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# Digital Learning Technology Adoption of University Students: A Structural Equation Modeling

**By**

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## Abstract

Information and Communications Technology had a tremendous influence on education and learning. A new model was developed, and confirmatory factor analysis was performed to comprehend how learners use ICT in the classroom truly. Another goal is to examine learners' desires and attitudes to using Information and Communications Technology for digital learning, their core computing skills, WBS, acceptance of digital learning devices, and media-related skills by polling learners at both public and private universities. Using structural equation modeling (SEM) and an upgraded version of the Technology Acceptance Paradigm (TAM) methodology, 500 university students were surveyed, and quantitative data collecting and analytic approaches were employed in this research. Learners' remarks were classified into seven types and evaluated to identify their intentions and attitudes about utilizing ICT in educational contexts. According to the findings, media-related skills, WBS, and BCS all significantly impacted how valuable and easy to use a tool was evaluated. This research-based approach well-captured learners' intentions and attitudes toward adopting ICT for digital learning. In order to help system developers, service providers, researchers, and practitioners to recognize a systematic study approach for model validation in education sustainability, particularly when modeling structural equations in mathematics utilizing Information and Communications Technology for digital learning, this research significantly contributes.

**Keywords:** Digital learning; Information and Communications Technology; Media; Structural equations modeling; Technology Acceptance Paradigm

## 1. Introduction

Educators are obliged to utilize ICT for administration and teaching (Hatlevik & Hatlevik, 2018). They have also changed agents in their schools when implementing new technologies (Deng et al., 2019). Conventional classroom activities may be maintained as lecturers utilize technology to accomplish the same goals without making major changes to their teaching methods (Oussous et al., 2018). The second approach includes integrating technology into the classroom to lower learners' obstacles to participation, link them to real-world experiences, and help them develop their learning styles. To some extent, technology adoption by instructors is influenced by their philosophy of education. Instructors' perspectives may impact their methods of instruction and classroom conduct. According to del Carmen Ramirez-Rueda et al. (2021), ICT-mediated education technology adoption is mediated. This includes discussing how to make academic choices like lesson design, implementation systems, assessment methodologies, and strategies for incorporating ICT into the classroom.

Areepattamannil and Santos (2019) claim that ICT advancements have provided several advantages, including new methods of communication, functionality, and education. With their help, institutions can provide thorough and efficient instruction to students who will become future technology experts. The use of ICT, according to experts, is a powerful learning tool since it excites and engages students (Kozlova & Pikhart, 2021). Developing effective study methods is critical to academic success since each student learns uniquely. Learners are using technology in their studies in a variety of ways since they are continuously exposed to it.

Consequently, studies like Vega-Hernández et al.'s (2018) show that the educational community is becoming increasingly interested in how students' study in relation to ICT usage. Technology's greatest benefit to higher education, says Firat and Köksal (2019), is its ability to enhance student learning. Tondeur et al.'s (2018) study on the ICT abilities of prospective teachers, or the one for instructors, are two examples of this influence on surveys. Mavroudi and Tsagari (2018) found that faculty members need ICT training to educate and do research. Learners' views on ICT are important because they affect how they utilize technology, directly affecting their academic and professional success. ICT components' favorable appraisal does not ensure that they will be used in the learning procedure, but it is a good beginning point (Chavoshi & Hamidi, 2019). Education and many other areas of social life are becoming more dependent on information and communication technology. Learners' education has evolved as a consequence of having a single point of contact for all of their questions and concerns. ICT use in education has grown significantly in recent years, as Cabero points out, enabling us to carry out challenging formative tasks that are not feasible with conventional technology (Yunis et al., 2018).

### *1.1 Background of the Problem*

Instructors and learners must work together to apply to learning. Educators must also be able to use technology in the classroom. Additionally, teachers must be proficient in using ICT (Gudmundsdottir et al., 2020). According to Mishra et al. (2020), learners must develop 4C abilities (creativity and innovation are important, as are problem-solving, critical thinking, communication, and teamwork). Consequently, ICT and digital learning tools are directly linked to the plan's learning model when used during planning. An important gap in our understanding of college students' requirements and how digital learning might help fill it has been discovered in this research (Caniglia et al., 2018). Consequently, students at all four-year colleges and universities must be able to use ICT and digital learning technologies in the classroom and have the ability to learn and be creative. As a result, this study offers a framework for evaluating the connection between learners' usage of ICT and their digital learning. Instructional technology implementation in developing countries is challenging, and it does not always lead to corresponding gains in learner learning outcomes. It is vital to investigate and assess crucial success variables to enhance learners' results when it comes to ICT and digital learning technologies (Alamri et al., 2020). Consequently, instructional technology and information systems are the focus of the research. This study looked at whether improvements would benefit emerging countries like Public and Private Universities. Consequently, this article focuses on university students' ICT usage and digital learning devices.

## 2. Formulation of a Hypothesis and Research Model

Using ICT in higher education has revolutionized the way students and faculty interact with technology and one another. A range of complementary and opposing research adoption models is related to adopting information systems (IS), like Information and Communications

Technology. The Technology Acceptability Model (TAM) was developed by Taherdoost (2018) and is now frequently utilized by academics to evaluate the adoption of new technologies. Students perceived ease of use (PEU), basic computer skills (BCS), web-based skills (WBS), media-related skills (MRS), students' attitude toward use (ATT), perceived usefulness (PU), and students' intentions to use (SIU) Information and Communications Technology for digital learning are all factors that affect whether or not students use Information and Communications Technology for online learning in the present research.

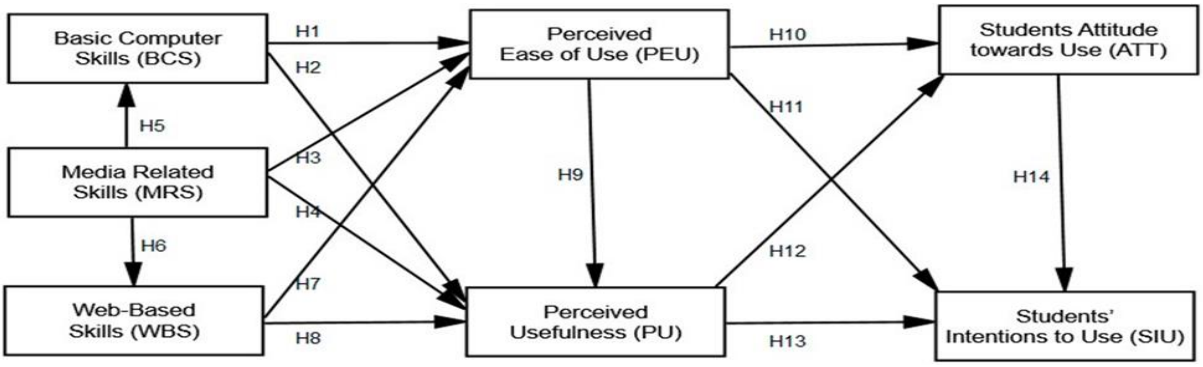


**Figure 1.** *Research Model*

### *2.1 Basic Computer Skills*

Computer expertise falls under both the "content" and "technical competence" headings since it may benefit workers who aren't in the IT field as well as IT workers (Lyu & Liu, 2021). Computer skills are more commonly used by student teachers with a scientific background than those with a humanities background (Saha et al., 2021). Computer abilities are more often used by prospective instructors who have a computer at home than those who do not. Users of the software significantly impact pupils' perceptions of their computer proficiency. As a result, students' expectations are impacted by their belief in the potential for future employment (Hatlevik et al., 2018). The proposed hypothesis for this construct is regarding using Information and Communications Technology for online learning, perceived utility and convenience affect core computer skills. Hypotheses based on this research include the following.

**Hypothesis 1 (H-A):** There is a strong correlation between PEU and BCS
**Hypothesis 2 (H-B):** There is a strong correlation between PU and BCS

### *2.2 Media-Related Skills*

Pedagogical and scholarly emotions and opinions are exempted from the prescribed milieu. Teachers in today's media-driven and digital environment can inculcate in their pupils the foundational abilities they need for digital learning (Kesharwani, 2020). Because today's students, known as digital natives, correspondence, knowledge management, and conduct their activities through current information and communication technologies. It is crucial to identify the abilities required to utilize these technologies and control their development (Suprapto et al., 2018; Teo, 2019). It is hypothesized that the perceived utility and convenience with which ICT may be used in educational settings significantly influences MRS attitudes regarding its usage in digital learning. These theories have been formulated as a result.

**Hypothesis 3 (H-C):** There is a strong correlation between PEU and MRS
**Hypothesis 4 (H-D):** There is a strong correlation between PU and MRS
**Hypothesis 5 (H-E):** There is a strong correlation between BCS and MRS
**Hypothesis 6 (H-F):** There is a strong correlation between WBS and MRS

### *2.3 Web-Based Skills*

The simplicity of WBS is its first distinguishing feature. It does not need much computer knowledge. There were no substantial barriers to WBS implementation due to its ease of use and practicality of WBS (Alt, 2018). Teachers devoted to offering high-quality online learning via WBS have emphasized the need for digital literacy (McNaughton et al., 2018). Web-based abilities are a need in the modern world; educational institutions must also give chances for students to acquire and maintain these key skills for digital learning to take place (Pérez-Foguet et al., 2018). Mehrolia et al. (2021) conducted reliability and validity assessments on the web-based learning abilities used to measure students' attitudes about web-based education. Teachers' attention should be focused on the key scientific principles rather than technological difficulties. Smart teaching methods must be paired with WBS in several recent research (Humrickhouse, 2021). Supposedly, WBS toward ICT use in digital learning is impacted by learners' perceptions of its usefulness and personal evaluations of its value (PEU). Hypotheses based on this research include the following.

**Hypothesis 7 (H-G):** There is a strong correlation between PEU and WBS
**Hypothesis 8 (H-H):** There is a strong correlation between PU and WBS

### *2.4 Perceived Ease of Use*

PEU stands for the extent to which a client perceives an ICT to be painless. The ease of using technology is more likely to elicit a positive response from users (Scherer & Teo, 2019). According to PEU, students believe that employing ICT is both simple and beneficial in this field (Taherdoost, 2018). PEU investigates the impact of technology on performance processes, while PU looks at its impact on increasing productivity in the workplace (Taherdoost, 2018). PU, learners' attitudes toward ICT utilization, and intentions of the desire learners to utilize ICT for online learning are all hypothesized to influence PEU. Hypotheses based on this research include the following.

**Hypothesis 9 (H-I):** There is a strong correlation between PU and PEU
**Hypothesis 10 (H-J):** There is a strong correlation between ATT and PEU
**Hypothesis 11 (H-K):** There is a strong correlation between SIU and PEU

### *2.5 Perceived Usefulness*

People who believe that technology can help them execute their jobs better are referred to be PUs (Taherdoost, 2018). With respect to their perceptions of how ICT may help them learn more successfully, learners in this research used the term "perception utility" (PU). Scherer and Teo (2019) discovered that learners' views and desire to use technology are influenced by their time at PU. Direct and indirect effects of learner happiness and the desire to use ICT in digital learning are both associated with the principle of positive reinforcement (PU). The construct recommended hypothesis states that learners' attitudes and aspirations toward adopting ICT for online learning positively influence PU. Hypotheses based on this research include the following.

**Hypothesis 12 (H-L):** There is a strong correlation between ATT and PU
**Hypothesis 13 (H-M):** SIU and PU have a strong correlation

### *2.6 Students' Attitude Toward Use*

Various studies have shown that students' attitudes regarding usage are influenced by their educational setting or their attention and approbation of their academic tasks. The PEU and the TAM, according to Taherdoost (2018), impact consumer attitudes toward ICT usage for digital learning. When combined, these two factors influence consumer attitudes. For virtual

courses, PEU and perceived usefulness were shown to be important markers (Oyetade et al., 2020). The PEU affects students' attitudes toward and preparedness to take action in ICT use. Because of their belief that technology aids their education, students are more likely to want to utilize it for digital learning, according to this research. When students have the intention to use ICT for digital learning, their attitudes about using it are more positive, as per the hypothesis of this construct. Thus, the following theory is put out as a consequence of this investigation:

**Hypothesis 14 (H-N):** *There is a strong correlation between SIU and ATT.*

### *2.7 Intentions of Learners to Utilize ICT*

"To use ICT" is a term used to describe the pupils' desire to utilize and continue to use technology. Learners' plans to use ICTs have a role in their actual technology use (Tamilmani et al., 2021). This study's ICT use was motivated by students' desire to increase their study enthusiasm. ICT-enhanced learning is a fundamental component of many technical growth utilization strategies (Taherdoost, 2018). Technology writers use the term "intention to use" to indicate the desire of a person to make use of technology in the not-too-distant future. This research selected it as an outcome variable because of its reliability in predicting actual technological use (Scherer & Teo, 2019).

## 3. Methodology

Section 3 of this research applied a quantitative analytical survey to evaluate the theoretical model and assumptions that were put forward there. It was determined that the measurement items would cover all phases of the building process shown in Figure 1 by conducting a thorough literature study. To secure the long-term viability and survival of higher education, several organizations throughout the globe have promoted the use of ICT platforms. Consequently, this study aims to utilize structural equation modeling to create a model for evaluating learners' activities regarding their SIU and ATT. Study participants included undergraduate and postgraduates who used ICT to facilitate digital learning. Public and private colleges and universities all around the world encourage their students to utilize readily accessible information and communication technologies (ICTs) to study online. Based on an in-depth look at how students use ICT in the classroom, this study hopes to develop a way to gauge how much they value and like technology. In this research, students at all levels of education utilized information and communication technology to supplement their classroom teaching.

**Table 1.** *A Comparison of the Final and Pilot Test Results for both Constructions' Reliability Coefficients*

| Latent Factors | Code | Pilot Test | Final Test |
|---|---|---|---|
| Students' intentions to use Information and Communications Technology | SIU | 0.828 | 0.900 |
| Students' attitudes towards the use of ICT | ATT | 0.722 | 0.936 |
| Perceived Usefulness | PU | 0.759 | 0.912 |
| Perceived Ease of Use | PEU | 0.772 | 0.891 |
| Web-Based Skills | WBS | 0.820 | 0.886 |
| Media Related Skills | MRS | 0.792 | 0.908 |
| Basic Computer Skills | BCS | 0.801 | 0.920 |

On a five-point Likert scale, 1 indicates severe disagreement, while 5 indicates strong agreement. Participants were asked about how happy they were with the consequences, how it influenced SIU Information and Communications Technology for online learning, and how Information and Communications Technology was utilized for digital learning. As a result, SPSS was utilized to verify the model's validity and reliability using Structural Equation Modeling (SEM) (AMOS-SEM). Construct Cronbach alpha, validity, composite reliability, and convergence validity for model fit were determined using factor loadings as advised by Alshanty and Emeagwali (2019), as outlined in their paper. We calculated Cronbach's alpha at 0.942 using standard items. Cronbach's alpha is provided in Table 1 for both pilot and final test designs; all variables were judged to be accurate and adequate. Details are shown in Table 1.

### *3.1 Data Gathering and Features of Sample*

This poll was conducted online from January-March 2021 because of the COVID-19 outbreak. A survey tool was created and assessed prior to the main data gathering to understand better how students use ICT for digital learning. We sent out 600 questionnaires as part of the research project. Because outliers might lead to incorrect statistical results, Alshanty and Emeagwali (2019) recommended excluding the replies of 25 persons after performing a normality test. A method known as confirmatory factor analysis is utilized to verify the accuracy of the model. A total of 500 respondents' replies were entered into the SPSS computer program. Learners at public and private universities that utilize ICT for virtual learning are the subject of this research, which was performed during the epidemic of COVID-19.

**Table 2.** *Demographic Information*

| Variables | | Total | Percentage | Variables | | Total | Percentage |
|---|---|---|---|---|---|---|---|
| Gender | Male | 170 | 34 | University | Private University | 247 | 49.4 |
| | Female | 330 | 66 | | Public University | 253 | 50.6 |
| Age | 18-21 years | 146 | 29.2 | Faculties | Computer Science | 49 | 9.8 |
| | 22-25 years | 122 | 24.4 | | Medical Science | 39 | 7.8 |
| | 26-29 years | 74 | 14.8 | | Arts and Humanities | 132 | 26.4 |
| | 30-33 years | 46 | 9.2 | | Science | 56 | 11.2 |
| | More than 34 years | 112 | 22.4 | | Education | 224 | 44.8 |
| Education Level | Postgraduate | 257 | 51.4 | Type of Study | Part-time | 213 | 42.6 |
| | Undergraduate | 243 | 48.6 | | Full time | 287 | 57.4 |
| Time of use ICT | More than 10 years | 99 | 19.8 | Use ICT | Never | 24 | 4.8 |
| | 5-10 years | 137 | 27.4 | | Sometimes | 177 | 35.4 |
| | Less than 5 years | 264 | 52.8 | | Always | 299 | 59.8 |

The demographic data are shown in Table 2. 170 male respondents (34 percent) were discovered among the 500 usable questionnaires questioned, whereas 330 female respondents (66 percent) were identified. Moreover, 146 respondents (29.2%) were ages between 18-21, 122 (24.4%) were ages between 22-25, 74 (14.8%) were ages between 26-29, 46 (9.2%) were ages between 30-33, and 112 (22.4%) were ages above 34. In addition, 353 participants (50.6%) from public universities and 247 participants (49.4%) from private universities took

part in the poll. Regarding education, 257 (51.4%) were postgraduate students, while 243 (48.6%) were undergraduate students. Members of the faculty included 49 (9.8 percent) members of the computer science faculty, 39 (7.8 percent) members of the medical science faculty, 132 (26.4 percent) members of the art faculty, 56 (11.2 percent) members of the science and humanities faculty, and 224 (44.8 percent) members of the education faculty. According to the findings, 2 213 (42.6 percent) respondents were part-time learners, while 87 (57.4 percent) were full-time learners. In terms of time spent using ICT for digital learning, 264 participants (52.8%) had only used ICT for less than or exactly 5 years, 137 participants (27.4 percent) had utilized ICT for 5-10 years, and 99 participants (19.8 percent) had utilized ICT for more than ten years. Finally, ICT may be used for online learning; 24 people (4.8 percent) said they did not use it at all, 177 participants (35.4 percent) said they used it part of the time, and 299 participants (59.8 percent) said they used it all of the time.

### *3.2 Instruments*

Materials used in previous studies proved the scales' material validity. Gender, age, educational level, and specialization were only a few of the fundamental demographics acquired by the survey, but there were other questions in the survey to score these characteristics.

**Table 3.** *The loadings of the items, the measurement model's reliability, and validity*

| Variables | Code | Loading | AVERAGE | CR | CA |
|---|---|---|---|---|---|
| Basic Computer Skills | BCS1 | 0.831 | 0.608 | 0.907 | 0.920 |
| | BCS2 | 0.853 | | | |
| | BCS3 | 0.820 | | | |
| | BCS4 | 0.723 | | | |
| | BCS5 | 0.762 | | | |
| Media-Related Skills | MRS1 | 0.744 | 0.600 | 0.820 | 0.910 |
| | MRS2 | 0.733 | | | |
| | MRS3 | 0.781 | | | |
| | MRS4 | 0.812 | | | |
| Web-Based Skills | WBS1 | 0.802 | 0.714 | 0.920 | 0.886 |
| | WBS2 | 0.755 | | | |
| | WBS3 | 0.754 | | | |
| Perceived Ease of Use | PEU1 | 0.722 | 0.664 | 0.899 | 0.893 |
| | PEU2 | 0.794 | | | |
| | PEU3 | 0.772 | | | |
| | PEU4 | 0.770 | | | |
| | PEU5 | 0.780 | | | |
| Perceived Usefulness | PU1 | 0.722 | 0.704 | 0.901 | 0.912 |
| | PU2 | 0.831 | | | |
| | PU3 | 0.791 | | | |
| | PU4 | 0.754 | | | |
| | PU5 | 0.769 | | | |
| Students' attitudes towards the use of ICT | ATT1 | 0.831 | 0.643 | 0.909 | 0.938 |
| | ATT2 | 0.883 | | | |
| | ATT3 | 0.740 | | | |
| | ATT4 | 0.861 | | | |
| Students' intentions to use Information and Communications Technology for digital learning | SIU1 | 0.810 | 0.696 | 0.894 | 0.900 |
| | SIU2 | 0.819 | | | |
| | SIU3 | 0.862 | | | |

Saha et al. (2021) provided the BCS, Kesharwani (2020) provided the media skills, McNaughton et al. (2018) provided the WBS, and Taherdoost (2018) provided the PEU, PU, students' attitudes, and provided the intents to utilize Information and Communications Technology for digital learning. As a result, multi-item tests based on previous research and self-reports were used to evaluate the components. Utilizing a five-point Likert scale, each variable was rated from 1-5, with one signifying "strongly disagree" and five signifying "strongly agree." Table 3 has a detailed inventory of all of the items.

# 4. Analysis and Findings

Structural equation modeling with covariance has been utilized to examine the conceptual model in the thesis (CB-SEM). Using CB-SEM offers a number of advantages. The measurement model focuses on construct validity, general model fitness, and reliability. Maximum likelihood (ML) was used to estimate these parameters (Alshanty & Emeagwali, 2019). AmoS and CB-SEM techniques were utilized to analyze the data set (v.24). Calculating and structural models were both evaluated as methodological measures. For example, the structural model addresses how Information and Communications Technology may be utilized to test online learning hypotheses.

### *4.1 Validity, Reliability, and Measurement Model Interventions*

These features, like reliability and validity, are exclusive to each SEM-AMOS model of measurement. The use of model fitness indicators and individual CFA from the measurement model was used in structural model analysis to analyze link direction intensity. Table 2 provides a breakdown of the measurement's components.

**Table 4.** *Validity in discrimination*

| Factors | Code | AVE | MRS | ASV | MSV | WBS | BCS | PEU | PU | ATT | SIU |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Media - Related Skill | MRS | 0.598 | 0.850 | 0.081 | 0.218 | | | | | | |
| Web - Based Skill | WBS | 0.712 | 0.400 | 0.070 | 0.092 | 0.898 | | | | | |
| Basic Computer Skill | BCS | 0.608 | 0.329 | 0.051 | 0.083 | 0.402 | 0.814 | | | | |
| Perceived Ease of Use | PEU | 0.664 | 0.210 | 0.068 | 0.209 | 0.204 | 0.200 | 0.850 | | | |
| Perceived Usefulness | PU | 0.702 | 0.220 | 0.063 | 0.229 | 0.245 | 0.256 | 0.268 | 0.857 | | |
| Attitude towards use | ATT | 0.641 | 0.292 | 0.033 | 0.050 | 0.365 | 0.343 | 0.267 | 0.340 | 0.872 | |
| Students' Intentions to use Information and Communications Technology | SIU | 0.698 | 0.217 | 0.042 | 0.119 | 0.315 | 0.321 | 0.277 | 0.329 | 0.383 | 0.928 |

The findings reveal that item dependability is not a concern since most commodities achieve the 0.706 criteria (Alshanty & Emeagwali, 2019). Using a composite reliability score that ranged from 0.820 to 0.920, we determined that the constructs' internal consistency exceeded the threshold of 0.69. (Alshanty & Emeagwali, 2019). From 0.711% to 0.5999%, the constructs' average variance derived (AVE) exceeded the 0.50 threshold for convergent validity

(Alshanty & Emeagwali, 2019). Researchers used cross-loading, the square root of the average absolute variance (AVE) (Fornell and Larcker ratio), maximum shared variance (MSV), and average shared variance (ASV) tests to evaluate discriminant validity. The value on the diagonal is bigger than the values on the neighboring rows and columns (Table 4). Symbolizes a closer relationship between the building and its environment. Similar to the ASV, the MSV is smaller than (AVE) in the same manner.

### *4.2 Model Fit Evaluation*

**Table 5.** *Findings in hypotheses testing*

| Hypotheses & Path | | | | β | SE | CR | p-Value | Result |
|---|---|---|---|---|---|---|---|---|
| H-A | PEU | <— | BCS | 0.222 | 0.039 | 5.575 | 0.000 | HA |
| H-B | PU | <— | BCS | 0.223 | 0.039 | 5.822 | 0.000 | HA |
| H-C | PEU | <— | MRS | 0.125 | 0.029 | 4.366 | 0.000 | HA |
| H-D | PU | <— | MRS | 0.002 | 0.028 | 0.125 | 0.902 | HO |
| H-E | BCS | <— | MRS | 0.438 | 0.028 | 16.219 | 0.000 | HA |
| H-F | WBS | <— | MRS | 0.531 | 0.028 | 19.412 | 0.000 | HA |
| H-G | PEU | <— | WBS | 0.106 | 0.040 | 2.719 | 0.008 | HA |
| H-H | PU | <— | WBS | 0.057 | 0.036 | 1.570 | 0.116 | HO |
| H-I | PU | <— | PEU | 0.604 | 0.035 | 16.984 | 0.000 | HA |
| H-J | ATT | <— | PEU | 0.349 | 0.046 | 7.444 | 0.000 | HA |
| H-K | SIU | <— | PEU | 0.310 | 0.041 | 7.445 | 0.000 | HA |
| H-L | ATT | <— | PU | 0.544 | 0.043 | 13.190 | 0.000 | HA |
| H-M | SIU | <— | PU | 0.268 | 0.040 | 6.794 | 0.000 | HA |
| H-N | SIU | <— | ATT | 0.369 | 0.034 | 11.305 | 0.000 | HA |

Note: H=Hypothesis; β=Beta; SE= Standard Error; CR= Critical Ratio; HO=Rejected; HA=Accepted

Table 5 shows a CMN/DF ratio of 4.332, which is less than the required level (5.00). The GFI (0.948) is a good starting point, but the TLI (0.920), IFI (0.929), and CFI (0.952) are all above average.

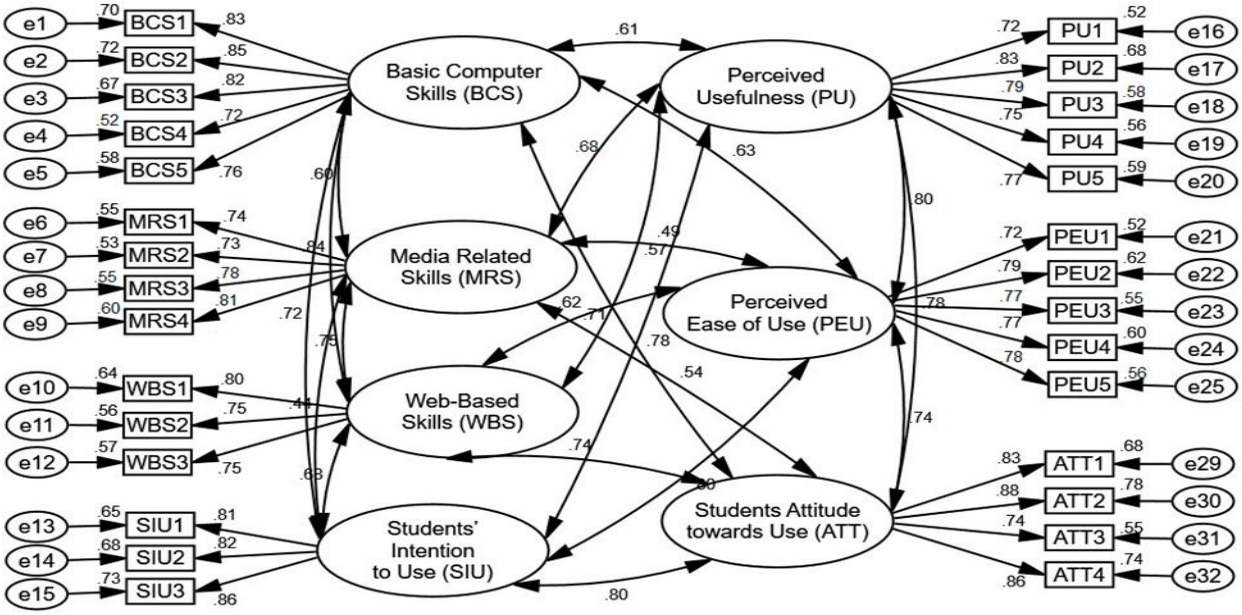


**Figure 2.** *Model of Measurement*

The model's badness metrics were adequate, with RMSEA and RMR values below the thresholds of 0.49 (0.05) and 0.035 (0.07), respectively (Alshanty & Emeagwali, 2019). The whole collection of observations is shown in Figure 2. This demonstrates that the measuring model was satisfactory and suitable for the structural model.

### *4.3 Model of Structural and Path Coefficient*

The model of structural describes the link between the dependent and independent variables and the direction of that relationship (path coefficient). For complicated models, the maximum likelihood approach, in specific, may be utilized to comprehensively investigate numerous correlations between multi-item components and the effect of moderating and mediating variables (Balapour et al., 2020). Examples of the direct impact of latent variables predicted by the route coefficient are shown in Figures 3 and 4.

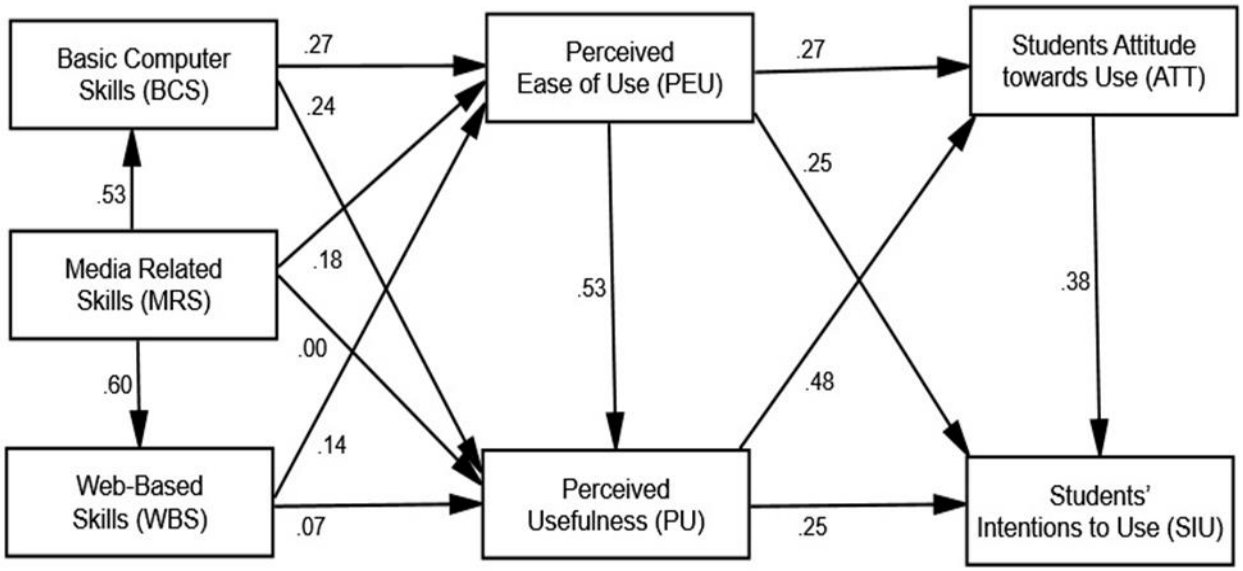


**Figure 3.** *Path coefficient*

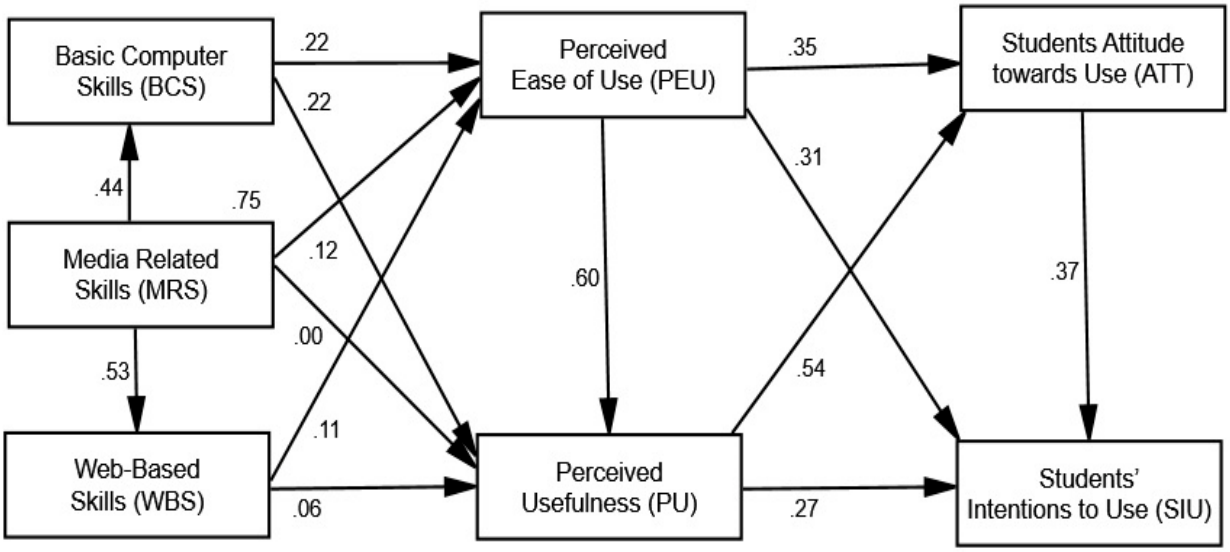


**Figure 4.** *Model of structural (p-Value)*

Table 5 shows that BCS (β = .222, CR = 5.575) has a favorable and significant influence on PEU, supporting H-A. H-B indicates that BCS (β = .223, CR = 5.822) has a significant and beneficial effect on PU. H-C indicates that MRS (β = .125, CR = 4.366) has a significant and

beneficial effect on PEU. MRS (β = .002, CR = .125) shows a negative influence on PU, however, refuting H-D. MRS (β = .438, CR = 16.219) has a favorable and significant influence on BCS, indicating that H-E is correct. Similarly, MRS (β = .531, CR = 19.412) has a favorable and significant influence on WBS, indicating that H-F is correct. H-G is supported since WBS (β = .106, CR = 2.719) has a favorable and substantial influence on PEU. On the other hand, WBS has a favorable and substantial impact on PU (β = .057, CR = 1.570), indicating that H-H is rejected. H-I is supported because PEU (β = .604, CR = 16.9824) has a favorable and substantial influence on PU. Furthermore, PEU (β = .349, CR = 7.444) has a favorable and substantial influence on learners' ATT, indicating that H-J is supported. H-K is supported since PEU (β = .310, CR = 7.445) has a favorable and substantial influence on SIU ICT for online learning. H-L is supported since PU (β = .544, CR = 13.190) has a favorable and substantial influence on learners' ATT-ICT. Furthermore, PU (β = .268, CR = 6.794) has a favorable and substantial influence on SIU ICT for online learning, indicating that H-M is correct. Finally, learners' ATT-ICT (β = .369, CR = 11.305) has a favorable and significant influence on SIU ICT for online learning, suggesting that H-N is correct.

### *4.4 Factor Description and Analysis*

There are two statistics that demonstrate the degree to which measurements in a population deviate from the average (mean) or anticipated value: SD and MD (mean). All data points are near the mean in a situation where standard deviations are low. If the standard deviation is large, then the data is spread out.

**Table 6.** *Measuring Basic Computer Skills*

| Factor | Code | Total and Percentage of Participants | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| Basic Computer Skills | BCS1 | 10 (1.5) | 14 (2.0) | 60 (8.5) | 210 (29.5) | 416 (58.6) | 4.45 | 0.826 |
| | BCS2 | 9 (1.4) | 15 (2.2) | 41 (5.7) | 203 (28.4) | 446 (62.6) | 4.51 | 0.789 |
| | BCS3 | 14 (2.1) | 15 (2.2) | 59 (8.2) | 189 (26.4) | 437 (61.5) | 4.45 | 0.883 |
| | BCS4 | 22 (3.2) | 43 (6.1) | 119 (16.4) | 227 (32.0) | 301 (42.4) | 4.06 | 1.064 |
| | BCS5 | 6 (1.0) | 14 (2.1) | 52 (7.2) | 195 (27.5) | 445 (62.6) | 4.50 | 0.801 |

A table showing that all principles were accepted shows that students' access to accessible ICTs helped them learn digitally, as demonstrated in Tables 6–12. According to research, most students support or strongly agree with basic computer skills and their perceived value and simplicity of use. Strongly disagree comes first, followed by disagreement (second), neutral (third), agree (fourth), then strongly agree (fifth). Consequently, this research defines basic computer abilities as learners' belief that utilizing Information and Communications Technology would enhance their digital education (Table 6).

**Table 7.** *Measuring Media-Related Skills*

| Factor | Code | Total and Percentage of Participants | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| Media Related Skills | MRS1 | 20 (2.9) | 75 (10.6) | 124 (17.5) | 244 (34.4) | 245 (34.4) | 3.85 | 1.093 |
| | MRS2 | 17 (2.4) | 55 (7.8) | 119 (16.7) | 234 (32.9) | 287 (40.6) | 4.02 | 1.045 |
| | MRS3 | 14 (1.9) | 32 (4.5) | 80 (11.2) | 250 (35.0) | 339 (47.7) | 4.24 | 0.938 |
| | MRS4 | 85 (12.0) | 129 (18.2) | 152 (21.3) | 171 (24.1) | 172 (24.2) | 3.29 | 1.335 |

According to Table 7 of the findings of the MRS, most of the learners believe that media-related talents have a high value and are easy to use. This research defines media-related skills as learners' conviction employing ICT might boost their digital learning (Table 7).

**Table 8.** *Measuring Web-Based Skills*

| Factor | Code | Total and Percentage of Participants | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| Web-Based Skills | WBS1 | 14 (2.0) | 27 (3.8) | 52 (7.5) | 245 (34.5) | 365 (51.5) | 4.29 | 0.922 |
| | WBS2 | 17 (2.3) | 30 (4.2) | 79 (11.2) | 250 (35.2) | 326 (45.9) | 4.21 | 0.977 |
| | WBS3 | 10 (1.2) | 21 (2.7) | 51 (6.8) | 224 (31.3) | 422 (59.2) | 4.42 | 0.814 |

Based on these data, it can be concluded that most students believe that WBS is useful and easy to implement, as indicated in Table 8. WBS refers to a learner's belief that adopting ICT would boost their digital learning (Table 8).

**Table 9.** *Measuring Perceived Ease of Use*

| Factor | Code | Total and Percentage of Participants | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| Perceived Ease of Use | PEU1 | 5 (0.5) | 30 (4.2) | 69 (9.8) | 303 (42.8) | 302 (42.5) | 4.22 | 0.829 |
| | PEU2 | 5 (0.5) | 19 (2.5) | 55 (7.7) | 287 (40.2) | 349 (49.3) | 4.36 | 0.767 |
| | PEU3 | 6 (0.9) | 44 (6.2) | 100 (14.2) | 305 (42.8) | 254 (35.8) | 4.07 | 0.913 |
| | PEU4 | 8 (1.1) | 29 (4.0) | 58 (8.2) | 280 (39.2) | 335 (47.5) | 4.26 | 0.867 |
| | PEU5 | 6 (0.9) | 13 (2.1) | 48 (6.7) | 245 (34.4) | 394 (55.9) | 4.43 | 0.782 |

PEU's perceived utility, student comments on usage, and SIU's ICT for digital learning are all well regarded by learners, according to Table 9. In this research, a student's belief that adopting ICT will boost their digital learning is defined as PEU (Table 9).

**Table 10.** *Measuring Perceived Usefulness*

| Factor | Code | Total and Percentage of Participants | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| Perceived Usefulness | PU1 | 9 (1.3) | 20 (2.8) | 42 (5.9) | 268 (37.7) | 371 (52.2) | 4.38 | 0.828 |
| | PU2 | 5 (0.7) | 5 (0.9) | 37 (5.2) | 249 (35.2) | 413 (58.0) | 4.50 | 0.692 |
| | PU3 | 11 (1.6) | 17 (2.4) | 75 (10.6) | 220 (30.9) | 385 (54.2) | 4.32 | 0.889 |
| | PU4 | 12 (1.6) | 15 (2.1) | 74 (10.4) | 245 (34.5) | 366 (51.4) | 4.30 | 0.855 |
| | PU5 | 10 (1.4) | 39 (5.7) | 83 (11.7) | 255 (36.1) | 320 (44.8) | 4.15 | 0.953 |

Findings from the PU survey suggest that a large number of learners agree or highly agree on the attitudes toward using ICT for online learning, intentions to utilize it, and perceived usefulness. It is thus defined as a learners' belief that Information and Communications Technology use will boost their digital learning in this study (Table 10).

**Table 11.** *Measuring students' Attitude Toward Use*

| *Factor* | *Code* | *Total and Percentage of Participants* | | | | | *Mean* | *SD* |
|---|---|---|---|---|---|---|---|---|
| *Students' Attitude towards Use* | ATT1 | 8 (1.2) | 6 (1.1) | 57 (8.1) | 250 (35.2) | 389 (54.6) | 4.39 | 0.786 |
| | ATT2 | 9 (1.3) | 14 (2.2) | 57 (8.2) | 242 (34.1) | 380 (53.8) | 4.38 | 0.832 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ATT3 | 14 (2.0) | 25 (3.7) | 86 (12.1) | 227 (31.8) | 356 (50.1) | 4.25 | 0.955 |
| ATT4 | 12 (1.7) | 23 (3.2) | 71 (9.9) | 240 (33.7) | 369 (52.0) | 4.33 | 0.879 |

An analysis of student attitudes toward digital learning with ICT is shown in Table 11, which indicates that a large number of students share their views on the topic. Consequently, this research defines a student's attitude toward ICT usage as the extent to which the learner believes that using Information and Communications Technology would enhance their digital learning (Table 11).

**Table 12.** *Measuring SIU ICT*

| Factor | Code | Total and Percentage of Participants | | | | | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| Students' Intention to Use | SIU1 | 13 (1.9) | 9 (1.3) | 39 (5.4) | 276 (39.2) | 374 (52.6) | 4.39 | 0.785 |
| | SIU2 | 6 (1.0) | 17 (2.3) | 45 (6.1) | 255 (36.2) | 386 (54.3) | 4.39 | 0.805 |
| | SIU3 | 11 (1.5) | 17 (2.3) | 59 (8.4) | 259 (36.4) | 359 (49.8) | 4.36 | 0.843 |

As seen in Table 12, the results of the survey on SIU ICT indicate that a large number of learners are in agreement or strongly in agreement that ICT would benefit digital learning. Consequently, the degree to which students believe that utilizing Information and Communications Technology would help them in their digital learning is used to characterize their intentions to use it in this research (Table 12).

## 5. Discussions

It's the first time the TAM model has been used to study the usage of ICTs in digital education. According to the model, fundamental computing talents, media-related skills, and WBS significantly impact PEU and usefulness. PEU and learners' perceptions of the value of ICT in digital learning affected their attitudes and intentions toward ICT usage. An astounding 73,8 percent (and an even higher 81.4 percent) of learners had differing opinions about the employment of ICTs in digital learning. According to the assumptions and the research methods, the results agreed.

As a consequence of the findings, we can see how the TAM components of MRS, WBS, and BCS (dependent variables) are utilized to evaluate learners' attitudes towards and intends to use Information and Communications Technology for digital learning and PEU and utility (mediating variables). Most classifications were shown to have a favorable and relevant link with learners' attitudes towards adopting ICT for online learning, including fundamental computer competencies, PE, MRS, PU, and WBS. Learners' ATT utilization and their plans to use Information and Communications Technology for digital learning have all been established in previous studies to have significant benefits for BCS, MRS, WBS, PEU, PU, and students. This research suggests that learners examine ICT's ability to meet their research objectives and necessary computer skills like PEU, PU, WBS, and MRS before using it for digital learning.

Learners' Information and Communications Technology usage for digital learning and their intentions to do so were also examined. Students who are already comfortable with technology are increasingly turning to ICT in the classroom. A student's perspective on technology is different from an adults. SIU Information and Communications Technology for online learning should be both easy to utilize and helpful to meet these criteria (Njenga et al., 2019). Their PU, WBS, PEU, MRS, and BCS impact learners' opinions on using ICT in online learning.

According to Table 4, all the predicted associations were proved to be true by statistical analysis results. This study's hypothesis results were at odds with those of other research, such as Scherer and Teo (2019), which revealed that having a fundamental understanding of computers has a substantial and positive influence on PU. Learners' views and intentions towards using Information and Communications Technology for digital learning were positively affected by WBS, MRS, and BCS. Due to the variable outcomes, more research into the connections between the various elements is required.

Learner views toward ICT in digital learning are improved by participation in the PEU and PU, according to the TAM. This finding is supported by previous studies (Njenga et al., 2019; Scherer & Teo, 2019). Specifically, this research found that learners' attitudes toward using ICT were improved, and their intentions to utilize Information and Communications Technology for digital learning were boosted when the PEU and PU were increased. According to other studies, there is a substantial and direct link between PU and PEU (Prasad et al., 2018). In addition, students feel Information and Communications Technology is simple to utilize if it enhances their education. Learners who have access to Information and Communications Technology are more likely to see technology as simple and beneficial.

It is thus imperative that programmers of ICT provide user-friendly solutions that are critical to the PEU's long-term achievement in student education. Managers can help learners figure out how to take advantage of ICT in their online education. These assessments affect learners' attitudes toward and readiness to utilize Information and Communications Technology for digital learning. According to the results, ICT programmers, designers, and buyers (like higher education institutions) must consider consumer demands and values to guarantee that the structure can match student needs. Students will be more likely to adopt new technologies if there is a good match between the qualities of the system and their educational objectives.

According to the study's results, students' views about ICT use were shown to be influenced by both their current beliefs about the technology and their future plans to utilize it for digital learning. Information and Communications Technology for online learning should be easy to utilize and beneficial for college students, or some variation thereof. ICT usage must be simple and clear, and precise guidelines must be provided. Learners' views on the use of technology significantly impact their intentions to use technology for online learning, as the data from this study demonstrate.

According to the results of this study, students' PEU and PU are affected when ICT is used to teach them computer basics, media literacy, and WBS. The PU and PEU of ICT influence learners' attitudes about technology and their plans to use it for online learning. Educational sustainability and Information and Communications Technology for digital learning impact TAM (Njenga et al., 2019; Scherer & Teo, 2019). As ICT becomes more widely used as a teaching tool, the number of tactics used by lecturers and learners alike will continue to rise (Aldiab et al., 2019).

Making learning more meaningful for students via an innovative method of regulating emotions and motivational processes incorporates ICT (Andaregie & Astatkie, 2021). Contrarily, ICTs provide significant possibilities for educational application, like the contributions of neuroscience education (Law et al., 2019). Lorenza and Carter (2021) discovered that both perceived ease of use and perceived usefulness affected learners' attitudes toward and intentions to utilize remote learning. As a result, this research differs from earlier ones in the following ways. Our study's first goal is an integrated model for ICT usage in

education that incorporates both our IS output model and our Teaching Assessment Model (TAM). Second, unlike prior studies in Saudi Arabia, this study attempts to give a complete overview of current publications on Higher education's use of ICT as a source of sustainability. The third point is that, in contrast to previous research that examined the impact of factors on intention to utilize, this research also examined the influence of factors on both SIU and ATT. A wide variety of results and data on learners' behavior, like ATT and SIU, are thus likely to be found in this research. Relationships between BCS, MRS, and WBS at two Saudi state colleges substantially impacted ATT, SIU, and PEU.

Teachers and public relations professionals at schools and colleges were the most helpful to learners throughout the global shutdown and transition to online education (Noori, 2021). On the other hand, learners got insufficient help and protection from others and their professors when they needed it (Moula, 2021). Universities must thus offer accessible, egalitarian, and high-quality education that lowers the digital gap while also fostering long-term activities that are environmentally friendly (Mengistie, 2021). In addition, our study shows that widely accessible ICTs may assist educators and learners solve issues, knowing about present events, and improving global communication and competitiveness. Last but not least, we have the contributions from the scientific community:

1. Incorporating ICT into instructional techniques has increased students' attitudes toward technology and their excitement for digital learning. ICT should be encouraged by lecturers and supervisors to solve issues, distribute information, and exchange expertise.
2. According to some experts, learners who have previously used ICT in the classroom must be encouraged rather than those who have not. A learner's learning process is enhanced by using ICT components and materials.
3. Technology and materials impact learners' intentions and attitudes toward using Information and Communications Technology for digital learning. ICT-based digital learning possibilities must be taken advantage of by all learners.

## 6. Limitations

Even though this research provides valuable information, it has its limitations. First, the conclusions of this research should be taken with a grain of salt since the conduct of students at various institutions (both private and public) may be quite different. Consequently, researchers should utilize qualitative data (interviews or observations) instead of quantitative data to avoid conflicts across research topics. Future studies should replicate this analysis in multiple areas, cultures, and countries to correct flaws and widen the breadth of its results. Moderator research was not feasible due to the small size of the sample; hence no consideration was given to the effects of gender or age. Researchers employed experimental power, data stability, and extra student satisfaction ratings to analyze the impact of moderators on acceptance in larger research that included several nations, institutions, or technology. In order to investigate the differences and similarities between the numerous opinions of a unified theory of the use and acceptance of technical components by context, the qualitative analysis would be relevant. More work is required to apply the results to different situations, analyze the model's breadth of applicability, and create new applications after this research on the IS and TAM Success Model. E-readiness and M-learning system adoption are only two examples of studies that might be expanded to understand better how IS applications are now being used.

## 7. Conclusions and Recommendations

Additionally, information on students' opinions about using ICT for digital learning was gathered to verify the TAM model's long-term viability in the classroom. An examination of both the work's theoretical and practical ramifications was conducted. This article presents new data on user acceptance and the usage of Information and Communications Technology for digital learning. Students in the twenty-first century, not only high schoolers but also college students, benefit greatly from the use of ICT. However, no previous research has examined how learners see Information and Communications Technology and their intentions to utilize it for digital learning. Learners' attitudes regarding ICT acceptance and objectives to use ICT for academic purposes have been found to be adequately resilient by the use of the TAM in this study. In order to help system developers, service providers, researchers, and practitioners to recognize a systematic study approach for model validation in education sustainability, particularly when modeling structural equations in mathematics utilizing Information and Communications Technology for digital learning, this research significantly contributes. Seven novel TAM model elements were introduced into this research as crucial determinants of ICT adoption for digital education. Learners' views regarding ICT utilization and their ambitions to utilize ICT for online learning are also considered part of the study approach. Because of the contradictory findings in the literature, further study is required to identify the association between web-based and media-related abilities and PU. A more in-depth understanding of how students and educators perceive ICT use for digital learning should focus on future research. The future study must examine these challenges by comparing them to this model and including cultural influences.

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