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The acceptance and effectiveness of digital learning technologies: A detailed empirical investigation in Islamic study classrooms

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Abstract

The acceptance of different technologies in different classroom settings has been addressed in the current study. Integrating alignment theory with the Technology Acceptance Model (TAM), this study investigates the predictive differences between the use and adoption of four technologies. The technologies were used in Islamic study classrooms for four months during the spring semester of 2022 among the students of the Palangkaraya state Islamic religious institute in Indonesia. The survey questionnaire was distributed among students at the end of the semester. The results of this study revealed students' behavioral intentions to use all four digital technologies. However, the impact of adopting the classroom response system was larger followed by digital textbooks, mobile virtual reality and classroom chats. These results depict that students prefer the classroom response system and have little preferences for classroom chats while learning Islamic studies. The favorable results for the classroom response system, digital textbooks and mobile virtual reality depict that practitioners should consider the ease of access and affordability of these technologies at all educational levels to enhance students' learning capabilities.

Keywords: Alignment theory, Classroom chats, Classroom response system, Digital textbooks, Mobile virtual reality, Technology acceptance model.

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Contents

Contribution of this paper to the literature
The current study extends the educational literature concerning modern technology usage by integrating the TAM with alignment theory. Moreover, by presenting the predictive differences among different technologies' adoption in Islamic study classrooms, a base has been provided for academicians and scholars to examine the significance of technological intrusion in classrooms.

1. Introduction

In the modern era, new technologies are increasingly diffused in society and educational institutions (Levchenko et al., 2021). In educational institutions, technologies are rapidly used in the classroom to assist instructors and serve various pedagogical objectives (Kharatova & Ismailov, 2022). On the one hand, the dramatic rise of technology in the education sector places a significant burden on educators to integrate the skills with technology which requires more effort and time management (Criollo-C, Guerrero-Arias, Jaramillo-Alcázar, & Luján-Mora, 2021). On the other side, the probabilities of learning and teaching with technology-enabled learning are widely apparent and continuously assist students in improving their technical competencies, problem-solving skills and critical thinking (To'raqulovich, 2021). Considering the utmost significance of educational technologies, the current study investigates the adoption of four important digital technologies in Islamic study classrooms including digital textbooks, classroom response systems, classroom chat and mobile virtual reality.

Moreover, the measurement and satisfaction of the users' expectations are mandatory which can be accessed with the help of the Technology Acceptance Model (TAM) (Murillo, Novoa-Hernández, & Rodriguez, 2021). The TAM measures the perceived ease of use and perceived usefulness linked with the adoption of a certain technology after its usage for a certain period (Fauzi, Wandira, Sepri, & Hafid, 2021). The models can predict the attitude towards the use of the technology and its behavioral intentions to use it leading to actual usage (Al-Rahmi et al., 2021). In addition, the current study has integrated the assumptions of alignment theory to predict technology acceptance among Islamic study students.

Previous studies have not provided a comparison of multiple educational technologies in a single study (Apedaile, 2020; Hudson, 2021; Mu'alimin, 2019; Sun, Chen, Tao, & Liu, 2019). Additionally, Sprenger and Schwaninger (2021) have recently assessed the above-mentioned digital technologies. However, they have directly assessed the behavioral intentions of the users to adopt those technologies. In contrast, the current study has first assessed the students' attitudes towards these digital learning technologies in the classroom leading to their behavioral intentions towards their usage.

Additionally, the current study has been conducted in a developing country i.e., Indonesia where Islamic studies is a compulsory subject at the primary, secondary and higher education levels. Moreover, Islam also encourages its believers to learn and spread technology and science. The learning of science and technology is also a part of the faith of the Muslims who believe in the Holy Quran and Hadith (Apriani, Williams, Rahardja, Khoirunisa, & Avionita, 2021). Islam promises knowledgeable individuals will be rewarded in the end. Moreover, the integration of Islamic education with modern science and technology is encouraged by various Islamic scholars (Asad, Ahmad, Haider, & Salman, 2018). Several religious scholars use various social networking sites to spread the teachings of Islam and educate the people by giving persuasive examples (DeJonge-Kannan, 2021). Hence, the use of technology in Islamic study classrooms can enhance the students' learning capabilities and help them apply Islamic codes of conduct in their practical lives. Additionally, digital appliances and sources are more affordable and accessible in Indonesia (Chawla, Kowalska-Pyzalska, & Widayat, 2019). Most citizens from low to middle-income households can afford and have laptops and smartphones (Ida, Saud, & Mashud, 2020). Simultaneously, most university students have their own smartphones (Anwas et al., 2020). According to the latest study by Hidayat, Lee, Mason, and Khaerudin (2022), the majority of Indonesians have more than one digital device. They also reported approximately 300 million active mobile phone connections as of January 2021 which is above Indonesia's total population of 274.9 million.

This further reflects that Indonesia is among the leading digital technology adoption countries. Researchers have reported Indonesia at the leading position concerning the number of social media users being the first largest user of Twitter and the second largest user of Facebook (Anwas et al., 2020; Ida et al., 2020). There is a high level of technology adoption in Indonesian English language learning classes (Salikin, 2017). In contrast with previous studies, mostly conducted in English language learning classes (Marzuki & Kuliahana, 2021; Pasaribu, 2020), the current study has extended the existing body of literature by empirically investigating and comparing the four technologies used by Indonesian lecturers in Islamic study classrooms. For this purpose, 190 students were selected to use digital technology for four months. After the prescribed time, their perceived ease of use, perceived usefulness, attitude towards usage and behavioral intentions to use those technologies were measured with the help of a survey questionnaire to present valuable policy insights for practitioners, academicians and educationalists.

2. Literature Review

2.1. Digital Textbooks (DT)

Digital textbooks are the latest innovations in digital learning platforms and are known as "e-textbooks," "electronic textbooks" or "digital textbooks" (Kim, Shin, Noh, & Kim, 2022). The digital textbook system has evolved based on the notorious application of personal electronic devices as learning platforms (Hudson, 2021). Digital textbooks display videos and infographics so students "can engage with such textbooks, respond, create, negotiate, co-construct and share with other members of the learning community" (Knight, 2015). Furthermore, the benefits of digital textbooks can be extracted both inside and outside the classrooms. A digital textbook is regarded as a platform that unites e-publishing technologies and e-learning in addition to the student's learning activities and interactive reading (Hidayah, Prihatin, & Utanto, 2021).

Moreover, digital textbooks are considered more interactive, accessible, extensive and flexible (Granik & Borisenko, 2021). Digital textbooks are not as widely used in the classroom as other technologies (Kim et al., 2022). Few studies have shown the significance of using digital textbooks in the classrooms to enhance the students'

learning outcomes (Granik & Borisenko, 2021; Hidayah et al., 2021). However, despite all these issues, most teachers now forward electronic books or links to their students to prepare their lectures. This facility further removes the barriers by using books that are not physically present in certain areas and university libraries (Norberg, 2021). Hence, rather than being confined to the physically available books it broadens the scope of using the latest books with valuable.

2.2. Classroom Chats (CC)

Students in the classrooms are encouraged to communicate with each other during the discussion section along with the teachers delivering the lectures (Sprenger & Schwaninger, 2021). The lecturers' talks in front of the class are called the "front channels" and the students' communications with each other are termed "backchannels" (Seglem & Haling, 2018). Nowadays, lecturers use chat tools to communicate and enhance backchannel communication to encourage students to discuss their questions and concerns regarding the lectures and learning materials (Rodríguez, Piñeiro, Regueiro, & Estévez, 2020). Some researchers have highlighted the dark side of this classroom chat system. Classroom chats can distract the students from their main aim of learning and following the lectures (Minalla, 2018). To overcome this issue, a new approach was adopted and students were encouraged to ask questions of the lecturers. The lecturers respond to those questions during the lectures or before the commencement of the next lecture. The researchers who used this approach reported a higher level of learning achievement based on the questions asked by the students (Byiringiro et al., 2021; Sprenger & Schwaninger, 2021). At the same time, keeping the student anonymous and applying electronic applications further encourage the students to freely ask questions regarding controversial topics despite being shy or introverted (Pasaribu, 2020). Moreover, the application and adoption of this classroom chat system in developing countries context is a valuable addition to the current study.

2.3. Classroom Response System (CRS)

Classroom response systems are also known as "audience response systems," "clickers," "electronic response systems," " immediate response systems," "personal response systems" and "student response systems" etc. Mu'alimin (2019). Using the CRS as a diversified teaching process, lecturers can ask multichoice questions in the classroom allowing students to answer using their electronic devices (Mosquera Feijóo, Suárez, Chiyón, & Alberti, 2021). At the same time, an aggregated sheet of the answers is prepared and the results are displayed to the students individually or collectively (Sprenger & Schwaninger, 2021). The results also help teachers change their teaching methodology or explain the topic in detail to enhance the students' understanding and clarify their concepts. (Ebadi, Rasouli, & Mohamadi, 2021). Students who do not participate in the class activities or feel shy about communicating with their teachers are also provided an opportunity to answer specific questions without being highlighted (Sprenger & Schwaninger, 2021). CRS acts as a mediator activating the students by breaking up the long lecture or presentation time to actively reproduce the content the teachers talked about (Ergulec & Misirli, 2022). Researchers have presented the significant influences of CRS in enhancing students' cognitive learning outcomes (Castillo-Manzano, Castro-Nuño, López-Valpuesta, Sanz-Díaz, & Yñiguez, 2016; Sprenger & Schwaninger, 2021). In addition to the previously mentioned applications of CRS, the current study has combined it with the course revision tasks considering the significance of reputation in long-term memorizing and knowledge retention (Tautz, Sprenger, & Schwaninger, 2021). Hence, the researchers requested the lecturers to pose questions after each lecture and discuss the results before starting the next lecture. It was done for multiple reasons including the provision of feedback to the students in the form of their learning progress, preparing the students for the usual exam questions, enhancing the active participation of the students during the lectures and encouraging students to continuously revise the content between the lectures to make it more fruitful.

2.4. Mobile Virtual Reality (MVR)

Virtual reality allows the creation of a virtual environment in the classroom using headphones and a computer (Li, Ip, & Ma, 2021). Visuals are used as input to train and educate (Abd Majid & Mohd Shamsudin, 2019). Nowadays, several educational institutions use virtual reality in classrooms with a significant improvement in processing power and affordability. Besides developing the pedagogical model of constructivism, multiple representations of reflective practices, knowledge construction and creating simulations, games and virtual world are provided in virtual reality (Sun et al., 2019). Previously researchers reported the effective implementation of virtual reality in medicine, mathematics, technology and science education (Abd Majid & Mohd Shamsudin, 2019; Li et al., 2021; Sprenger & Schwaninger, 2021). At the same time, scholars have highlighted the significance of virtual reality in increasing learning outcomes in individual gameplay tasks (Dalle et al., 2020; Venkatesan et al., 2021). Hence, the current study has extended the previous knowledge and highlighted the significance of virtual reality in Islamic study classrooms in a developing nation.

In addition, as a specific subset of virtual reality in mobile virtual reality rather than using a specialized headset and a desktop computer, the processor and screen of a smartphone are used along with the cardboard to develop the immersion experience (Ritter & Chambers, 2022). This use of MVR is cost-effective in terms of software and hardware. The majority of the students at the tertiary educational level own a mobile phone with the MVR feature (Feng, Bao, & Wei, 2021). However, MVR is a new technology; it is less popular in educational institutions. According to the latest study, only 20% of educational settings use MVR compared to computer-based virtual reality systems which are more expensive despite producing similar outcomes as MVR (Sprenger & Schwaninger, 2021). The current study assessed the use of MVR based on its usefulness in the classroom in developing countries.

3. Theoretical Foundation and Hypotheses Development

3.1. Technology Acceptance Model (TAM)

The TAM predicts that attitudes towards the use of a certain technology based on its perceived usefulness can further lead to its use (Zaineldeen, Hongbo, Koffi, & Hassan, 2020). These behavioral intentions to use certain

technologies for their products will affect the actual use of such technologies in the future (Kim & Shin, 2015). Furthermore, the TAM has been widely accepted model for measuring technology acceptance (Fauzi et al., 2021). Previously, researchers have applied the technology acceptance model to assess gamification, learning analytics visualization, digital and mobile libraries, virtual learning environments and social media etc. (Abd Majid & Mohd Shamsudin, 2019; Murillo et al., 2021; Venkatesh, Thong, & Xu, 2012). Moreover, regardless of several extensions of the TAM, it holds a higher explanatory power and is a highly influential method in determining technology acceptance (Murillo et al., 2021). Therefore, the current study has considered the TAM model to present a comparison of the acceptance and effectiveness of four different technologies in educational settings, more specifically in Islamic education classrooms in developing countries context.

3.2. Alignment Theory

The alignment theory presents the agreement between course material and assessment results (Sprenger & Schwaninger, 2021). The students learn a particular course with a focus on the information being evaluated and important to their class assessment scores (Huang, Gao, & Khayat, 2021). Considering this important issue Biggs (2003) highlighted the significance of the constructive alignment model which requires lecturers to explicitly define the intended learning outcomes related to the specific subject prior to determining an appropriate assessment regime. For instance, introductory courses related to Islamic studies first define Islamic history, the basic beliefs of Muslims and their ideologies. The intended learning outcomes must be the creation of interest in Islamic education and an urge to learn more about Islamic beliefs and apply them in the students' daily lives. Later, students' behaviors and engagement levels must be evaluated by the lecturers and multiple-choice tests should be conducted using specific terminologies designed to evaluate the learning outcomes. Researchers have previously reported the high significance and relevance of the alignment theory to make predictions linked with technology acceptance (Sprenger & Schwaninger, 2021; Yuen, Cai, Qi, & Wang, 2021).

Furthermore, based on the literature review and theoretical background, the current study has posted the following hypotheses to be empirically tested while presenting a clear comparison between the adoptions of four different digital technologies in the classroom. Moreover, the theoretical model of the study is presented in Figure 1.

H1 and 2: Perceived ease of use positively influences perceived usefulness and intentions to use a) digital textbooks, b) classroom chat, c) classroom response systems and d) mobile virtual reality.

H3: There is a positive impact of perceived usefulness on the intentions to use a) digital textbooks, b) classroom chat, c) classroom response systems and d) mobile virtual reality.

H4: Perceived ease of use positively influences the attitude towards using a) digital textbooks, b) classroom chat, c) classroom response systems and d) mobile virtual reality.

H5: Perceived usefulness positively influences the attitude towards using a) digital textbooks, b) classroom chat, c) classroom response systems and d) mobile virtual reality.

H6: The attitude towards using digital technologies positively impacts intentions to use a) digital textbooks, b) classroom chat, c) classroom response systems and d) mobile virtual reality.

H7 and 8: The attitude towards using digital technologies mediates the association of perceived ease of use and perceived usefulness with intentions to use a) digital textbooks, b) classroom chat, c) classroom response systems and d) mobile virtual reality.

3.3. Theoretical Framework of the Study

Figure 1 presents the theoretical framework of the study based on the literature review and the TAM model.

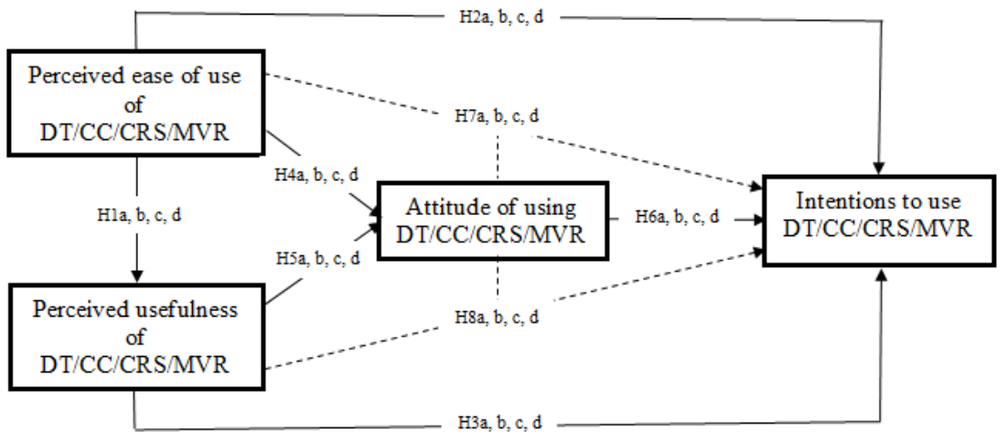

Figure 1. The theoretical framework of the study.

4. Research Methodology

4.1. Participants and Procedures

The current study participants were first and second year graduate level students in the course of Islamic studies at the Palangkaraya state Islamic religious institute in Indonesia. The respondents voluntarily participated in the study. Out of 230 registered students in the Islamic study class, 190 students (87 males and 103 females) participated in the study. The study was conducted in the spring semester (February 2022- June 2022). After four months, a survey was conducted during class with strict adherence to concentrate on the survey without any distraction (Stieger & Reips, 2010). The independent variables in the current study were four technological tools including DT, CC, CRS and MVR whereas the mediator and dependent variables were four components of the technology substance model including perceived ease of use, perceived usefulness, attitude towards usage and

behavioral intentions to use. Each student was requested to evaluate each of the four tools applied in the classrooms.

4.2. Study Measures

The survey questionnaire consists of two parts, i.e., the first part measures the demographic characteristics of the students and the second part measures the study constructs. To conduct a comparative analysis, the original TAM measures by Davis and Davis (1989) were used to assess the perceived ease of use and perceived usefulness of 5 items for each construct with necessary modifications linked to each digital technology used in the classroom. To measure attitudes towards using technology (5 items) and behavioral intentions to use the technology (3 items), the scales adapted from Davis and Venkatesh (2004) were used. A seven-point Likert scale ranging from 1(completely disagree) to 7(completely agree) was used to assess all the study constructs.

4.3. Digital Learning Technologies

Digital Textbooks: At the beginning of the semester, the lecturers shared digital textbooks with the students and guided them about the topics to be covered during the semester. To enhance the students' interest in learning, they were provided with videos, narrators, info graphics or diagrams etc. through shared links by the instructors or lecturers. The students were frequently asked about the topics covered and the material shared. Their assessment was done based on multiple choice and cross-questions to evaluate their involvement and reading intensity.

Classroom Chats: A classroom chat was used in the classroom during the lectures where students could anonymously ask random questions using their laptops or smartphones through a web interface. The lecturers reviewed the questions with the students during break time and addressed the same after break time. Lecturers directly answer almost 95% of the questions asked by the students. In addition, a buzz group method was used to conduct the classroom discussions to address the remaining 5% of questions.

Classroom Response System: A fee –based web service was used to implement the classroom response system which was accessible to the students on their mobile phones and laptops. The lecturer used to provide five multiple-choice questions to the students at the end of each lecture which they were supposed to answer before the next lecture. After completion, the students were displayed with the correct answers and aggregated results leading to an explanation and discussion section based on the students' requests for discussions.

Mobile Virtual Reality: During the second month of the semester, four different mobile virtual reality modules or scenarios were used in the classrooms which students could experience using their smartphones and cartoon headsets provided by the educational institution. Certain interactions were necessary during each module. In the 1st scenario, students had to experience the preservatives in their color perceptions due to the mixing of different wavelength of light. The 2nd and the 3rd modules dealt with the depth and distance perceptions. Finally, the 4th scenario was a 360-degree video presenting the scholarly talks.

After four months of using all these technologies in the classroom, students were requested to participate in a survey questionnaire by the end of the semester.

5. Analysis and Results

5.1. Measurement Model

For the analysis of the students' data, Smart PLS v. 4 software was applied to assess the measurement and the structural models using the Structural Equation Modelling (SEM) approach. A confirmatory factor analysis (CFA) was performed for each technological tool based on the TAM. Table 1 presents the factor loadings for the TAM constructs for each technological tool separately which were under the prescribed range of > 0.70 (Mansoor, Awan, & Paracha, 2021). Additionally, the constructs' reliabilities and validities were calculated. For that purpose, "Cronbach's α (CA)" and "Composite Reliability (CR)" were assessed (Henseler, Ringle, & Sarstedt, 2015; Mansoor, 2021). The results revealed that CA and CR were within suggested range of > 0.70 establishing the convergent validity of a study variables. Moreover, the "Average Variance Extracted (AVE)" of all the latent constructs was above 0.50. Hence, establishing the "convergent validity" of the study constructs. Table 2 presents values of AVE, CR and CA calculated based on the TAM separately for each technological tool used in the classroom before conducting the survey. Furthermore, the factor loadings for the TAM constructs are presented in Figure 2 for one technological tool, i.e., digital textbooks. Similarly, factor loadings and impact sizes for all four technological tools based on the TAM were assessed.

Table 1. Factor loadings of TAM constructs for each technological tool (DT, CC, CRS and MVR).

Items	Digital textbooks (DT)				Classroom chats (CC)				Classroom response system (CRS)				Mobile virtual reality (MVR)			
	PEOU	**PU**	**ATU**	**ITU**	**PEOU**	**PU**	**ATU**	**ITU**	**PEOU**	**PU**	**ATU**	**ITU**	**PEOU**	**PU**	**ATU**	**ITU**
PEOU1	0.768				0.745				0.714				0.737			
PEOU2	0.723				0.757				0.723				0.745			
PEOU3	0.761				0.712				0.751				0.750			
PEOU4	0.708				0.758				0.717				0.729			
PEOU5	0.793				0.709				0.723				0.741			
PU1		0.808				0.729				0.771				0.753		
PU2		0.747				0.732				0.756				0.761		
PU3		0.780				0.713				0.721				0.735		
PU4		0.766				0.745				0.712				0.744		
PU5		0.760				0.701				0.715				0.740		
ATU1			0.701				0.709				0.772				0.748	
ATU2			0.706				0.734				0.759				0.737	
ATU3			0.797				0.776				0.804				0.712	
ATU4			0.778				0.711				0.792				0.731	
ATU5			0.776				0.722				0.727				0.719	
ITU1				0.749				0.766				0.725				0.770
ITU2				0.748				0.751				0.733				0.781
ITU3				0.783				0.742				0.754				0.762

Note: PEOU= Perceived ease of use; PU= Perceived usefulness; ATU= Attitude towards use; ITU= Intentions to use.

Table 2. Constructs' reliabilities and validity.

Tools	Constructs	Average variance extracted (AVE)	Composite reliability (CR)	Cronbach's alpha (CA)
DT	PEOU	0.564	0.866	0.816
	PU	0.597	0.881	0.867
	ATU	0.567	0.867	0.819
	ITU	0.578	0.804	0.791
CC	PEOU	0.542	0.856	0.813
	PU	0.524	0.846	0.809
	ATU	0.534	0.851	0.811
	ITU	0.567	0.797	0.775
CRS	PEOU	0.527	0.848	0.810
	PU	0.541	0.855	0.812
	ATU	0.595	0.880	0.824
	ITU	0.544	0.781	0.743
MVR	PEOU	0.548	0.869	0.817
	PU	0.557	0.863	0.815
	ATU	0.532	0.850	0.810
	ITU	0.595	0.815	0.778

In addition, to the convergent validity and composite reliability, we also considered the prerequisite of establishing the discriminant validity of study constructs based on the Heterotrait-Monotrait (HTMT) ratio (Henseler et al., 2015; Mansoor, Saeed, Rustandi Kartawinata, & Naqi Khan, 2022). The Heterotrait-Monotrait (HTMT) ratio is also used to determine the potential multicollinearity issues among the study variables. Results showed that all the HTMT ratio values are less than 0.9 as shown in Table 3 reflecting no issues of multicollinearity and the discriminant nature of the study variables.

Table 3. Heterotrait-monotrait ratio.

Tools		PEOU	PU	ATU	ITU
DT	PEOU	0.750			
	PU	0.480	0.772		
	ATU	0.503	0.489	0.778	
	ITU	0.540	0.567	0.423	0.742
CC	PEOU	0.736			
	PU	0.399	0.723		
	ATU	0.496	0.622	0.730	
	ITU	0.521	0.560	0.516	0.752
CRS	PEOU	0.725			
	PU	0.513	0.835		
	ATU	0.597	0.580	0.771	
	ITU	0.498	0.600	0.522	0.737
MVR	PEOU	0.740			
	PU	0.478	0.746		
	ATU	0.601	0.539	0.729	
	ITU	0.570	0.544	0.426	0.771

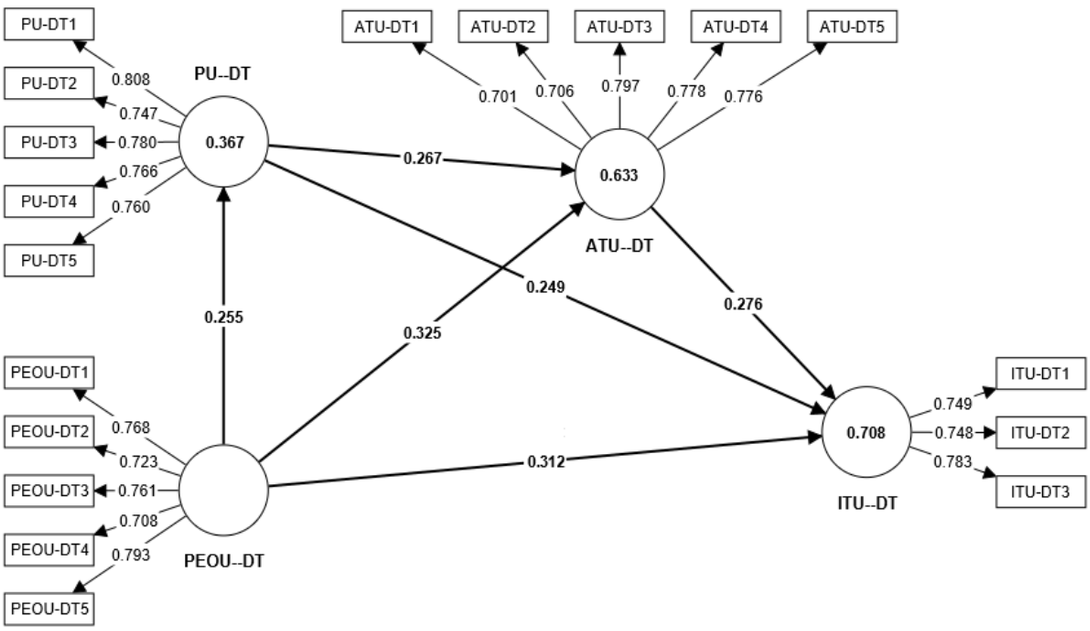

Figure 2. Full measurement model

Note: PEOU-DT= Perceived ease of use of digital textbooks; PU-DT= Perceived usefulness of digital textbooks; ATU-DT= Attitude towards using digital textbooks; ITU-DT= Intentions to use digital textbooks.

5.2. Structural Model Assessment

We used the coefficient of determination (R2) to assess the influence of independent and mediatory variables' impact on the dependent variable (Hair, Hult, Ringle, Sarstedt, & Thiele, 2017). Results for one technological tool, i.e., DT revealed a 63.3% variance in attitudes towards using digital textbooks based on their perceived ease of use and perceived usefulness. Results revealed a 70.8% variance in intentions to use digital textbooks based on the direct and indirect impacts of perceived usefulness, perceived ease of use and attitude towards using digital textbooks in their Islamic study classrooms. Similarly, a significant amount of variance in attitude toward using and behavioral intentions to use the classroom chats, classroom response system and mobile virtual reality was found. However, results revealed a higher variance for behavioral intentions to use the classroom response system which depicts the utmost significance of the classroom response system as a modern technological tool to be applied in Islamic study classrooms to achieve the best possible student outcomes.

5.2.1. Hypotheses Testing

The study's findings show that a perceived ease of use ($\beta = 0.255^{**}$) has a significance impact on the perceived usefulness of digital textbooks in Islamic study classrooms. The results also showed a significant and positive influence of perceived ease of use ($\beta = 0.312^{***}$), perceived usefulness ($\beta = 0.249^{**}$) and attitude towards using ($\beta = 0.276^{***}$) digital textbooks by Islamic study students on their behavioral intentions. At the same time, a significant positive impact of perceived ease of use ($\beta = 0.325^{***}$) and perceived usefulness ($\beta = 0.267^{**}$) on attitudes towards using digital textbooks was found. Similarly, direct associations, an indirect impact of perceived ease of use ($\beta = 0.239^{**}$) and perceived usefulness ($\beta = 0.311^{***}$) on the behavioral intentions to use digital textbooks by the Islamic studies students was found in the presence of an attitude towards using digital textbooks. Hence, hypotheses H1-8a were approved by the study results. Moreover, these results are presented in Figure 2. Moreover, Figure 3 illustrates the strength of the associations between independent and dependent variables. All the p-values reflect that the associations are significant and positive. Additionally, the results for hypotheses H1-8b, H1-8c, and H1-8c are presented in detail in Table 4.

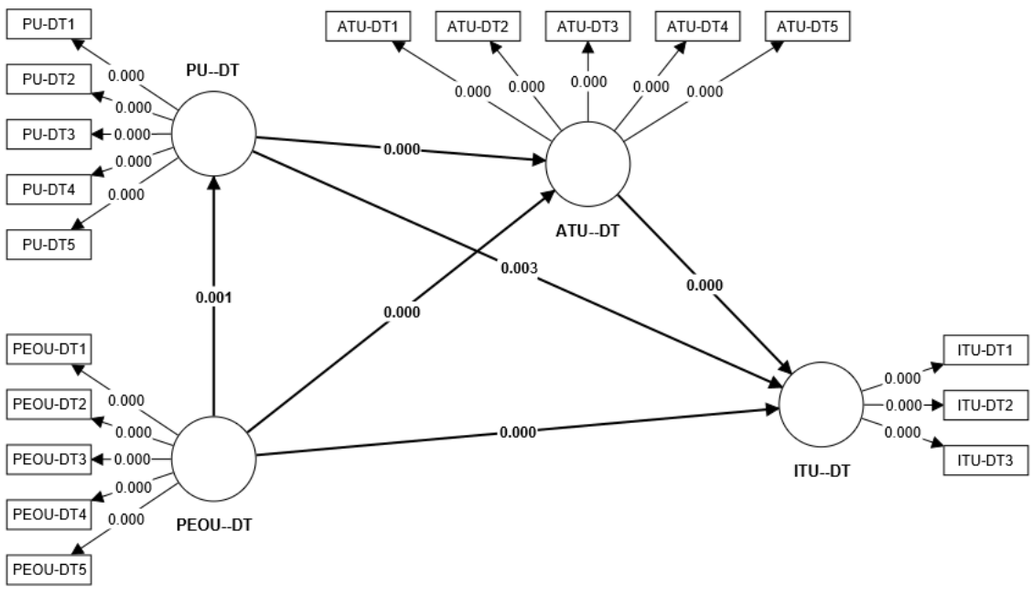

Figure 3. Full structural model.

6. Discussion

6.1. Findings

The authors of the current study tried to present a comparative analysis of the adoption and significance of different digital technologies used in Islamic study classrooms. For this purpose, four different technologies including digital textbooks, classroom charts, classroom response systems and mobile virtual reality were selected. Implement these four digital technologies in the Islamic study classrooms at the Palangkaraya state Islamic religious institute in Indonesia, a survey was conducted at the end of the semester. Based on Islam being the primary religion of the country and being taught in all educational institutions, the current study is very valuable in terms of not only investigating the adoption of digital technologies in Islamic study classrooms but also empirically testing the effectiveness of these technologies in enhancing the religious knowledge of students according to their modern needs.

Table 4. Hypotheses testing results.

Hypotheses		DT (H1-8a)			CC (H1-8b)			CRS (H1-8c)			MVR (H1-8d)		
		Std. β	Sig.	Supported	Std. β	Sig.	Supported	Std. β	Sig.	Supported	Std. β	Sig.	Supported
H1	PEOU→PU	0.255	0.001	Yes	0.197	0.009	Yes	0.354	0.000	Yes	0.242	0.003	Yes
H2	PEOU→ITU	0.312	0.000	Yes	0.180	0.011	Yes	0.409	0.000	Yes	0.267	0.000	Yes
H3	PU→ ITU	0.249	0.003	Yes	0.213	0.007	Yes	0.306	0.000	Yes	0.219	0.006	Yes
H4	PEOU→ ATU	0.325	0.000	Yes	0.233	0.005	Yes	0.416	0.000	Yes	0.290	0.000	Yes
H5	PU→ ATU	0.267	0.000	Yes	0.190	0.001	Yes	0.291	0.000	Yes	0.240	0.003	Yes
H6	ATU→ITU	0.276	0.000	Yes	0.186	0.009	Yes	0.304	0.000	Yes	0.256	0.001	Yes
H7	PEOU→ ATU→ITU	0.239	0.004	Yes	0.167	0.013	Yes	0.288	0.000	Yes	0.232	0.005	Yes
H8	PU→ ATU→ITU	0.311	0.000	Yes	0.152	0.021	Yes	0.343	0.000	Yes	0.272	0.000	Yes

The results found a significant positive impact of perceived ease of use on perceived usefulness for all four digital technologies. This further represents that when students feel the use of a certain technology is not difficult and is user-friendly, they extract the hidden benefits included in those technologies They also try to find modern solutions to the questions linked to their religious beliefs with facts and figures. These results can be further related to the prior studies conducted in different contexts that reported the significance of adopting modern technologies to enhance student outcomes in the form of enhanced engagement, critical thinking abilities learning capabilities and great improvements (Kharatova & Ismailov, 2022; Levchenko et al., 2021; Sprenger & Schwaninger, 2021; To'raqulovich, 2021).

Regardless of the significance of the adoption of all four digital technologies in Islamic study classrooms, we found differential findings. For instance, the adoption level for this classroom response system was higher than all other technologies followed by digital textbooks, mobile virtual reality and classroom chats.

In addition, the current study results are quite different from previous studies regarding the adoption of mobile virtual reality in classrooms. Previously, researchers reported a low level of mobile virtual reality adoption based on multiple constraints including setting time off mobile virtual reality sequences (Sprenger & Schwaninger, 2021) and technological issues faced by some students (Ritter & Chambers, 2022; Sun et al., 2019) that have impacted the results of the previous studies. However, the current study revealed that students felt very comfortable with mobile virtual reality and assessing their quizzes and assignments on their mobile phones was easy and convenient. Finally, against the authors' predictions, the results of adopting classroom chats to enhance the outcomes were contradictory. Some of the students considered it a distracting factor. They did not like the idea of a break during the lectures because they thought that they lost their attention and concentration during the lectures.

These findings further reflect that several questions arise in the minds of the students while learning religion that they might not be able to ask directly of the teachers in front of the whole class. Hence, the classroom response systems and digital textbooks help them find the answers to those questions. Similarly, classroom chat helps them ask controversial questions to their fellows and the lecturers without being disclosed clarifying their concepts. Simultaneously, instant questions and solutions help them identify their mistakes which they can correct immediately based on the lectures' response and discussion sections. At the same time, digital textbooks and the materials linked with the religious talks available on the various social networking sites shared by the lecturers help the students enhance their religious knowledge. Islam believes in practically implementing the faith and doing good deeds in the best interest of others (Jackson & Parker, 2008). As a result, persuasive scholarly talks and materials related to the Hadith that are not available in classrooms or libraries help students in their daily lives.

6.2. Implications

Integrating the TAM with alignment theory, the current study is important to the educational literature concerning the use of modern technologies in classrooms. By comparing the adoption and significance of four different technologies in Islamic study classrooms, the current study opens future research avenues for academicians and scholars to explore the significance of using multiple technologies in different educational sectors to enhance students' engagement and improve their learning capabilities. Simultaneously, students can be encouraged to adopt modern technologies to extract the benefits of such technologies based on the degree of agreement between the expectations associated with the course materials and assessment results. Similarly, the teacher should be encouraged to use multiple methods in the classroom to engage their students, enabling them to not only learn in the classroom but also implement those lessons in their practical lives. The favorable results for the classroom response system, digital textbooks and mobile virtual reality further reflect that practitioners should seriously consider the ease of access and affordability of these technologies at all educational levels to enhance students' learning capabilities. Moreover, mobile virtual reality is the cheapest technology that can be introduced in the classroom on a larger scale. Universities, colleges and schools should enrich their library collections in terms of digital textbooks to facilitate lecturers and students regarding multiple topics. Furthermore, there is a need to enhance the existing knowledge regarding the benefits of classroom chat to enhance the effectiveness of the lectures. The students should be guided regarding the usage of classroom chat to highlight their concerns regarding controversial topics without any hesitation. They must also be encouraged to put their classroom knowledge into practice rather than focusing on getting grades and assessment processes.

6.3. Limitations and Future Research Directions

In addition to the several implications of the current study, it has a few limitations. The first limitation is linked with the measurement of TAM after four months of applying digital technologies in the classrooms. Researchers encourage the measurement of the TAM constructs after 4 to 12 months of using the technologies. Although four months is acceptable and falls within the range. However, future researchers can assess the probable differences (if any) after assessing the TAM for a longer time of technology use in the classrooms. Second, the current study has considered the predictive differences between the four technologies regarding students' behavioral intentions to use each technology. Future researchers can also assess the significance of other important technologies and their adoption in classrooms to benefit students. Third, the current study has analyzed the four different technologies in Islamic study classrooms. In contrast, future researchers can also compare different technologies in different classroom settings (subject-wise) to see the predictive differences in technology adoption among students from different subjects or courses. Finally, the current study has applied PLS-SEM using Smart PLS version 4 as one of the most commonly used techniques to calculate structural models and verify the hypothesized relationships. In contrast, future researchers can conduct covariance-based structural equation modeling (CV-SEM) to see any predictive differences based on the procedures used.

References

Abd Majid, F., & Mohd Shamsudin, N. (2019). Identifying factors affecting acceptance of virtual reality in classrooms based on technology acceptance model (TAM). *Asian Journal of University Education, 15*(2), 1-10. https://doi.org/10.24191/ajue.v15i2.7556

Al-Rahmi, A. M., Shamsuddin, A., Alturki, U., Aldraiweesh, A., Yusof, F. M., Al-Rahmi, W. M., & Aljeraiwi, A. A. (2021). The influence of information system success and technology acceptance model on social media factors in education. *Sustainability*, *13*(14), 7770. https://doi.org/10.3390/su13147770

Anwas, E., Sugiarti, Y., Permatasari, A., Warsihna, J., Anas, Z., Alhapip, L., & Rivalina, R. (2020). Social media usage for enhancing English language skill. *International Journal of Interactive Mobile Technologies*, *14*(7), 41-57. https://doi.org/10.3991/ijim.v14i07.11552

Apedaile, L. (2020). Using Local Research as a Phenomenon in the classroom. *The American Biology Teacher*, *82*(9), 614-618. https://doi.org/10.1525/abt.2020.82.9.614

Apriani, D., Williams, A., Rahardja, U., Khoirunisa, A., & Avionita, S. (2021). The use of science technology In Islamic practices and rules in the past now and the future. *International Journal of Cyber and IT Service Management*, *1*(1), 48-64. https://doi.org/10.34306/ijcitsm.v1i1.16

Asad, M., Ahmad, I., Haider, S. H., & Salman, R. (2018). A crital review of Islamic and conventional banking in digital era: A case of Pakistan. *International Journal of Engineering & Technology*, *7*(4), 57-59. https://doi.org/10.14419/ijet.v7i4.7.20382

Biggs, J. (2003). Aligning teaching and assessing to course objectives. *Teaching and Learning in Higher Education: New Trends and Innovations*, *2*(April), 13-17.

Byiringiro, S., Nelson, K., Akumbom, A., Davidson, P. M., Li, M., Moser, C. H., & Shattell, M. (2021). Using a twitter chat as an alternative to traditional classroom discussion. *Nurse educator*, *46*(5), 311-316.

Castillo-Manzano, J. I., Castro-Nuño, M., López-Valpuesta, L., Sanz-Díaz, M. T., & Yñiguez, R. (2016). Measuring the effect of ARS on academic performance: A global meta-analysis. *Computers & Education*, *96*, 109-121. https://doi.org/10.1016/j.compedu.2016.02.007

Chawla, Y., Kowalska-Pyzalska, A., & Widayat, W. (2019). Consumer willingness and acceptance of smart meters in Indonesia. *Resources*, *8*(4), 1-23. https://doi.org/10.3390/resources8040177

Criollo-C, S., Guerrero-Arias, A., Jaramillo-Alcázar, Á., & Luján-Mora, S. (2021). Mobile learning technologies for education: Benefits and pending issues. *Applied Sciences*, *11*(9), 4111. https://doi.org/10.3390/app11094111

Dalle, J., Siyoto, S., Astika, N. D., Negara, D. J., Chandra, T., & Anam, K. (2020). Moderating role of IT adoption and mechanism of dynamic capabilities on Indonesian pharmaceutical firms performance. *Systematic Reviews in Pharmacy*, *11*(9), 982-992.

Davis, F. D., & Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319-340. https://doi.org/10.2307/249008

Davis, F. D., & Venkatesh, V. (2004). Toward preprototype user acceptance testing of new information systems: Implications for software project management. *IEEE Transactions on Engineering Management*, *51*(1), 31-46. https://doi.org/10.1109/tem.2003.822468

DeJonge-Kannan, K. (2021). Religious, secular, and spiritual diversity on campus: Book review of Goodman, Giess & Patel (2019) Educating about religious diversity and interfaith engagement. *Journal on Empowering Teaching Excellence*, *5*(1), 6.

Ebadi, S., Rasouli, R., & Mohamadi, M. (2021). Exploring EFL learners' perspectives on using Kahoot as a game-based student response system. *Interactive Learning Environments*, 1-13. https://doi.org/10.1080/10494820.2021.1881798

Ergulec, F., & Misirli, Ö. (2022). A game-based student response system: Engaging assessment in the classroom research anthology on developments in gamification and game-based learning. In (pp. 903-915): IGI Global. https://doi.org/10.4018/978-1-6684-3710-0.ch041

Fauzi, A., Wandira, R., Sepri, D., & Hafid, A. (2021). Exploring students' acceptance of google classroom during the covid-19 pandemic by using the technology acceptance model in West Sumatera Universities. *Electronic Journal of e-Learning*, *19*(4), pp233-240. https://doi.org/10.34190/ejel.19.4.2348

Feng, X., Bao, Z., & Wei, S. (2021). LiveObj: Object semantics-based viewport prediction for live mobile virtual reality streaming. *IEEE Transactions on Visualization and Computer Graphics*, *27*(5), 2736-2745. https://doi.org/10.1109/tvcg.2021.3067686

Granik, G., & Borisenko, N. (2021). Psychological and didactic issues of digital textbooks creation. *Psychological Science and Education*, *26*(3), 102-112. https://doi.org/10.17759/pse.2021260307

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Thiele, K. O. (2017). Mirror, mirror on the wall: A comparative evaluation of composite-based structural equation modeling methods. *Journal of the Academy of Marketing Science*, *45*(5), 616-632. https://doi.org/10.1007/s11747-017-0517-x

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, *43*(1), 115-135. https://doi.org/10.1007/s11747-014-0403-8

Hidayah, R., Prihatin, T., & Utanto, Y. (2021). Development of Training on Writing Digital Textbooks Based in On in Service Learning for Teacher. *Innovative Journal of Curriculum and Educational Technology*, *10*(2), 74-89. https://doi.org/10.1075/lllt.57.08kar

Hidayat, D. N., Lee, J. Y., Mason, J., & Khaerudin, T. (2022). Digital technology supporting English learning among Indonesian university students. *Research and Practice in Technology Enhanced Learning*, *17*(1), 1-15. https://doi.org/10.1186/s41039-022-00198-8

Huang, H., Gao, X., & Khayat, K. H. (2021). Contribution of fiber alignment on flexural properties of UHPC and prediction using the composite Theory. *Cement and Concrete Composites*, *118*, 103971. https://doi.org/10.1016/j.cemconcomp.2021.103971

Hudson, D. L. (2021). Learning How to Learn from Digital Textbooks: Evidence-Informed Recommendations for Instructors and Students. *Canadian Psychology*, *62*(4), 377-384. https://doi.org/10.1037/cap0000304

Ida, R., Saud, M., & Mashud, M. i. (2020). An empirical analysis of social media usage, political learning and participation among youth: A comparative study of Indonesia and Pakistan. *Quality & Quantity*, *54*(4), 1285-1297. https://doi.org/10.1007/s11135-020-00985-9

Jackson, E., & Parker, L. (2008). 'Enriched with knowledge': Modernisation, islamisation and the future of islamic education in Indonesia. *Review of Indonesian and Malaysian Affairs*, *42*(1), 21-53.

Kharatova, S. K., & Ismailov, T. X. O. G. L. (2022). Use of innovative technologies in the educational process. *Science and Education*, *3*(3), 713-718.

Kim, H., Shin, K., Noh, T., & Kim, M. (2022). Analyzing the form, presentation, and interactivity of external representations in the matter units of elementary science digital textbooks developed under the 2015 revised national curriculum. *Journal of Korean Elementary Science Education*, *41*(2), 418-431.

Kim, K. J., & Shin, D.-H. (2015). An acceptance model for smart watches: Implications for the adoption of future wearable technology. *Internet Research*, *25*(4), 527-541. https://doi.org/10.1108/intr-05-2014-0126

Knight, B. A. (2015). Teachers' use of textbooks in the digital age. *Cogent Education*, *2*(1), 1015812. https://doi.org/10.1080/2331186x.2015.1015812

Levchenko, I., Dmytriieva, O., Shevchenko, I., Britchenko, I., Kruhlov, V., Avanesova, N., & Solodovnik, O. (2021). Development of a method for selected financing of scientific and educational institutions through targeted capital investment in the development of innovative technologies. *Eastern-European Journal of Enterprise Technologies*, *3*(13), 111. https://doi.org/10.15587/1729-4061.2021.235930

Li, C., Ip, H. H. S., & Ma, P.-K. (2021). Experiential learning for children with autism spectrum disorder using virtual reality headsets: A preliminary report. *International Journal of Innovation and Learning*, *30*(3), 317-333. https://doi.org/10.1504/ijil.2021.118194

Mansoor, M. (2021). Citizens' trust in government as a function of good governance and government agency's provision of quality information on social media during COVID-19. *Government Information Quarterly*, *38*(4), 101597. https://doi.org/10.1016/j.giq.2021.101597

Mansoor, M., Awan, T. M., & Paracha, O. S. (2021). Predicting pro-environmental behaviors of green electronic appliances' users. *International Journal of Business and Economic Affairs*, *6*(4), 175-186. https://doi.org/10.24088/ijbea-2021-64002

Mansoor, M., Saeed, A., Rustandi Kartawinata, B., & Naqi Khan, M. K. (2022). Derivers of green buying behavior for organic skincare products through an interplay of green brand evaluation and green advertisement. *Journal of Global Fashion Marketing*, *13*(4), 328-343. https://doi.org/10.1080/20932685.2022.2085597

Marzuki, A. G., & Kuliahana, A. (2021). Using language games to enhance EFL students' speaking skill in Indonesia. *Al-Ta-lim Journal*, *28*(3), 213-222. https://doi.org/10.15548/jt.v28i3.700

Minalla, A. A. (2018). The effect of WhatsApp chat group in enhancing EFL learners' verbal interaction outside classroom contexts. *English Language Teaching*, *11*(3), 1-7. https://doi.org/10.5539/elt.v11n3p1

Mosquera Feijóo, J. C., Suárez, F., Chiyón, I., & Alberti, M. G. (2021). Some web-based experiences from flipped classroom techniques in aec modules during the covid-19 lockdown. *Education Sciences, 11*(5), 211. https://doi.org/10.3390/educsci11050211

Mu'alimin, M. a. (2019). Application of classroom response systems (CRS): Study to measure student learning outcome. *International Journal of Emerging Technologies in Learning, 14*(14), 132-142. https://doi.org/10.3991/ijet.v14i14.10506

Murillo, G. G., Novoa-Hernández, P., & Rodriguez, R. S. (2021). Technology Acceptance Model and Moodle: A systematic mapping study. *Information Development, 37*(4), 617-632. https://doi.org/10.1177/0266666920959367

Norberg, M. (2021). Exercise design in mathematics textbooks: The case of subtraction. *Nordic Studies in Mathematics Education, 26*(1), 5-30. https://doi.org/10.1007/978-94-007-7560-2_12

Pasaribu, T. A. (2020). Challenging EFL students to read: Digital reader response tasks to foster learner autonomy. *Teaching English with Technology, 20*(2), 21-41.

Ritter, K. A., & Chambers, T. L. (2022). Three-dimensional modeled environments versus 360 degree panoramas for mobile virtual reality training. *Virtual Reality, 26*(2), 571-581. https://doi.org/10.1007/s10055-021-00502-9

Rodríguez, S., Piñeiro, I., Regueiro, B., & Estévez, I. (2020). Intrinsic motivation and perceived utility as predictors of student homework engagement. *Journal of Psychodidactics, 25*(2), 93-99. https://doi.org/10.1016/j.psicoe.2019.11.001

Salikin, H. (2017). The Social media-based approach in teaching writing at Jember University, Indonesia. *International Journal of English Linguistics, 7*(3), 46-57. https://doi.org/10.5539/ijel.v7n3p46

Seglem, R., & Haling, L. (2018). I Got confused reading it: Using backchannels to collaboratively build meaning with texts. *Journal of Teaching and Learning with Technology, 7*(1), 43-58. https://doi.org/10.14434/jotlt.v7i1.23346

Sprenger, D. A., & Schwaninger, A. (2021). Technology acceptance of four digital learning technologies (classroom response system, classroom chat, e-lectures, and mobile virtual reality) after three months' usage. *International Journal of Educational Technology in Higher Education, 18*(1), 1-17. https://doi.org/10.1186/s41239-021-00243-4

Stieger, S., & Reips, U.-D. (2010). What are participants doing while filling in an online questionnaire: A paradata collection tool and an empirical study. *Computers in Human Behavior, 26*(6), 1488-1495. https://doi.org/10.1016/j.chb.2010.05.013

Sun, Y., Chen, Z., Tao, M., & Liu, H. (2019). Communications, caching, and computing for mobile virtual reality: Modeling and tradeoff. *IEEE Transactions on Communications, 67*(11), 7573-7586. https://doi.org/10.1109/tcomm.2019.2920594

Tautz, D., Sprenger, D. A., & Schwaninger, A. (2021). Evaluation of four digital tools and their perceived impact on active learning, repetition and feedback in a large university class. *Computers & Education, 175*, 104338. https://doi.org/10.1016/j.compedu.2021.104338

To'raqulovich, J. U. (2021). Innovative pedagogical technologies in a preschool educational institution. *International Journal of Culture and Modernity, 11*, 215-218.

Venkatesan, M., Mohan, H., Ryan, J. R., Schürch, C. M., Nolan, G. P., Frakes, D. H., & Coskun, A. F. (2021). Virtual and augmented reality for biomedical applications. *Cell Reports Medicine, 2*(7), 100348.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *Management Information Systems Quarterly, 36*(1), 157-178. https://doi.org/10.2307/41410412

Yuen, K. F., Cai, L., Qi, G., & Wang, X. (2021). Factors influencing autonomous vehicle adoption: An application of the technology acceptance model and innovation diffusion theory. *Technology Analysis & Strategic Management, 33*(5), 505-519. https://doi.org/10.1080/09537325.2020.1826423

Zaineldeen, S., Hongbo, L., Koffi, A., & Hassan, B. (2020). Technology acceptance model'concepts, contribution, limitation, and adoption in education. *Universal Journal of Educational Research, 8*(11), 5061-5071. https://doi.org/10.13189/ujer.2020.081106