amin, S. (2013). *An effective use of ICT for education and learning by drawing on worldwide knowledge, research, and experience: ICT as a Change Agent for Education*. University of Kashmir.
- Player-Koro, C. (2012). Factors Influencing Teachers' Use of ICT in Education. *Education Inquiry*, 3(1), 93-108.
- Roostika, R. (2012). Mobile internet acceptance among university students: A value-based adoption model. *International Journal of Research in Management & Technology*, 2(1), 21-28.
- Vroman, K. G., Arthanat, S., & Lysack, C. (2015). "Who over 65 is Online?" Older Adults' Dispositions toward Information Communication Technology. *Computers in Human Behavior*, 43, 156-166. <http://dx.doi.org/10.1016/j.chb.2014.10.018>
- Nur, A. H. B., (2012.). *Profiling ICT Availability and Determints of Teachers' ICT Acceptance in Jember Schools, East Java Indonesia*. Institute of Education, International Islamic University Malaysia. July 2012
- Straub, D.W., Loch, K., & Hill, C. (2001) Transfer of Information Technology to the Arab World: A test of cultural influence modeling. *Journal of Global Information Management*.
- Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model, *Information systems research*, 11(4), 342–365
- Yi, M. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, 59(4), 431–449.