



Current Research in Education: Conference Series Journal

Journal homepage: <https://ejournal.upi.edu/index.php/crecs>



Elementary School Teachers' Acceptance Factors of Web-Based Learning Media on Energy Material

Pitri Maharai Efendi ^{1*}, Ai Sutini²

Magister PGSD, Universitas Pendidikan Indonesia, Cibiru, Indonesia

*Correspondence: E-mail: pitrimaharaniefendi@upi.edu

ABSTRACT

The utilization of technology in education has a positive impact on students' behavior and thinking, making them more critical, creative, innovative, and collaborative. Currently, there is a need for the integration of technology into education, including the use of web-based learning media. However, the intention and behavior of teachers, in particular, are key factors in the adoption of web-based learning media. The aim of this research is to investigate the predictive factors of primary school teacher acceptance of web-based learning media for energy-related topics. The research method employed a correlational survey involving variables from the UTAUT 2 model. The results indicate that SI, FC, and PLO have a significant influence on BI and are factors affecting the acceptance of web-based learning media by primary school teachers.

ARTICLE INFO

Article History:

Submitted/Received 02 Nov 2023

First Revised 15 Jan 2024

Accepted 01 Mar 2024

First Available online 01 May 2024

Publication Date 01 Aug 2024

Keyword:

Predictive factors of teacher acceptance,
UTAUT 2 model,
Web-based learning media.

1. INTRODUCTION

In the field of education, technological advancements have been used as a means to connect teachers and students Bainbridge (2014), whether it's conducted inside or outside the classroom in the context of the learning process. The integration of technology, information, and communication in educational activities between teachers and students in the 21st century shapes 21st-century learning (Hargreaves & Shirley, 2012; Yakoob, 2022). the integration of technology, information, and communication, a concept and mechanism for technology-based learning activities are required. This is because the impact of applying technological applications itself has a positive influence on students' critical, creative, innovative, and collaborative behaviors and thinking. One tangible form of applying technological applications in education is through the utilization of technology in web-based learning media. Research has shown that as many as 80% of students use technology-based learning as a means of communication. Students utilize various technological tools such as phones (27%), email (61%), and virtual chats (43%) (Liaw et al., 2007).

Teachers are one of the key elements in determining the implementation of web-based learning media in schools. Naturally, teacher acceptance of technology influences the use of web-based learning media in elementary schools, especially in the context of energy-related subjects. This teacher acceptance is closely related to the teachers' own intentions and is influenced by predictive factors such as performance expectancy (PE), effort expectancy (EE), social influence (SI), infrastructure conditions (FC), information technology usage habits (IUH), perceived learning opportunities (PLO), and hedonic motivation (HM).

To investigate these factors, the UTAUT model is utilized, which is widely regarded as the best predictive model currently available (Al-Shafi, 2009). This research is conducted with the aim of identifying the predictive factors that influence the acceptance of web-based learning media by primary school teachers in the context of energy-related subjects.

2. METHODS

According to Kember et al. (2010) a website, more commonly known as the web, serves as a learning medium for students and a platform for providing various kinds of information. The information available on the web can be accessed by students without the need for face-to-face interaction or limitations of place and time, enabling learning to take place anywhere and anytime (Ananga & Biney, 2017). This has an impact on the interaction between students and their peers, students and learning materials, and students and teachers, all of which contribute to the improvement of students' learning outcomes (Goh et al., 2019; Usta, 2011).

Web-based learning media provides benefits and contributes to the field of education. It is effective when used as a learning tool in the 21st century. Students are trained to think critically through web-based learning media. It helps prepare the lessons to be taught by teachers and facilitates the delivery of challenging learning materials. Additionally, according to Lee & Owens Tambunan et al. (2017), the learning experience is enhanced as it deepens understanding and makes learning more engaging.

Web-based learning media itself offers benefits for both teachers and students. For teachers, one of the advantages is the ease it provides in delivering and conveying learning materials. As for students, it fosters independent learning and trains students to utilize technology in their learning, helping them develop self-directed learning skills (Astuti et al., 2020; Rashid et al., 2016; Sudarsana et al., n.d.).

However, there are several factors that need to be considered when utilizing web technology as a learning medium, including the supporting infrastructure such as internet connectivity and tools that can facilitate the use of web-based media. Additionally, it involves the users, in this case, both teachers and students, as well as the stakeholders within the school environment (Dika Tria Puspitasari et al., 2018). Furthermore, the characteristics of learning content/material and organizational capacity are also important considerations in the use of technology as a learning medium.

The desire of an individual to incorporate and utilize technology to accomplish tasks in their daily activities is the definition of technology acceptance (Maruping et al., 2009). In other words, technology is accepted by individuals when they apply it as a tool to fulfill their daily tasks. This acceptance is closely related to the attitudes of individuals influenced by various factors. There are several theories related to individual attitudes affecting the use of technology, including the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). The TAM model has been widely used in previous research as a reference for analyzing the technology acceptance process by individuals. User motivation, perceived usefulness, and attitudes towards technology are key variables in the TAM model.

Another theory explaining the acceptance of technology by individuals is the Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT theory integrates eight previous theories of technology acceptance and usage, which include the Technology Acceptance Model (TAM), Theory of Rational Action (TRA), Theory of Planned Behavior (TPB), Task Technology Fit Model (TTF), Innovation Diffusion Theory (IDT), Model Motivation (MM), Social Cognitive Theory (SCT), and Model PC Utilization (MPCU). These theories are combined and summarized into four variables: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC), which impact users' behavioral intentions (BI) toward technology. Additionally, there are control/moderator variables such as gender, age, experience, and voluntariness. These variables are constructs in the UTAUT model.

Currently, the UTAUT model has undergone modification by adding three variables, based on findings from a study conducted in Hong Kong. The research showed that the addition of constructs in the UTAUT2 model significantly affects changes in behavioral intentions (BI) and the use of technology. The variables added to the UTAUT2 model include hedonic motivation, price value, and habit. Based on the research, UTAUT is considered the most suitable model for identifying factors influencing technology acceptance (Alshehri, 2013; Ammenwerth, 2019; Kijisanayotin et al., 2009; Williams et al., 2015).

Based on the literature review above, the hypotheses in this research include:

- H1: Performance Expectancy (PE) has a positive impact on behavioral intention (BI) to use web-based learning media.
- H2: Effort Expectancy (EE) has a positive impact on behavioral intention (BI) to use web-based learning media.
- H3: Social Influence (SI) has a positive impact on behavioral intention (BI) to use web-based learning media.
- H4: Facilitating Conditions (FC) has a positive impact on behavioral intention (BI) to use web-based learning media.
- H5: ICT Usage Habit (IUH) has a positive impact on behavioral intention (BI) to use web-based learning media.
- H6: Perceived Learning Opportunities (PLO) has a positive impact on behavioral intention (BI) to use web-based learning media.

H7: Hedonic Motivation (HM) has a positive impact on behavioral intention (BI) to use web-based learning media.

This research is conducted with the purpose of identifying the predictive factors influencing the acceptance of web-based learning media by primary school teachers. The research method employed is a correlational survey. The first step was to develop web-based learning media and design a questionnaire. In this research, the questionnaire was divided into two parts. The first part included demographic information about the respondents, such as age, gender, and years of teaching experience. The second part encompassed the variables/constructs found in UTAUT 2, which are PE, EE, SI, FC, BI, IUH, PLO, and HM. Each variable/construct consisted of 5 statements. Each statement was measured using a 5-point Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree." Subsequently, data was evaluated using Structural Equation Modeling (SEM).

The respondents in this study were elementary school teachers distributed in various regions in West Java, totaling 100 individuals. The respondents comprised 31 males (31%) and 69 females (69%), with ages ranging from 20 to 50 years. The majority of respondents were 30 years old. In terms of teaching experience, the highest number of respondents had teaching experience ranging from 11 to 15 years.

3. RESULTS AND DISCUSSION

Measurement of the indicators (Outer Model) was conducted, including assessing convergent validity. Convergent validity is used to determine if specific items are designed to measure the constructs they are intended to measure. To assess convergent validity, the Average Variance Extracted (AVE), composite reliability (CR) of each variable, and the reliability of each item were examined. An AVE greater than 0.50 represents 50% variance of the items, indicating adequate convergent validity. Crossloading in **Table 1** shows that values range from 0.7 to 0.9, exceeding the recommended threshold of 0.5. Table 1 reveals that the CR values for seven variables are above the recommended value of 0.7, indicating valid results. However, one variable is below 0.7, indicating invalid results.

Table 1. Measurement model results.

Variables	Indicator	Loading	AVE	CR
Performance Expectancy (PE)	PE1	0,810	0,679	0,843
	PE2	0,861		
	PE3	0,784		
	PE4	0,838		
Effort Expectancy (EE)	EE1	0,952	0,919	0,930
	EE2	0,965		
Social Influence (SI)	SI1	0,789	0,688	0,787
	SI4	0,849		
	SI5	0,848		
Facilitating Condition (FC)	FC4	0,739	0,705	0,761
	FC5	0,930		
Behavior Intention (BI)	BI4	0,878	0,757	0,681
	BI5	0,862		
ICT Usage Habbits (IUH)	IUH1	0,820	0,641	0,879
	IUH2	0,852		
	IUH3	0,830		
	IUH4	0,741		
	IUH5	0,756		
Perceived Learning Opportunities (PLO)	PLO1	0,743	0,669	0,883
	PLO2	0,820		

Variables	Indicator	Loading	AVE	CR
Hedonic Motivation (HM)	PLO3	0,849	0,634	0,861
	PLO4	0,817		
	PLO5	0,856		
	HM1	0,776		
	HM2	0,761		
	HM3	0,851		
	HM4	0,733		
	HM5	0,853		

Below are the results of indicator analysis and an overview of the relationships between latent variables in this study.

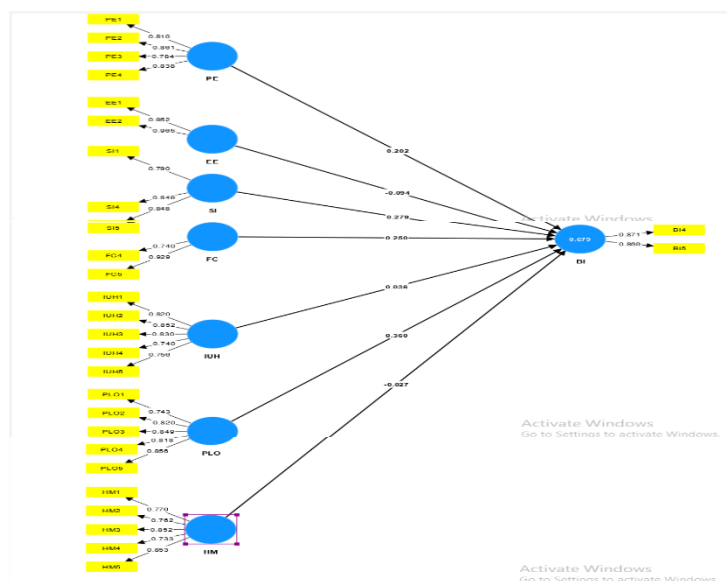


Figure 1. Analysis of relationships between latent variables.

Discriminant validity is assessed to measure how distinct the constructs are. To support discriminant validity, each square root of AVE should have a greater value than the intercorrelation of the construct with every other construct (Fornell & Larcker, 1981). Table 3 shows that the diagonal elements or square roots of AVE are higher than the off-diagonal elements. This indicates that the model used meets the Fornell-Larcker criteria and satisfies discriminant validity.

Table 2. Discriminant validity model - fornell-larcker criteria.

	BI	EE	FC	HM	IUH	PE	PLO	SI
BI	0,870							
EE	0,431	0,959						
FC	0,688	0,530	0,840					
HM	0,603	0,390	0,499	0,796				
IUH	0,481	0,502	0,472	0,460	0,801			
PE	0,625	0,397	0,561	0,517	0,463	0,824		
PLO	0,680	0,458	0,588	0,695	0,401	0,504	0,818	
SI	0,628	0,501	0,570	0,612	0,532	0,486	0,424	0,829

In addition to the Fornell-Larcker version of discriminant validity, there is a new discriminant validity criterion introduced by Ringle and Sarstedt (2015) called the

Heterotrait-Monotrait Ratio (HTMT). HTMT requires values below 0.9 between two reflective constructs to establish good discriminant validity. In other words, the HTMT criterion is evaluated to verify the discriminant validity of the model as shown in **Table 3**.

Table 3. Discriminant validity model (heterotrait-monotrait ratio [HTMT]).

	BI	EE	FC	HM	IUH	PE	PLO	SI
BI								
EE	0,544							
FC	1,001	0,733						
HM	0,782	0,433	0,618					
IUH	0,612	0,574	0,635	0,515				
PE	0,821	0,451	0,739	0,600	0,527			
PLO	0,876	0,509	0,737	0,794	0,459	0,585		
SI	0,857	0,609	0,806	0,747	0,665	0,593	0,512	

The structural model also includes R2 values, indicating how much of the dependent variable is explained by the independent variables. BI is significantly determined by seven exogenous variables: PE, EE, SI, FC, IUH, PLO, and HM, resulting in an R2 of 0.680. These independent variables explain 68% of the variance in BI. This means that the BI variable is influenced by PE, EE, SI, FC, IUH, PLO, and HM by 68%. The magnitude of the influence between constructs and interaction effects is assessed by path coefficients. Path coefficients with T-statistic values ≥ 1.96 are considered significant, while path coefficients with T-statistic values ≤ 1.96 are considered not significant. In addition to analyzing the T-statistic, the direction of the relationship is also analyzed using Path Coefficients. This can indicate whether the hypothesized variable relationships have a positive direction (between 0 and 1) or a negative direction (between 0 and -1).

Table 4. Path Analysis model.

	Original sample (O)	Sample average (M)	Standard Deviation (STDEV)	T statistics (O/STDEV)	P-value
H ₁ : PE -> BI	0,203	0,200	0,105	1,929	0,054
H ₂ : EE -> BI	-0,094	-0,093	0,075	1,251	0,211
H ₃ : SI -> BI	0,278	0,253	0,101	2,763	0,006
H ₄ : FC -> BI	0,253	0,245	0,109	2,326	0,020
H ₅ : IUH -> BI	0,033	0,053	0,089	0,368	0,713
H ₆ : PLO -> BI	0,360	0,365	0,119	3,015	0,003
H ₇ : HM -> BI	-0,027	-0,015	0,120	0,226	0,821

Table 4 presents the results of hypothesis testing for path coefficients and their significance. Performance expectancy, effort expectancy, ICT usage habit, and hedonic motivation are constructs with path coefficients having T-statistics ≤ 1.96 and P-values ≥ 0.05 . These four paths are considered to have an influence but are not statistically significant.

The results of hypothesis testing are as follows:

- 1) PE has a positive but not significant impact on BI, indicated by $\beta = 0.203$, $t = 1.929$, $p \geq 0.05$.
- 2) EE has a negative and not significant impact on BI, indicated by $\beta = -0.094$, $t = 1.251$, $p \geq 0.05$.
- 3) SI has a positive and significant impact on BI, indicated by $\beta = 0.278$, $t = 2.763$, $p \leq 0.05$.
- 4) FC has a positive and significant impact on BI, indicated by $\beta = 0.253$, $t = 2.326$, $p \leq 0.05$.

- 5) IUH has a positive but not significant impact on BI, indicated by $\beta = 0.033$, $t = 0.368$, $p \geq 0.05$.
- 6) PLO has a positive and significant impact on BI, indicated by $\beta = 0.360$, $t = 3.015$, $p \leq 0.05$.
- 7) HM has a negative and not significant impact on BI, indicated by $\beta = -0.027$, $t = 0.226$, $p \geq 0.05$.

Based on the findings of the study, it is evident that SI, FC, and PLO are predictive factors influencing teachers' acceptance of web-based learning media on the topic of energy. On the other hand, the variables PE, EE, IUH, and HM are not factors contributing to teachers' acceptance of web-based learning media, and thus, the hypotheses are rejected.

3.1. Performance Expectancy (PE)

In this study, the variable PE has a positive but not significant impact on BI, as indicated by the β , T-statistic, and P-value. Therefore, the hypothesis regarding PE's impact on BI is rejected, meaning that PE does not influence BI. The use of web-based learning media does not lead to an improvement in teacher performance. This is in contrast to a study in South Korea, which showed that performance expectancy has a significant relationship with Behavior Intention in using technology. The use of technology has an impact on performance improvement in work, which aligns with the concept of performance expectancy.

3.2. Effort Expectancy (EE)

The variable EE has a negative and non-significant impact on BI, as indicated by the β , T-statistic, and P-value. Therefore, the hypothesis regarding EE's impact on BI is rejected, and EE does not influence BI. Teachers encounter barriers in using web-based learning media, as it requires significant effort. When looking at several empirical studies, it is evident that effort expectancy is crucial in the acceptance and usage of technology. Effort expectancy refers to how easy technology is to use.

3.3. Social Influence (SI)

In their research, demonstrated that social influence is a crucial factor in technology use for learning. SI has a positive and significant impact on BI, as indicated by the β , T-statistic, and P-value. The hypothesis regarding SI's impact on BI is accepted. Social Influence pertains to the extent of influence from people in the surrounding environment that can change users' behavior and attitudes toward technology. The findings in this study indicate that teachers embrace web-based learning media because they are encouraged by their immediate environment, including colleagues, leaders, and students. This aligns with research that shows social influence has a positive impact on behavioral intention in technology usage.

3.4. Facilitating Condition (FC)

Revealed that the availability of facilities or access to technology can influence users' behavioral intention (BI). Facilitating Condition refers to the availability of facilities that can be utilized for technology use. FC has a positive and significant impact on BI, indicating a significant impact when facilitating conditions on users' technology behavioral intention. Consistent with the findings in this study, FC has a positive and significant impact on BI, as indicated by the β , T-statistic, and P-value. Therefore, the hypothesis regarding FC's impact on BI is accepted.

3.5. ICT Usage Habbit (IUH)

Habit can be defined from two different perspectives. Habit as a prior behavior and habit as automatic/instant behavior. Having a habit of using technology is undoubtedly something that encourages teachers to use technology. However, in contrast to the findings in this study, IUH has a positive but not significant impact on BI, as indicated by the β , T-statistic, and P-value. Therefore, the hypothesis regarding IUH's impact on BI is rejected, meaning that IUH does not influence BI. Having a habit of using technology is not a factor in teachers' acceptance of web-based learning media.

3.6. Perceived Learning Opportunities (PLO)

Perceived learning is defined as a set of beliefs and feelings related to the learning process. There are three main dimensions of perceived learning, which are 1) cognitive, related to the aspect of acquiring new knowledge; 2) emotional, concerning the feelings, experiences, and emotions involved in acquiring new knowledge (in terms of complexity or ease); and 3) social, related to the satisfaction obtained from interactions with others during the acquisition of new knowledge. PLO is not a factor that influences a teacher's acceptance of web-based learning media. This is shown by the results of β , T-statistic, and P-value. Therefore, the hypothesis regarding PLO's impact on BI is rejected, meaning that PLO does not influence BI.

3.7. Hedonic Motivation (HM)

The pleasure and happiness derived from the use of technology is the definition of hedonic motivation. Feeling happy influences an individual's adoption of new technology. However, the findings in this study indicate that teachers do not experience happiness and comfort when confronted with web-based learning media. This is shown by the results of β , T-statistic, and P-value, which indicate that the variable HM has a negative and non-significant impact on BI. Therefore, the hypothesis regarding HM's impact on BI is rejected.

4. CONCLUSION

There are three variables that influence the acceptance of web-based learning media by teachers. PLO, SI, and FC are the factors that affect teacher acceptance of web-based learning media. PLO is the most dominant factor. Teachers feel that web-based learning provides them with the opportunity to teach in new ways, interact with students, think creatively, motivate students, and improve their competencies. In addition, the influence of close individuals, colleagues, school support, the availability of supporting equipment, and the provision of web-based learning media training enable teachers to accept this form of learning media.

On the other hand, the other four variables, namely PE, EE, IUH, and HM, are not factors in teacher acceptance of web-based learning media. For teachers, using web-based learning media requires extensive preparation, complex technology, and difficulties in usage. Consequently, teachers believe that web-based learning media does not impact the quality, effectiveness, and productivity of teaching.

The findings in this study do not necessarily represent the views of the majority of primary school teachers regarding the acceptance of web-based learning media on the subject of energy. This is because the number of respondents is still relatively small, and latent variables are only focused on behavioral intention (BI). Therefore, further research is needed on teacher acceptance of web-based learning media for other subject matters,

involving a larger number of respondents/teachers and considering various other influencing variables.

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