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Influence of Technology Availability and Ease of Use on Academic Achievement with Behavioral Control, Usefulness, and Subjective Norm as Mediators

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Abstract*. This study aims to analyze the influence of Technology Availability and Perceived Ease of Use on Academic Achievement with mediating variables of Perceived Behavior, Perceived Usefulness, and Subjective Norm. A qualitative approach with an explanatory design was used in this study. The research population consists of all students at Politeknik Bisnis Indonesia who actively use technology in academic activities, with a sample of 130 respondents selected through a purposive sampling technique. The research results show that Technology Availability has a significant positive effect on Perceived Behavioral Intention (T-Statistic 8.412; P-Value 0.000) and Perceived Usefulness (T-Statistic 3.249; P-Value 0.001). Perceived Ease of Use shows a significant positive effect on Perceived Usefulness (T-Statistic 10.875; P-Value 0.000) and Subjective Norm (T-Statistic 11.476; P-Value 0.000). These results support the Technology Acceptance Model (TAM) theory. Additionally, Perceived Behavioral Intention and Perceived Usefulness each have a significant positive effect on Academic Achievement (T-Statistic 3.382; P-Value 0.001, T-Statistic 2.422; P-Value 0.016). However, Subjective Norms do not have a direct impact on Academic Achievement. (T-Statistik 1,452; P-Value 0,147). These findings highlight the importance of technology availability and perceived ease of use in enhancing students' academic performance by meditating on behavioural intention and perceived benefits. Recommendations are given for improving access and technology training in educational environments to maximize the use of technology in learning.*

Keywords *Technology Availability, Perceived Ease of Use, Academic Achievement*

1. INTRODUCTION

The progress of technology in the classroom has a significant effect on student learning (Yuliana, Nirmala, and Ardiasih 2023). The availability of technology is one of the determining factors in supporting a more efficient and effective learning process and teaching. Students today are expected to optimally use technology to access information, communicate, and complete academic tasks (Kirkwood and Price 2014). However, the utilization of technology in education depends not only on the availability of devices and access but also on how students perceive the Usefulness of the technology and ease of use.

Prior research, as articulated in the Technology Acceptance Model (TAM) by Davis (1989), underscores that the perception of usability and the advantages of technology are critical determinants in technology adoption. In addition, Perceived Behavioral Intention often

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serves as a mediator of users' perceptions of technology and its application in academic contests. Subjective Norms also play a role in shaping students' behavioural intentions, especially when social pressure or support encourages the use of technology. Venkatesh and Davis (2000) expanded the model by incorporating the element of behavioural intention.

Although various studies have discussed the influence of technology availability and perceived ease of use on technology adoption, there is still a gap in the literature addressing how these factors affect overall academic Achievement, especially through mediating variables such as behavioural intention, perceived benefits, and subjective norms (Azzahra and Kusumawati 2023). A deeper understanding of this influence pathway is important for identifying effective steps in maximizing technology use among students (Putro and Takahashi 2024).

Thus, this study examines how technology availability and perceived ease of use affect academic achievement while taking into account the mediating effects of subjective norm, perceived usefulness, and perceived behavioural intention. It is anticipated that the results of this study will aid in the creation of more potent teaching methods that use technology to raise student achievement.

2. LITERATURE REVIEW

A popular paradigm for understanding the elements influencing the acceptance and usage of technology is the Technology Acceptance Model (TAM) theory, which was established by Davis (1989). Perceived usefulness and simplicity of use are the two most important aspects of technology that affect people's intentions to use it, according to TAM (Zubir and Abdul Latip 2024). A person's perception of a technology's usefulness determines how much they think it will improve their performance, while a person's perception of a technology's ease of use indicates how much they think utilizing the technology will be effortless. Venkatesh and Davis (2000) found that these two variables are significant in determining the likelihood of technology adoption in a number of settings, including classrooms.

To the behavior model, Ajzen's (1991) and Rozenkowska (2023) Theory of Planned Behavior incorporates subjective norm and perceived behavioral control. A person's subjective norms are the societal expectations placed on them to act in a certain way. Students' intents to utilize technology in the classroom might be impacted by these subjective standards when it comes to the support and influence they receive from teachers, classmates, and the overall academic atmosphere. Although the effect differs depending on the setting and the sample

population, research by Taylor and Todd (1995) demonstrates that subjective norm significantly affects the desire to utilize technology.

Both TAM and TPB state that one's perceived behavioral intention is a direct predictor of their technology use. The perceived advantages and simplicity of the technology impact a person's behavioral intention, according to research by Venkatesh and Davis (2000). In the classroom, the extent to which technology is integrated into students' learning depends on their behavioral intents to use it. Research by Lin et al. (2020) indicates a favorable relationship between students' intentions to use technology and their academic accomplishment. Specifically, students who have a high intention to use technology tend to have better learning results. The availability of technology plays a significant role on students' ability to access and use it, which is essential for technology-based learning processes (Kirkwood and Price 2014; Gurung and Rutledge 2014).

Several research have talked about how perceptions of usefulness and behavioral intention have a mediating effect. The influence route from independent to dependent variables can be better understood through mediation, according to Hair Jr et al. (2021). According to research by Zhou, Lu, and Wang (2010), the connection between how easy something is to use and how well you do in school is moderated by how valuable you think it is. According to Park (2009), there is ongoing disagreement over the direct impact of subjective norm on academic success. Rather than having an immediate impact on students' grades, subjective standards serve as mediators via their behavioral intentions.

3. METHODS

This study use a quantitative technique and an explanatory design to examine the direct and indirect effects of independent factors on dependent variables. Students from Indonesian Business Polytechnic who make extensive use of technology in their studies made up the research population, and 130 of them were selected using a purposeful sample technique. Research factors such as demographics, availability of technology, perceived utility, perceived ease of use, perceived behavioral intention, subjective norm, and academic accomplishment were measured using a 5-point Likert scale in a structured questionnaire.

The data was analyzed using SmartPLS software in conjunction with PLS-SEM, a method that examines hypotheses via the use of T-Statistics and P-Values, as well as reliability and validity through the use of outer loadings, Cronbach's alpha, and Composite Reliability. In compliance with ethical research norms, participation was entirely voluntary, and participants

were informed of the goals of the study (Hair Jr et al. 2021). The anonymity of their data was also carefully protected.

4. RESULTS

Using the PLS-SEM model using SMART PLS software, 130 respondents, all of whom were students at the Indonesian Business Polytechnic, had their data evaluated. Below, in Table 1, we can see the characteristics of the responders. The characteristics of the respondents are detailed.

Table 1. Respondent Characteristics.

Question	Answer	Number	Percentage
Gender	Male	32	24,61%
	Female	98	75,39%
Age	18 – 23 Years	123	94,61%
	24 – 28 T Years	7	0,53%

Source: Primary Data Processing, 2024

The study's respondents comprise 24.61% male and 75.39% female individuals. According to age demographics, 94.61% of respondents are between 18 and 23 years old, while 0.53% are between 24 to 28 years.

This metric guarantees that all of the concept's indicators adequately explain the construct. Each indicator's validity and reliability are assessed using Outer Loading Testing (Measurement Model).

Table 2 Outer Loading

	Academic Achievement	Perceived Behavioral	Perceived Ease of Use	Perceived Usefulness	Subjective Norm	Technology Availability
AA1	**0.859**					
AA2	**0.878**					
AA3	**0.744**					
AA4	**0.830**					
AA5	**0.823**					
AA6	**0.824**					
PB1		**0.934**				
PB2		**0.934**				
PE1			**0.910**			
PE2			**0.850**			
PE3			**0.856**			
PU1				**0.879**		
PU2				**0.917**		
PU3				**0.906**		

PU4				**0.925**		
PU5				**0.762**		
SN1					**0.933**	
SN2					**0.890**	
SN3					**0.870**	
TA1						**0.621**
TA2						**0.761**
TA3						**0.788**
TA4						**0.713**

Source: Primary Data Processing, 2024

According to Table 2 of the outer loading analysis, Academic Achievement (AA) is deemed acceptable as its loading factor is more than 0.7. With a score over 0.7, Perceived Behavioral Intention (PB) is considered a robust construct measure. A valid and credible number for Perceived Ease of Use (PE) is greater than 0.7. When it comes to measuring the concept, Subjective Norm (SN) is considered excellent as its value is over 0.7.

With the exception of TA1, all values of Technology Availability (TA) should be greater than 0.7. The research model utilized is exploratory research, which means that this outer is preserved as long as the need remains over 0.6, which means it may be used again. Figure 1 shows the outside loading values.

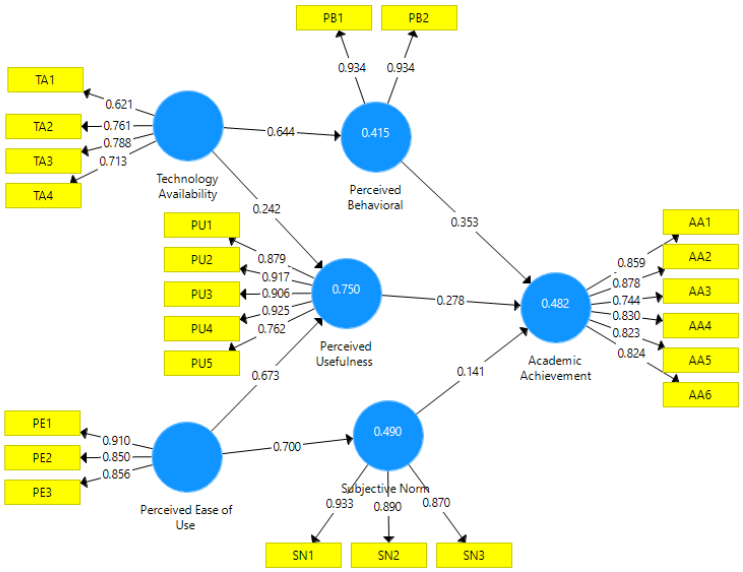

Figure 1. Outer Loading, Source: Primary Data Processing, 2024

The measuring activities of the outer model are presented in Table 3. To test the internal consistency of each construct, composite reliability and Cronbach's Alpha are used.

Table 3. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Academic Achievement	**0.907**	**0.908**	**0.929**	**0.685**
Perceived Behavioral	**0.853**	**0.853**	**0.932**	**0.872**
Perceived Ease of Use	**0.843**	**0.848**	**0.905**	**0.761**
Perceived Usefulness	**0.926**	**0.928**	**0.945**	**0.774**
Subjective Norm	**0.880**	**0.893**	**0.926**	**0.806**
Technology Availability	**0.695**	**0.708**	**0.814**	**0.524**

Source: Primary Data Processing, 2024

Composite Reliability and rho-of Table 3, Even if Cronbach's Alpha is greater than 0.7 and Technology Availability is slightly less than 0.695, the A values demonstrate that this construct maintains sufficient internal consistency. If the AVE score is bigger than 0.5, then these ideas have enough convergent validity. The Fornell-Larcker Criterion or cross loading values are used to measure the outer model and find out if each variable correlates more with its indicator than with other indicators. The results of the measurement approach are shown in Table 4.

Table 4. Discriminant Validity

	Academic Achievement	Perceived Behavioral	Perceived Ease of Use	Perceived Usefulness	Subjective Norm	Technology Availability
Academic Achievement	0.827					
Perceived Behavioral	0.650	0.934				
Perceived Ease of Use	0.662	0.817	0.872			
Perceived Usefulness	0.635	0.751	0.850	0.880		
Subjective Norm	0.543	0.626	0.700	0.650	0.898	
Technology Availability	0.623	0.644	0.731	0.734	0.614	0.724

Source: Primary Data Processing, 2024

Results from the Fornell-Lacker Criterion show that the model is discriminant validity valid (see Table 4). The model's suggestions accurately assess each contract, and there is little

to no overlap between them. To measure the strength of the link between latent variables, we employ bootstrapping to see if the path coefficient is significant when assessed using the t-statistic value (a t-value > 1.96 indicates significance at the 5% level). The results of the route are shown in Table 5 below.

Table 5. Path Coefficients (Mean, STDEV, T-Values, P-Values)

	Original Sample (O)	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**
Technology Availability -> Perceived Behavioral	0.644	0.643	0.077	8.412	**0.000**
Technology Availability -> Perceived Usefulness	0.242	0.244	0.075	3.249	**0.001**
Perceived Ease of Use -> Perceived Usefulness	0.673	0.667	0.062	10.875	**0.000**
Perceived Ease of Use -> Subjective Norm	0.700	0.695	0.061	11.476	**0.000**
Perceived Behavioral -> Academic Achievement	0.353	0.362	0.104	3.382	**0.001**
Perceived Usefulness -> Academic Achievement	0.278	0.271	0.115	2.422	**0.016**
Subjective Norm -> Academic Achievement	0.141	0.140	0.097	1.452	**0.147**

Source: Primary Data Processing, 2024

By considering the Mean, STDEV, T-Values, and P-Values in Table 5, several conclusions can be drawn:

a. The influence of Technology Availability on Perceived behaviour has a T-statistic of 8.4121 with a P-value of 0.000, meaning Technology Availability has a significantly positive relationship with Perceived Behaviour. This indicates that the availability of adequate technology can encourage students' intention to use technology in academic activities.

b. The influence of Technology Availability on Perceived Usefulness has a T-Statistic of 3.249 with a P-Value of 0.001, meaning that Technology Availability has a significant positive impact on Perceived Usefulness, indicating that good access to technology enhances the perception of its benefits.

c. The influence of Perceived Ease of Use on Perceived Usefulness has a T-statistics of 10.875 with a P-value of 0.000, indicating that Perceived Ease of Use exerts a substantial and

statistically significant positive effect on Perceived Usefulness. The results suggest that the research findings corroborate the Technology Acceptance Model (TAM) paradigm.

d. The influence of Perceived Ease of Use on Subjective Norm has a T-statistic of 11.476 with a P-value of 0.000, indicating that Perceived Ease of Use exerts a substantial beneficial effect on Subjective Norm. The user-friendliness of technology will foster a favourable social reaction to its utilisation.
e. The influence of Perceived Behavior Intention on academic Achievement has a T-statistics of 3.382 with a P-value of 0.001, meaning the value is above the T-statistics of 1.96 and below the P-value of < 0.5. This indicates that perceived behaviour intention has a significant positive influence on academic Achievement.
f. The influence of Perceived Usefulness on Academic Achievement has a T-statistic of 2.422 with a P-value of 0.016, meaning Perceived Usefulness has a significant positive impact on Academic Achievement.
g. The influence of Subjective Norm on Academic Achievement has a T-Statistic of 1.452 with a P-Value of 0.147, meaning Subjective Norm does not have a significant impact on Academic Achievement. This means that subjective norms might have an indirect influence if mediated through variables such as behavioural

Table 6 below explains the findings of the analysis of direct and indirect connections that was carried out using output from SmartPLS. The purpose of this analysis was to determine the direct and indirect impacts between the variables in the research model.

Table 6. Specific Indirect Effects (Mean, STDEV, T-Values, P-Values)

	Original Sample (O)	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**
Technology Availability -> Perceived Behavioral -> Academic Achievement	0.227	0.233	0.073	3.099	**0.002**
Technology Availability -> Perceived Usefulness -> Academic Achievement	0.067	0.069	0.039	1.714	**0.087**
Perceived Ease of Use -> Perceived Usefulness -> Academic Achievement	0.187	0.181	0.077	2.425	**0.016**
Perceived Ease of Use -> Subjective Norm -> Academic Achievement	0.099	0.096	0.066	1.483	**0.139**

Source: Primary Data Processing, 2024

From Table 6, it is explained that the Specific Indirect Effects between Technology Availability -> Perceived Behavioral -> Academic Achievement have a T-Statistic of 3.0993 with a P-Value of 0.002, meaning that Technology Availability has a significant indirect effect on Academic Achievement through Perceived Behavioral Intention. The availability of technology encourages the behavioural intention to use technology, which can ultimately enhance academic performance. This research is corroborated by Venkatesh et al. (2003), who assert that the intention to utilise technology mediates the correlation between technology availability and user performance. Technology accessibility significantly influences behavioural intentions and affects academic outcomes.

Technology Availability -> Perceived Usefulness -> Academic Achievement, where it has a T-Statistics of 1.714 with a P-Value of 0.087, meaning the Technology Availability path does not have a significant indirect effect on Academic Achievement through Perceived Usefulness as mediation. Previous research conducted by Teo (2011) indicates that the availability of technology influences perceived Usefulness, but its impact on academic performance may depend on other factors. This allows for the possibility that the availability of technology is not only sufficient to enhance the perception of benefits significantly.

Perceived Ease of Use → Perceived Usefulness → Academic Achievement, which has a T-Statistic of 2.425 with a P-Value of 0.016, means that Perceived Ease of Use has a significant positive indirect effect on Academic Achievement through Perceived Usefulness as a mediating variable. This research is also supported by the Technology Acceptance Model (TAM) theory by Davis (1989), where the perception of ease of use can enhance perceived Usefulness, improving academic performance. The research by Al-Emran et al. (2018) also supports this relationship in the context of educational technology adoption.

Perceived Ease of Use -> Subjective Norm -> Academic Achievement where it has a T-Statistics of 1.483 with a P-Value of 0.139, meaning the path from Perceived Ease of Use does not have a significant indirect effect on Academic Achievement through Subjective Norm as a mediating variable. According to Ajzen's Theory (1991), subjective norms do play a role in shaping behavioural intentions, but they do not always have a significant impact on the outcome of academic performance without behavioural intentions as a mediator (Rozenkowska 2023). This result may indicate that subjective form is not the main factor linking the perception of ease with academic Achievement.

5. DISCUSSION

This study's findings corroborate those of other research that provide credence to TAM and TPB, the Theory of Planned Behavior. Perceived usefulness and simplicity of use are two factors that matter for people's intentions and acceptance of technology, according to Davis(1989) . Further evidence from this study supports the claim made by Venkatesh et al. (2003) that behavioral intention is the primary factor influencing technology usage.

(Gurung and Rutledge (2014) found that students are more likely to utilize technology in the classroom when they have easy access to it, lending credence to the idea that students' views of the advantages and their behavioral intentions are heavily influenced by the availability of sufficient technology. Consistent with Park's (2009) research, this study found that subjective norms had little bearing on academic achievement. This suggests that social norms have a greater impact on behavioral intentions than on educational accomplishments.

6. CONCLUSION

Both the perceived ease of use and the availability of technology have a substantial influence on students' academic progress, according to this study. Access to technology has a positive and substantial effect on students' perceptions of their own behavioral intentions and the utility of that technology, which in turn affects their capacity to do well in school. The idea behind the Technology Acceptance Model (TAM) is that people are more likely to accept new technologies when they have a favorable impression of their utility and how well they fit in with societal norms. One of the factors that influences these impressions is how easy the technology is to use.

In the link between independent factors and academic achievement, this research highlights the relevance of perceived behavioral intention and perceived usefulness as mediators. In order to motivate students to utilize technology, which might lead to improved academic achievement, it is vital to consider their perceived behavioral intention. The Subjective Norm is more effective through a mediation pathway, as it does not significantly impact academic achievement.

It is suggested that educational institutions use practical measures to increase the availability and accessibility of technology and to give training that makes it easy to use. Students will be motivated to make the most of technology throughout their study, which will improve their academic achievement in the long run.

Advice for future studies on how to control for potential confounds in the correlation between perceived ease of use, technology availability, and student performance in the classroom.

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