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Factors Affecting the Adoption of Digital Information Technologies in Higher Education: An Empirical Study

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Abstract: In this study, we present the results of an assessment of an initiative that seeks to transcend the application of digital information in the higher education sector by recommending an integrative approach that quantifies both the flow of digital information and tutors' quality impacts concerning technology acceptance model (TAM) constructs and the perceived experience of digital information in education (DIE). There is a mounting evidence that the educational institutions that prioritize the perceived experience and the quality of the tutors do not, generally, take into account the limited exposure to digital information and technologies. Data gathered from a survey of 485 college students were used to evaluate the model and hypotheses. The findings show that users' perceptions of the value of DIE may depend on several extrinsic conditions that improve their experiences of learning and teaching. The user's traits, such as technological preparedness, are vital in determining perceived ease of use. In some cultures, the superior quality of the tutor may further increase perceptions of the technology's perceived usefulness. The intention to adopt technology may also be highly influenced by other variables such as information flow. Therefore, academic institutions must reevaluate the usefulness of digital information technology as a tool for improving educational sections. This research limited its focus to educational environments in which DIE has a significant impact on the teaching and learning setting. Future works may concentrate on health or monetary organizations.

Keywords: digital information; higher education; tutors' quality; technology acceptance model

1. Introduction

The digital transformation in education has received a lot of positive attention [1]. In higher education, the application of digital technologies to improve learning has drawn a lot of interest. In recent times, it has frequently been difficult to acquire education via an alternative learning process approach. Technology advancements have made it possible to currently find answers to issues such as communication, information access, and

corporate or cooperative ventures. As a result, there is numerous research that addresses the significance of technology self-efficacy in academia. However, most of the research concentrates on technology proficiency, while other research gives insight into digital technologies, which are thought to be crucial in shaping the type of digital information people receive and their acquired learning skills. This research advances and broadens the use of digital technology and information in the educational field, consequently promoting research programs, research findings, and the academic success of students [2–4]. The preponderance of earlier studies [4–9] concentrated on the adoption of digital technology in institutional educational contexts. The impact of experience, TAM, teachers' roles, and students' views are among the factors that can affect a student's digital informal learning, although an empirical study on these factors is scarce. Additionally, a past study showed impediments to digital learning in traditional schools, but its status in higher education is still unknown. Our goal in this study is to shed light on the circumstances surrounding digital learning at college level education from the standpoint of the instructor. We looked at (1) the digital flow of information concerning the perceived ease of use of the digital learning, (2) tutor quality concerning the perceived usefulness, and (3) perceived experience concerning whether the perceived ease of use and perceived usefulness are indicative of the intention to employ digital learning in special education.

2. Review of the Literature

The most recent developments can be seen as a reflection of how technology is expanding and becoming more prevalent to help achieve exceptional innovation levels. Significant shifts were brought about by digital technologies in several industries, notably education. This results in lessening the impact of conventional teaching and learning methods. Digital technology in the educational setting was the subject of earlier research. The research concentrated on peoples' knowledge in contrast to the dramatic shifts in information and communication technologies in the education system, commencing with the establishment of digital information competence [5,6]. Computer proficiency is a key component that supports individuals' involvement in society and a job. Owing to even basic access to digital information, it is believed that digital information competency is the foundation for the capacity to retain continuous learning. Teachers who oversee helping students develop their digital information and communication skills may be significantly impacted by literacy abilities. By concentrating on the sorts of technology utilized as instruments to achieve various educational objectives, namely accessing, assessing, exchanging, and conveying digital information, the degree of competency in the application of digital information and communication abilities is conceived. It is important to recognize the contribution of teachers in promoting the usage of digital information. According to research, instructors' views, and support of the usage of digital information play a significant effect. The importance placed on the digital domain of information for academic reasons is significantly influenced by instructors' roles [5–7,10].

To evaluate computer self-efficacy, computer anxiety, perceived enjoyment, and acceptance of digital learning as sustainable in connection to students' satisfaction, research by [11] developed a novel model that may quantify characteristics that influence the adoption of digital information by students. Earlier research has a variety of goals. The research tried to study the safety issues with digital educational resources that are offering the finest ways to resolve the challenge of the perceived risk underneath security challenges, because the emphasis on the issue of security in utilizing digital information was important [12,13]. Other research, though, focused on the uptake of digital information. Prior research was conducted to analyze the influence of the digital storytelling approach on digital literacy abilities, with a specific emphasis on the development and adoption of the method [8,9].

Additionally, researchers found that thresholds of digital literacy shifted upon the implementation of novel digital information, implying that both instructors' and students' perspectives shifted given the struggles they faced when using the new digital information [8,11]. Based on the type of model used, the findings of previous research have a variety

of consequences. Most of the research concentrated on elements such as perceived enjoyment, perceived usefulness, perceived ease of use, computer anxiety, computer self-efficacy, and TAM components. This research accentuates the beneficial role that the method of using digital information plays in educational contexts. According to the literature review's findings, self-efficacy and perceived support both have a substantial impact on digital learning at the corporate stage, while self-control and parental assistance are the key barriers for students. A training program should be made available for education instructors, students, and practitioners in digital learning to address the self-efficacy issue [9]. As a component of the barriers preventing the adoption of digital information and technologies, other relevant variables such as student attendance, digital challenges, connectivity consideration, and involvement are included. A list of suggestions was made, including creating media content that enables bidirectional communication to enhance inter-institutional collaboration [9,13].

Although earlier research used various models to assess how well digital information was accepted, the present research differed from preceding research since it concentrated on the impact of other external factors including perceived experience and tutor quality. These elements have never been discussed in research that investigated the effects of digital information. TAM was identified in published findings as a crucial paradigm for assessing the acceptability of digital information in the educational setting. The present research tried to look into how perceived experience and TAM components relate to one another.

2.1. Digital Flow Information

To illustrate the varying levels of the usefulness of technology, the component of digital information serves as a depiction of the flowing spectrum. Components of the digital information flow have perceived benefits of technology. According to research, the perceived trust that people have in the information they receive is related to the digital flow of information. People who have access to information on educational platforms exhibit growing trust in digital information. When students view the information flow digitally as reliable, they are more likely to use it frequently. It acts as a type of inducement to keep using the information flow provided by digital technology. On the other side, innovation appears to have a detrimental consequence on the digital information flow, since it alters students' views based on their experiences and the sorts of information supplied [14,15]. Based on the foregoing supposition, it is possible to hypothesize that:

Hypothesis 1 (H1). *Digital information has a positive effect and great impact on the perceived ease of use*.

2.2. Tutor Quality

The tutor now plays a variety of other roles instead of just passing along the information to a group of students. The growth of the e-learning ecosystem altered the responsibility of the tutor. In situations where students believe their tutor to be of high quality, they can serve as the mediator, mentor, trouble-shooter, and somebody who can resolve any hardware or software problems. A high-quality tutor will motivate students or learners to participate in novel e-learning settings and utilize novel digital information with ease. The evolution of the tutor's position led to new responsibilities such as group instructional help, conducting in-person or online classes for specialized assistance, emailing, and building online groups, in addition to electronic feedback for online assignments [16,17]. Considering that there is a favorable relationship between students' intention to use digital information and the perceived usefulness that results from high tutor quality, prior research linked high-quality tutors and perceived usefulness [16,17]. As a result, it is assumed that:

Hypothesis 2 (H2). *Tutor quality has a positive effect and great impact on the perceived usefulness*.

2.3. TAM Model and Experience

The TAM model was first developed by [18], who established the ground for a collection of cognitions and beliefs linked to the acceptance of technology that also takes into account the two important factors of perceived usefulness and perceived ease of use intended to address the idea of DIE acceptability. A psychological construct known as experience can be regarded as an inherent motive that includes fun and fulfilment [19,20]. Previous research that combined perceived experience with TAM suggested that people with extensive experience value employing technology, with an emphasis on on-time experience that can strongly anticipate the perceived usefulness and perceived ease of use. Therefore, people may believe that technology is easy to use, presuming that ease of use will allow them to use it freely, without having to exert much thought or work. This occurs anytime experienced users interact with technology regularly, which may create a comfortable and welcoming atmosphere [21]. The relationship between perceived experience, perceived usefulness, and perceived ease of use is the central concern as shown in Figure 1. Consequently, the following hypotheses are put forth:

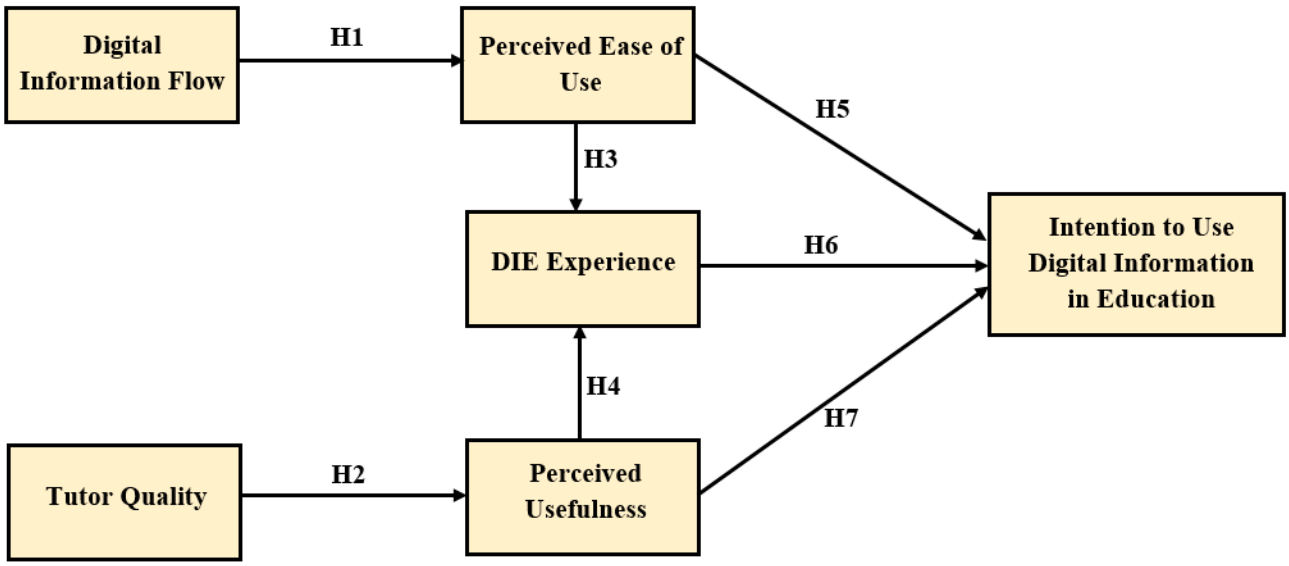

Figure 1. Research model.

Hypothesis 3 (H3). *The perceived ease of use has a positive effect and great impact on the DIE experience.*

Hypothesis 4 (H4). *The perceived usefulness has a positive effect and great impact on the DIE experience.*

Hypothesis 5 (H5). *The perceived ease of use has a positive effect and great impact on the intention to use DIE.*

Hypothesis 6 (H6). *DIE experience has a positive effect and great impact on the intention to use DIE.*

Hypothesis 7 (H7). *The perceived usefulness has a positive effect and great impact on the intention to use DIE.*

3. Methodology

3.1. Data Collection

Online surveys were distributed to interested students from universities in the UAE. The period covered by the data collection procedure was from 5 April to 30 June 2022. The research team distributed 500 questionnaires arbitrarily. A 97% response rate was obtained from these surveys, with the responder answering 485 of the questionnaires. In addition, 15 questionnaires were disqualified due to some incomplete data. As a result, there were 485 acceptable questionnaires. According to Krejcie and Morgan [22], the sample size for these acceptable questionnaires (the anticipated sampling size for 306 respondents/1500 population) was at the proper threshold. The sample size (485) and the minimal needs are very dissimilar. Given this, the sample size might be the results of the structural equation modeling analysis [23], which were then utilized to verify the hypotheses. It is also important to note that our hypotheses were built on the preceding theories (contextually digital information). The research team utilized structural equation modeling (SEM) (SmartPLS Version 3.2.7) to assess the measurement model. The final path model was used to carry out the advanced treatment.

3.2. Students' Personal Information/Demographic Data

Among respondents, 58% were female students and 42% male students. In addition, 65% of participants were between the ages of 18 and 29, and the remaining participants were older than 29. Most of the responders were educated and held university degrees. More precisely, 68%, 30%, and 2% of the student population had bachelor's, master's, and Ph.D. degrees, respectively. According to [24], the "purposive sampling approach" can be used when participants indicate a readiness to volunteer. Regarding this sample, the students came from various universities, age categories, and academic stages. In addition, IBM SPSS Statistics version 23 was utilized to analyze the demographic data. In Table 1, the demographic and personal information is shown.

Table 1. Demographic data of the respondents.

Criterion	Factor	Frequency	Percentage
Gender	Female	283	58%
	Male	202	42%
Age	Between 18 and 29	315	65%
	Between 30 and 39	130	27%
	Between 40 and 49	35	7%
	Between 50 and 59	5	1%
Education qualification	Bachelor	328	68%
	Master's	146	30%
	Doctorate	11	2%

3.3. Study Instrument

Seventeen more items were introduced to the survey to evaluate the six components of a questionnaire. The origins of these elements are shown in Table 2. A survey instrument was recommended for this research to help validate the hypothesis. The questions from earlier studies were modified by academics to make the study more practical.

Table 2. Measurement Items.

Constructs	Items	Instrument	Sources
Intention to use digital information in education	IU1	I will keep using DIE to further my education and keep ahead more with digital information.	[25]
	IU2	To speed up my search for digital information for my education, I shall employ DIE.	
Perceived ease of use	PE1	My engagement with DIE is simple and clear.	[26]
	PE2	The university personnel are quite transparent about engaging with DIE.	
	PE3	DIE interaction takes cognitive work.	
Perceived usefulness	PU1	By adopting DIE, I can contribute more to class each day.	[26]
	PU2	My comprehension of the practical disciplines I enrolled in has improved by employing DIE.	
	PU3	My conceptual homework and assignments benefit from employing DIE.	
Digital information flow	DI1	I consider DIE important since it assists in the exchange of information.	[27]
	DI2	I believe DIE assists in the development of innovative, beneficial technology.	
	DI3	DIE makes it simple for teams to share information.	
Tutor quality	TU1	Using DIE, my tutor can clarify the course material.	[16]
	TU2	My instructor assists me in honing my DIE learning techniques.	
	TU3	My tutor explains how to use DIE and the steps to follow.	
DIE experience	DE1	I have a lot of DIE experience.	[28,29]
	DE2	DIE is simple to operate, which is how I acquired experience using it.	
	DE3	I have a lot of experience with DIE since it is helpful.	

3.4. Common Method Bias (CMB)

According to the analysis, the newly created factor accounts for 22.48% of the largest variation, which is less than the threshold value of 50% [30]. Therefore, there were no concerns regarding the CMB in the data that were collected. Harman's single-factor analysis was performed with seven components to verify that the collected data did not contain CMB [30]. Then, the ten factors were loaded into a single factor.

3.5. Pilot Study of the Questionnaire

Five hundred students were chosen as the sample size, accounting for 10% of the entire sample size for the assessment. To measure the reliability of the questionnaire items, a pilot study was carried out. Fifty students were chosen at random from the predetermined demographic for this pilot study. For this reason, the study requirements were highly stressed. Using IBM SPSS Statistics version 23, Cronbach's alpha test for internal reliability was used to assess the results of the pilot study. This helped to produce reliable results for the measurement items. A reliability coefficient of 0.70 is regarded as satisfactory [31] when considering the mentioned tendency of social science research. The Cronbach's alpha values are shown in Table 3 about the following 5 measurement scales.

Table 3. Cronbach's Alpha values for the pilot study (Cronbach's Alpha $\geq$ 0.70).

Construct	Cronbach's Alpha
DE	0.826
DI	0.808
IU	0.876
PE	0.813
PU	0.773
TU	0.795

3.6. Survey Structure

The students were handed a questionnaire survey. Three sections made up this survey.

- Personal data about the respondents were the subject of the first part;

- The generic concern on "intention to use digital information" was represented by two questions in the second part;
- The final component had 15 items that were divided into four categories: "Perceived Ease of Use, Perceived Usefulness, DIE Experience, and Tutor Quality."

A five-point Likert scale with the following alternatives was used to evaluate the 17 items: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

4. Findings and Discussion

4.1. Data Analysis

A two-stage assessment approach using the structural model and measurement model was used to analyze the collected data [32]. The partial least squares structural equation modeling (PLS-SEM) tool, with support from the SmartPLS V.3.2.7 program, was used to analyze the data for this paper [33]. There are various justifications for the usage of PLS-SEM in this research.

Speculative investigations using complex models can effectively apply the PLS-SEM tool [34]. Secondly, rather than disassembling the entire model, PLS-SEM analyses it as a whole [35]. The primary justification for using PLS-SEM is that it performs best when the investigation is built on previous research or studies [36]. Finally, PLS-SEM provides concurrent analysis for measurement and structural modeling, enabling us to use it to produce correct computations [37].

4.2. Convergent Validity

In this instance, validity includes convergent and discriminant validity, whereas construct reliability includes composite reliability (CR) and Cronbach's alpha (CA). According to Hair et al. [32], when assessing a measuring model, constructs' reliability and validity must be investigated. Table 4 demonstrates that the Cronbach's alpha (CA) values that are employed to assess construct reliability are higher than the threshold of 0.7 and fall within the region of 0.828 to 0.904. The findings also show that Table 4's composite reliability (CR) scores, which are significantly higher than the suggested level of 0.7 [38], span from 0.819 to 0.902. Assessing the average variance extracted (AVE) and factor loading are essential to measuring convergent validity [32]. Considering the results of Table 4, the recommended number of 0.7 is below the levels of all factor loadings. In addition, the findings of Table 4 show that the AVE yields values between 0.720 and 0.808, which are higher than the '0.5' threshold level. These prospective findings allow for an effective evaluation of convergent validity for each of the constructs.

Table 4. Convergent validity results.

Constructs	Items	Factor Loading	Cronbach's Alpha	CR	AVE
Intention to use digital information	IU1	0.840	0.892	0.825	0.756
	IU2	0.792			
Digital information flow	DI1	0.852	0.889	0.819	0.695
	DI2	0.859			
	DI3	0.855			
Perceived ease of use	PE1	0.905	0.904	0.902	0.800
	PE2	0.882			
	PE3	0.890			
DIE experience	DE1	0.797	0.828	0.827	0.808
	DE2	0.890			
	DE3	0.802			
Perceived usefulness	PU1	0.877	0.833	0.848	0.720
	PU2	0.868			
	PU3	0.871			
Tutor quality	TU1	0.771	0.897	0.881	0.744
	TU2	0.799			
	TU3	0.745			

4.3. Discriminant Validity

The Fornell–Larker factor confirms these requirements and the results of Table 5 because every AVE score outweighs the value of the correlation it exhibits with other constructs when its square roots are summed [39]. We suggest measuring two parameters, specifically the Fornell–Larker factor and the heterotrait–monotrait ratio (HTMT), to assess discriminant validity [32]. The results of the data analysis point to an aggravation evaluation of the measurement model's validity and reliability. Table 6 shows the calculated HTMT ratio values and shows that each construct's number is currently higher than the 0.85 threshold level [40]. Thus, the HTMT ratio is verified. Determining discriminant validity is dependent on these results. The structural model can, therefore, be evaluated by using the data that were collected more extensively.

Table 5. Fornell–Larcker scale.

	IU	DI	PE	DE	PU	TU
IU	**0.800**					
DI	0.264	**0.887**				
PE	0.675	0.382	**0.873**			
DE	0.307	0.087	0.244	**0.836**		
PU	0.650	0.532	0.623	0.432	**0.937**	
TU	0.664	0.283	0.373	0.391	0.336	**0.874**

Table 6. Heterotrait–monotrait ratio (HTMT).

	IU	DI	PE	DE	PU	TU
IU						
DI	0.092					
PE	0.391	0.436				
DE	0.285	0.413	0.406			
PU	0.659	0.573	0.501	0.352		
TU	0.301	0.149	0.641	0.495	0.326	

4.4. Hypotheses Testing Using PLS-SEM

Each path's variance description (R^2 value) and each connection's path significance in the research model were evaluated. The simultaneous assessment of the nine preceding hypotheses was conducted using the structural equation modeling (SEM) method [41–47]. According to Table 7, the R2 values for tutor quality, perceived usefulness, intention to use digital information, and DIE experience range from 0.597 to 0.666. These constructs, consequently, seem to have moderate predictive power [48]. Figure 2 and Table 8 show the normalized path coefficients and path significances.

Table 7. R^2 of the endogenous latent variables.

Construct	R^2	Results
PU	0.597	Moderate
IU	0.641	Moderate
DE	0.642	Moderate
PE	0.666	Moderate

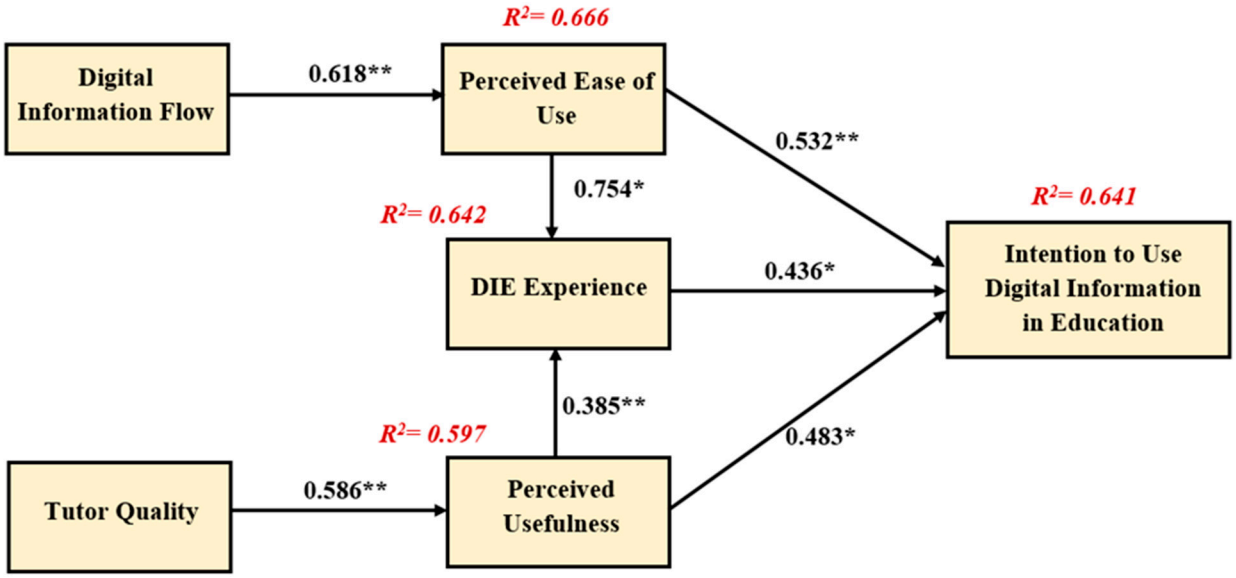

Figure 2. Path coefficient of the model (significant at ** p < = 0.01, * p < 0.05).

Table 8. Hypotheses testing of the research model (significant at ** p < = 0.01, * p < 0.05).

H	Relationship	Path	*t*-Value	*p*-Value	Direction	Decision
H1	DI -> PE	0.618	12.828	0.000	Positive	Supported **
H2	TU -> PU	0.586	13.183	0.000	Positive	Supported **
H3	PE -> DE	0.754	6.749	0.031	Positive	Supported **
H4	PU -> DE	0.385	6.587	0.039	Positive	Supported **
H5	PE -> IU	0.532	15.260	0.003	Positive	Supported **
H6	DE -> IU	0.436	7.102	0.026	Positive	Supported **
H7	PU -> IU	0.483	5.097	0.030	Positive	Supported **

The empirical data support hypotheses H1, H2, H3, H4, H5, H6, and H7 according to the data analysis.

The results show that digital information flow (DI) has significant effects on perceived ease of use (PE) (β = 0.618, p < 0.001); hence, H1 is supported. The results also show that perceived usefulness (PU) significantly influences tutor quality (TU) (β = 0.586, p < 0.001), supporting hypothesis H2. Perceived ease of use (PE) and perceived usefulness (PU) have significant effects on DIE experience (DE) (β = 0.754, p < 0.05) and (β = 0.385, p < 0.05), respectively; hence, H3 and H4 are supported. Finally, the relationships between perceived ease of use (PE), DIE experience (DE), and perceived usefulness (PU) have significant effects on intention to use DIE (IU) (β = 0.532, p < 0.01), (β = 0.436, p < 0.05), and (β = 0.483, p < 0.05), respectively; hence, H5, H6, and H7 are supported.

5. Discussion

Universities need cutting-edge technology solutions that improve e-research, e-teaching, and e-learning chances. Universities and the educational system have been impacted by the development of technology. By utilizing multimedia applications that are appealing to people who use technology, the digital flow of information enables creative exchanges amongst tech users. The present research developed a conceptual model founded on the preceding supposition to quantify the ongoing application of digital information in the educational setting. In the conceptual model that corresponds with the primary element, which is the digital flow of information, the perceived ease of use is seen as one of the essential factors. On the other side, the intention to use DIE is directly influenced by perceived ease of use. The findings of the present research are consistent with earlier publications predicated on previously established correlations [49–59].

The stated hypotheses are validated and substantiated by numerous parts of literature-based data [60–67]. On the other hand, perceived ease of use and tutor quality are related. The quality of the tutor in a virtual world changes the instructor's role from that of a knowledge source to that of a facilitator and trouble-shooter; as a result, a high degree of perceived ease of use suggests a higher degree of readiness to adopt the digital information. These elements taken together may be used to evaluate the application of DIE [68–74].

The existing findings are consistent with earlier research on the significance of technology acceptance, highlighting the evidence that PEOU and PU can be combined with external factors to evaluate the efficacy of technology based on each person's attributes and the novel capabilities of the technology [75–80]. The TAM construct, which influences a person's propensity to adopt DIE technology, received the most attention in the integrated model concerning DIE experience [81–85]. It explicitly connects the constructs of perceived ease of use, perceived usefulness, and DIE experience to the ongoing intention to adopt DIE [85,86].

5.1. Theoretical Implication

Since it concentrates on the components that demonstrate dissimilarities by concentrating on tutor quality and experience, this research is far ahead of other research studies. In terms of the research's theoretical importance, adoption and acceptance of research can take advantage of the incorporation of numerous external elements with the TAM constructs. In contrast to the straightforward application of SEM analysis that can be used in other empirical research, the focus on individual distinctions improves the deep-learning analysis. As a result, this research makes a significant literary addition and opens the door for further analysis of how people adopt the technology. Additionally, the suggested technique improves the research's evaluation and findings' predictive power.

5.2. Managerial Implications

They suggest that users may understand the value of the technology depending on their wants and necessities, in addition to the unique characteristics of the technology. By offering contemporary significance for teaching and learning practice, the research's conclusions can improve the proposed project for universities and other educational organizations. The administrative staff may be prompted to incorporate a more innovative viewpoint established in an educational institution and improve the educational setting by delivering more DIE that differentiates in quality and quantity if DIE is used as a useful component in the educational setting. Regarding how people view perceived usefulness and ease of use, developers may be able to concentrate on the efficacy of these two aspects in newly created digital products. As a result, instructors and proponents of technology should give students the chance to experience how particular DIE must be utilized as a backup that supports their function as trouble-shooters, not as a source of information. On the other hand, as time goes on, students will have a clear, good opinion of the educational setting and be more ready to employ technology, which will result in further advancements in the educational environments. Gender-based interpersonal distinctions in personal choice, beliefs, and academic impact should be considered in a prospective study.

6. Conclusions, Limitations and Future Studies

The digital revolution has had a huge impact on education. Digital technologies have attracted a lot of interest in higher education for improving learning. Providing education using various learning techniques has been difficult in recent years. Challenges with collaboration, business, information access, and communication can now be resolved using technology. Digital information literacy is essential for people to participate in society and perform their jobs well. Digital literacy is thought to be the foundation for the capacity to continue continuous learning as an outcome of the introduction to digital information. Education professionals are essential in advancing digital literacy. Therefore, academic institutions must reevaluate the usefulness of digital information technology as a tool

for improving educational sections. The present research contains several drawbacks. First, the conceptual model is limited to a selection of external factors that might have an explicit correlation with the TAM constructs. Subsequent research may, therefore, include additional external factors that speak to the particulars of the questioned technology. Second, the sample is restricted to a collection of university students who have chosen various majors. The subsequent research may concentrate on the independent variations among individuals, since the survey does not address gender inequalities among university students. Third, while the survey was disseminated via social media and the internet, surveys may be disseminated differently in the coming years, particularly if the negative effects of the pandemic start to fade. Fourth, this research limits its focus to educational environments in which the DIE has a significant impact on the teaching and learning setting [51,52]. Subsequent research may concentrate on health or monetary organizations.

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