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Integration of Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) in E-learning with Zoom

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Abstract

E-learning through the Zoom platform has emerged as a popular trend in the digital era. This study aims to assess the effectiveness of e-learning via Zoom by engaging 100 respondents from Universitas Islam Indonesia (UII) in Yogyakarta. The study employs a combined approach of the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB). Quantitative methodology with a questionnaire as the data collection instrument was used, and the analysis technique utilized the Partial Least Squares Structural Equation Modeling (PLS-SEM) method with Smart PLS software. The findings reveal that perceptions of ease of use, usefulness, and intention to use Zoom significantly influence the effectiveness of e-learning. However, perceived behavioral control does not exhibit a significant effect. Limitations include the focus on UII students, reducing generalizability, and the absence of long-term change analysis. Recommendations include expanding the study's scope to encompass a wider population and employing a mixed-methods approach for deeper insights. Increasing references and involving students from other universities can enhance the study's external validity and generalizability.

Keywords: E-learning, Zoom, TAM, TPB, PLS-SEM

1. INTRODUCTİON

The contemporary digital landscape has witnessed a notable surge in the adoption of e-learning methodologies, particularly through platforms like Zoom. As traditional educational paradigms evolve, understanding the effectiveness of e-learning becomes paramount. This study delves into the realm of e-learning effectiveness, focusing on Zoom as the chosen platform. The existing literature offers insights into technology acceptance models and planned behavior theories, yet gaps persist in comprehensively addressing the amalgamation of these factors within the context of Zoom-based e-learning. This study seeks to bridge this gap by amalgamating the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), aiming to unravel the complex interplay of perceived ease of use, usefulness, behavioral control, and intention to use Zoom. By investigating the interrelationships of these constructs, the research aims to provide novel insights into the dynamics of e-learning effectiveness, ultimately contributing fresh perspectives to the field of educational technology.

2. LİTERATURE REVİEW

In the realm of online education, particularly e-learning facilitated through platforms such as Zoom, the integration of theoretical frameworks plays a pivotal role in enhancing the effectiveness of the learning experience. This chapter delves into the exploration of two prominent models, the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), to illuminate their significance in elevating the quality of e-learning with Zoom.

2.1 E-learning and Zoom

E-learning, defined as the utilization of electronic means for teaching and learning, has redefined the boundaries of education, enabling educators and learners to engage in a virtual learning environment transcending geographical limitations (Muhammad Ahsan & Asep Saepul Anwar, 2020). It harnesses the power of Technology and Information Communication (TIK) to facilitate interactive and flexible learning experiences, with

platforms like Zoom serving as a versatile tool for conducting online sessions (Nurfadilah et al., 2021).

2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), conceptualized by Davis in 1989, elucidates the factors influencing users' acceptance and adoption of technology. This model comprises two primary elements, perceived usefulness (PU) and perceived ease of use (PEU), which determine individuals' perceptions of the benefits and simplicity of employing a particular technology (Davis, 1989).

2.3 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB), an extension of the Theory of Reasoned Action, posited by Ajzen in 1991, delves into the psychosocial determinants influencing individual behavior. It encompasses three core beliefs: attitude (AT), subjective norm (SN), and perceived behavioral control (PBC), which collectively shape behavioral intentions and subsequent actions (Ajzen, 1991).

2.4 Previous Studies

Previous studies have investigated theoretical model integration across contexts, revealing insights into user behavior and technology adoption. Limeng Chai et al. (2022) merged TAM and TPB with risk perception, finding a positive impact on telecommuting adoption during COVID-19. Yuna Yao et al. (2022) explored ICT's effects on psychological constructs among Henan students, highlighting the positive correlation between technology acceptance and constructs. Abu Elnasr E. Sobaih et al. (2022) discovered social networking apps' positive influence on academic performance in Egypt. Ni Wayan Ananda Ratih et al. (2022) showed Zoom's positive impact on remote learning in a vocational school. Sarabjit Kaur (2022) emphasized technology's role in rural Punjab's e-learning adoption. Bora Ly et al. (2023) found a positive link between TAM, TPB, and Zoom adoption among Cambodian students, enhancing online learning.

2.5 Variable Definitions

The variables of interest, namely Self Awareness (SA), Attitude (AT), Subjective Norms (SN), Perceived Behavioral Control (PBC), Perceived Ease of Use (PEU), Perceived Usefulness (PU), and Continued Use Intention (CUI), encompass the psychological constructs crucial in comprehending e-learning with Zoom.

2.6 Hypothesis Development

The current study postulates a series of hypothesis to ascertain the relationships between the identified variables within the context of e-learning with Zoom. These hypothesis elucidate the interconnectedness of Self Awareness, Perceived Ease of Use, Perceived Usefulness, Attitude, Subjective Norms, and Continued Use Intention.

3. RESEARCH METHOD

3.1 Research Approach

This research employs a quantitative research approach to examine the integration of the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) in the context of e-learning using the Zoom platform.

3.2 Types of Research Data

The study utilizes primary data collected through an online questionnaire, encompassing respondent information and questions related to TAM, TPB, and the use of e-learning with Zoom.

3.3 Research Data Sources

The primary data source is the targeted respondents who actively utilize Zoom for e-learning purposes at various study programs within Universitas Islam Indonesia.

3.4 Techniques for Determining Informants or Respondents

Respondents are selected through purposive sampling, involving 100 individuals who are currently using Zoom for e-learning during the ongoing semester.

3.5 Research Instruments

The research employs an online questionnaire containing adapted scales from previous studies, particularly the research by Limeng Chai, Jian Xu, and Shanliang Li (2021), to measure the variables: Self Awareness (SA), Attitude (AT), Subjective Norms (SN), Perceived Behavioral Control (PBC), Perceived Ease of Use (PEU), Perceived Usefulness (PU), and Continued Use Intention (CUI).

3.6 Data Collection Techniques

Data analysis comprises two stages: descriptive analysis and quantitative analysis using Partial Least Square Structural Equation Modeling (PLS-SEM). Descriptive analysis provides insights into respondent characteristics and observed variables, presenting summary statistics such as mean, median, and standard deviation. PLS-SEM is employed to test the relationships among variables within the model.

3.7 Framework Theory (Framework) Used

The study integrates the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) to explore their interconnectedness and influence in the context of e-learning with Zoom.

3.8 Data Analysis Techniques

Quantitative data analysis is conducted using Partial Least Square Structural Equation Modeling (PLS-SEM), facilitated by the Smart PLS software. The structural model's fitness is assessed by comparing goodness-of-fit indices such as SRMR, d_ULS, d_G, Chi-Square, NFI, and rms Theta against predefined criteria. Hypothesis testing involves analyzing

coefficient signs, significance values, and standardized coefficients to measure the strength of relationships among variables.

3.9 Data Credibility

The credibility of data is ensured through rigorous questionnaire design, adaptation from validated scales, and a well-defined sampling approach. Statistical analyses using PLS-SEM provide a robust means of evaluating relationships among variables, contributing to the overall data credibility.

4. RESULT

4.1 Variable Measurement Results

Table 1. Variable Measurement Results

Variable	***Mean***
Self Awareness	3,73
Attitude	3,73
Subjective Norms	3,85
Perceived Behavioral Control	3,87
Perceived Ease of Use	4,35
Perceived Usefulness	3,62
Continued Use Intention	3,69

Source: Data Analysis, 2023

Based on the results of variable measurements, the Perceived Ease of Use variable has the highest mean, indicating that respondents find Zoom Meetings easy to use for teaching and learning activities. On the other hand, the Perceived Usefulness variable has the lowest mean, possibly suggesting that respondents have doubts about how much the use of Zoom Meetings can help them achieve their learning goals.

4.2 Outer Model

The measurement model was evaluated using the Partial Least Squares (PLS) method to test the convergent validity, discriminant validity, and reliability of each indicator or item in measuring the related latent variables.

4.3 Convergent Validity

Table 2. Convergent Validity Test

Variable	Indicator	Loading Factor	Explanation
Self Awareness	SA.1	0.917	Valid
	SA.2	0.896	Valid
Attitude	AT.1	0.843	Valid
	AT.2	0.773	Valid
	AT.3	0.772	Valid
Subjective Norms	SN.1	0.922	Valid
	SN.2	0.944	Valid
	SN.3	0.900	Valid
Perceived Behavioral Control	PBC.1	1.000	Valid
Perceived Ease of Use	PEU.1	0.782	Valid
	PEU.2	0.726	Valid
	PEU.3	0.911	Valid
Perceived Usefulness	PU.1	0.954	Valid
	PU.2	0.954	Valid
Continued Use Intention	CUI.1	1.000	Valid

Source: Data Analysis, 2023

Table 2 presents the results of the convergent validity test for each variable. All indicators have loading factor values above 0.7, thus it can be concluded that all these indicators are valid and contribute significantly to measuring the related latent variable.

4.4 Discriminant Validity

Table 3. Discriminant Validity Test

Variable	√AVE	Explanation
Self Awareness	0,907	Valid
Attitude	0,797	Valid
Subjective Norms	0,922	Valid
Perceived Behavioral Control	1.000	Valid
Perceived Ease of Use	0,810	Valid
Perceived Usefulness	0,954	Valid
Continued Use Intention	1.000	Valid

Source: Data Analysis, 2023

The results of the discriminant validity test indicate that the Average Variance Extracted (AVE) values for each variable are greater than the correlations between that variable and other variables in the model. This suggests that each observed variable effectively explains its underlying latent variable. Consequently, it can be concluded that all items meet the criteria for discriminant validity and are considered valid in measuring their respective latent constructs.

4.5 Reliability

Table 4. Reliability Test

Variable	Composite Reliability	rho_A	Cronbach's Alpha	Explanation
Self Awareness	0.903	0.822	0,785	Reliable
Attitude	0,839	0.635	0,719	Reliable
Subjective Norms	0,944	0,850	0,912	Reliable
Perceived Behavioral Control	1,000	1,000	1,000	Reliable
Perceived Ease of Use	0,850	0,656	0,749	Reliable

Variable	Composite Reliability	rho_A	Cronbach's Alpha	Explanation
Perceived Usefulness	0,953	0,909	0,900	Reliable
Continued Use Intention	1,000	1,000	1,000	Reliable

Source: Data Analysis, 2023

All variables in this study are considered reliable based on the results of the reliability test using statistics such as Composite Reliability, rho_A, and Cronbach's Alpha. This indicates that the measurement instruments used in this study can provide consistent and dependable results in measuring the examined constructs.

4.6 Inner Model

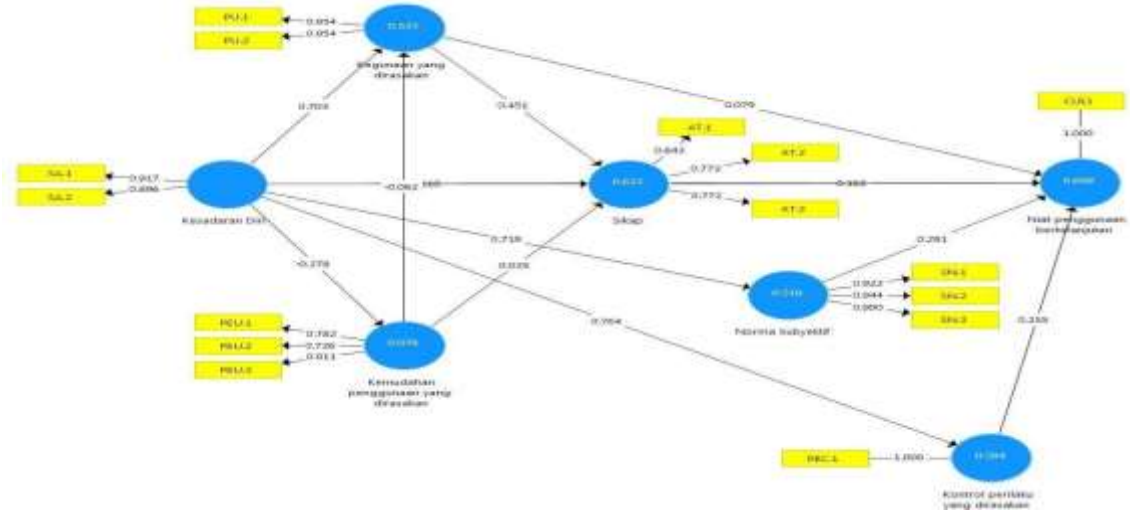

Figure 1 Structural Model – August 2023

The results of the PLS structural model testing indicate the level of fit between the model and empirical data.

4.7 R-Square

Table 5. ***R-Square***

Variabel	***R-Square***	***R-Square Adjusted***
Perceived Usefulness	0.523	0.513
Perceived Ease of Use	0.078	0.068
Perceived Behavioral Control	0.584	0.580
Intention to Use Continuously	0.698	0.682
Subjective Norm	0.518	0.513
Attitude	0.623	0.611

Source: Data Analysis, 2023

The variables "Perceived Behavioral Control," "Intention to Use Continuously," and "Attitude" have a significant contribution in explaining the variance in the intention to use e-learning with Zoom continuously. However, the variable "Perceived Ease of Use" has a low contribution. The Adjusted R-Square provides a more conservative value, taking into account the complexity of the model.

4.8 Goodness Of Fit Test

Table 6. *Goodness of Fit Test*

Criteria	*Saturated Model*	Estimation Models
SRMR	0.084	0.118
d_ULS	0.849	1.660
d_G	0.593	0.810
Chi-Square	341.423	408.139
NFI	0.728	0.674
rms Theta	0.262	

Source: Data Analysis, 2023

The Estimation Model does not fit well with the empirical data according to the results of the goodness of fit test. This is indicated by the SRMR value of the estimation model exceeding the threshold of 0.10 (0.118), and the NFI value of the estimation model being lower than the threshold of 0.90 (0.674). Although the Chi-Square value of the estimation model is higher than that of the Saturated model, the model fit should be evaluated using other criteria. The Saturated model shows better fit with the data, as evidenced by lower values of SRMR, d_ULS, and d_G compared to the estimation model.

4.7 Hypothesis Testing Results

Hypothesis testing was conducted to determine the relationships between variables in this study. Based on the results of testing the influence of independent variables on the dependent variable, several significant relationships were identified:

Table 7. Hypothesis Testing Total Effects (Mean, STDEV, T-Values, P-values)

Variable	Original Sample (O)	Average Sample (M)	Standard Deviation (STDEV)	T Statistic (| O/STDEV|)	*P Values*	Explanation
Perceived Usefulness – Continued Use Intention	0.079	0.080	0.111	0.709	0.478	Not Supported
Perceived Usefulness – Attitude	0.451	0.456	0.123	3.679	0.000	Supported
Perceived Ease of Use - Perceived Usefulness	-0.062	-0.071	0.069	0.896	0.371	Not Supported

Variable	Original Sample (O)	Average Sample (M)	Standard Deviation (STDEV)	T Statistic (| O/STDEV|)	*P Values*	Explanation
Perceived Ease of Use - Attitude	0.035	0.025	0.058	0.606	0.545	Not Supported
Self Awareness - Perceived Usefulness	0.703	0.699	0.063	11.180	0.000	Supported
Self Awareness - Perceived Ease of Use	-0.279	-0.290	0.078	3.594	0.000	Supported
Self Awareness - Perceived Behavioral Control	0.764	0.764	0.049	15.544	0.000	Supported
Self Awareness - Continued Use Intention	0.149	0.157	0.097	1.546	0.123	Not Supported
Self Awareness - Subjective Norms	0.719	0.718	0.054	13.385	0.000	Supported

Variable	Original Sample (O)	Average Sample (M)	Standard Deviation (STDEV)	T Statistic (| O/STDEV|)	*P Values*	Explanation
Self Awareness - Attitude	0.410	0.414	0.116	3.532	0.000	Supported
Perceived Behavioral Control - Continued Use Intention	0.255	0.255	0.121	2.111	0.035	Supported
Subjective Norms - Continued Use Intention	0.291	0.281	0.117	2.494	0.013	Supported
Attitude - Continued Use Intention	0.384	0.321	0.115	3.241	0.001	Supported

Source: Data Analysis, 2023

The results of testing the hypothesis in this study indicate the following findings: First, there is no significant influence between perceived usefulness and intention to continue using it. Second, perceived usefulness has a significant effect on attitudes. Third, there is no significant effect between perceived ease of use and perceived usefulness. Fourth, there is no significant effect between perceived ease of use and attitude. Fifth, self-awareness has a significant influence on perceived usefulness. Sixth, self-awareness has a significant influence on perceived ease of use. Seventh, self-awareness has a significant effect on perceived behavioral control. Eighth, there is insufficient evidence to support a significant effect between self-awareness and intention to use. Ninth, self-awareness has a significant influence on subjective norms. Tenth, self-awareness has a significant influence on attitude.

Eleventh, perceived behavioral control has a significant influence on intention to use it continuously. Twelfth, subjective norms have a significant influence on the intention to continue use. And lastly, attitude has a significant influence on intention to continue use. These findings provide in-depth insight into the factors influencing the adoption of e-learning through the Zoom platform in an academic context.

4.8 Influence of Independent Variables

Table 8. Influence Test

	Perceived usefulness	Perceived ease of use	elf-awareness	Perceived behavioral control	ontinued Use Intention	Subjective Norms	Attitude
Perceived usefulness	0.000	0.000	0.000	0.000	0.005	0.000	0.257
Perceived ease of use	0.007	0.000	0.000	0.000	0.000	0.000	0.003
Self-awareness	0.957	0.084	0.000	1.403	0.024	1.073	0.210
Perceived behavioral control	0.000	0.000	0.000	0.000	0.058	0.000	0.000
Continued Use Intention	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Subjective Norms	0.000	0.000	0.000	0.000	0.085	0.000	0.000
Attitude	0.000	0.000	0.000	0.000	0.030	0.000	0.000

Source: Data Analysis, 2023

The results of the hypothesis analysis in this study reveal the following findings: First, in the context of using e-learning with the Zoom platform, perceived usefulness has a positive influence on users' attitudes towards the technology, and has a positive influence on their perception of perceived ease of use. Second, perceived ease of use has a positive effect on perceived usefulness, but has a negative effect on perceived perceived behavioral control. Third, the self-awareness factor has a positive influence on perceived usefulness, perceived ease of use, perceived behavioral control, intention to continue use, subjective norms, and attitudes. Fourth, perceived behavioral control has a positive influence on perceived usefulness. Fifth, intention to use continuously does not show a significant effect of the other variables observed. Sixth, subjective norms have a positive influence on perceived usefulness. And finally, user attitudes have a positive influence on the perceived usefulness of using the Zoom e-learning platform. These findings provide a deeper understanding of the factors influencing the adoption of e-learning technology with Zoom.

5. DİSCUSSİON

In line with the work of Limeng Chai, Jian Xu, and Shanliang Li (2022), who integrated the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) with risk perception to investigate employees' intention to adopt telecommuting during the COVID-19 pandemic, our study sheds light on the positive influence of perceived usefulness and ease of use on attitudes towards technology adoption. Similarly, the study conducted by Yuna Yao, Ping Wang, YuJun Jiang, Qiang Lid, and Yingji Li (2022) supports our findings, showcasing the positive impact of Information and Communication Technology (ICT) usage on self-awareness, attitude, subjective norms, perceived behavioral control, perceived ease of use, perceived usefulness, and continued use intention among students.

Moreover, the research by Abu Elnasr E. Sobaih, Ahmed Hasanein, and Ibrahim A. Elshaer (2022) underscores our findings by highlighting the constructive role of social networking applications in enhancing academic performance through digital learning platforms. This resonates with our observation that technology, including social media, can significantly enhance the effectiveness of online education. The study by Ni Wayan Ananda

Ratih, I Wayan Gede Narayana, and Komang Hari Santhi Dewi (2022) further reinforces our conclusion, illustrating the affirmative impact of Zoom application usage on distance learning effectiveness within secondary vocational schools.

In accordance with the research carried out by Sarabjit Kaur (2022), our study strengthens the notion that technology acceptance models positively influence electronic learning adoption, especially in challenging contexts such as rural areas during the pandemic. Additionally, the study conducted by Bora Ly, Romny Ly, and Sunleap Hor (2023) aligns with our findings, indicating the positive behavioral adoption of Zoom classes among Cambodian students, thereby enhancing online learning effectiveness in the country.

6. CONCLUSİON

In conclusion, this study sheds light on crucial facets of e-learning adoption within the academic context, particularly through the Zoom platform. The research findings underscore the significant impact of perceived usefulness on students' technological attitudes, whereas the influence of perceived ease of use appears limited, especially in the context of Zoom Meetings. Self-awareness emerges as a powerful predictor, positively influencing various dimensions such as perceived usefulness, ease of use, subjective norms, behavioral control, and attitudes. Nonetheless, the study acknowledges the absence of a significant link between perceived ease of use and behavioral control or attitudes.

These insights enhance our comprehension of technology acceptance in the realm of e-learning and underscore the intricate interplay of psychological elements in the adoption journey. The practical implications involve optimizing online learning experiences by prioritizing self-awareness, attitudes, and subjective norms. Developers stand to benefit from these findings by fine-tuning e-learning platforms to enhance user engagement. While this study contributes significantly to the existing knowledge, its limitations underscore the necessity for future research with broader participant samples and diverse platforms, in order to comprehensively explore the dynamics of e-learning adoption.

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