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Research Article

The Effect of Technology Perception and Learning Engagement on Student Satisfaction in Online Learning

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Abstract: This study aims to analyze the effect of online learning engagement on student satisfaction, with time management as a mediating variable. Using a quantitative approach with a cross-sectional survey design, this study involved 150 students from the UPPBJ UT Makassar Program who were selected using cluster sampling techniques. The variables used in this study included online learning engagement, technology perception, and student satisfaction, which were measured using a 5-point Likert scale. The data were analyzed using Smart PLS version 4.0 software, which included measurement and structural model evaluation to examine convergent, discriminant, and reliability validity. The results showed that online learning engagement did not have a significant effect on student satisfaction, although there was a positive relationship. However, online learning engagement had a significant effect on technology perception, which in turn had a significant effect on student satisfaction. Technology perception played an important role as a mediator in the relationship between online learning engagement and student satisfaction, reinforcing the direct effect. This mediating effect shows that even though online learning engagement does not directly increase satisfaction, perceptions of online learning technology play a crucial role in increasing student satisfaction. This study provides insight into the importance of technology perceptions in online learning.

Keywords: Online Learning; Smart PLS; Student Engagement; Student Satisfaction; Technology Perception.

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1. Introduction

In this increasingly digital era, the use of technology in education has become inevitable. Online learning, as a form of educational innovation, is now the main method applied in various educational institutions. The technology used in online learning, such as Learning Management Systems (LMS), video conferencing, and various other online education platforms, has changed the way students interact with course materials and instructors(Maddison et al. 2017) .

This educational approach utilizes digital technology and the internet to deliver content and facilitate distance learning, making education more accessible and flexible(Khurshid, Shaheen, and Zulfiqar 2024) . Online learning offers flexibility in terms of time and location, while also allowing access to a wide range of educational resources(Romadhon and Fahrurrozi 2021) . However, this process also faces significant challenges, such as the digital divide, where not all students have equal access to technology and stable internet connections(Pratiwi and Parwata 2021) Dewi & Sadjiarto (2021).

However, the acceptance and effectiveness of technology in online learning do not always align with expectations, as students' perceptions of technology and their level of engagement in the learning process can influence their overall learning experience.

The challenges of online learning involve various factors that can affect its effectiveness. According to Bwire et al.(2020) , reliable internet connectivity and electricity supply are essential to ensure the smooth running of the learning process, but their absence, especially in rural areas, can hinder access to materials. In addition, academic integrity is a major issue due to the lack of direct supervision during remote assessments, which can potentially affect academic honesty(Jamjoom et al. 2023) . On the other hand, effective online learning requires students to have good independent learning skills, motivation, and technological proficiency(Wang 2025) . Meanwhile, instructor readiness is also a challenge, as teachers need adequate training in designing and delivering online courses to maximize the learning potential(Bwire et al., 2020)

The acceptance of online learning technology is influenced by factors such as ease of use(Huang, Teo, and Scherer 2022) , reliability, perceived benefits, and additional factors. Ease of use, which is influenced by self-efficacy, enjoyment, and previous experience(Kuo 2018; Sadik 2017) can increase the intention and use of technology. Reliability, which is related to perceived usefulness and accessibility, contributes to increased intention and learning performance(Hanif, Jamal, and Imran 2018) . Perceived benefits, such as improved performance and learning satisfaction through e-learning and m-learning, also have a significant influence on learning satisfaction and performance. Research shows that students who have a positive perception of technology tend to be more satisfied with flexible and online learning(Drennan, Kennedy, and Pisarski 2005) . If students feel that the technology used in online learning is not user-friendly or ineffective, this can hinder them in adapting and optimizing the learning process. On the other hand, a positive perception of technology can increase students' comfort and motivation in participating in online learning. The benefits of technology in the context of education are often measured through improved performance and learning satisfaction as well as engagement in the learning process.

Student engagement in online learning is an important focus in educational research, given that more and more educational institutions are adopting digital platforms for the teaching and learning process. Understanding various indicators of student engagement can help educators improve the effectiveness of online education and improve student learning outcomes.

2. Preliminaries or Related Work or Literature Review

Active participation in online discussions is a very important behavioral indicator of student engagement. This participation reflects students' desire to interact with classmates and learning materials, which has a strong correlation with higher levels of academic engagement(Gledson et al. 2021) . In addition, interaction with instructors plays a significant role in increasing student engagement. Immediate feedback, support, and interaction with instructors are crucial for maintaining motivation and satisfaction in online learning(Jr 2025).

The use of learning management systems (LMS) and interactive features is a factor in student engagement in frequent LMS use, such as accessing learning materials and participating in interactive content, which has been shown to increase participation frequency and academic performance(Ahmadi et al. 2023; Mahmud et al. 2025) . The frequency of online assignment submissions is a direct measure of engagement, with regular and timely submissions being associated with better academic success(Kim, Allen, and Jimerson 2024) .

Learning engagement is a crucial aspect of online learning success. This engagement includes the extent to which students actively participate in various learning activities, whether it is interacting with the material, discussing with classmates, or communicating with lecturers. The higher the level of student engagement in online learning, the more likely they are to feel satisfied with the learning process they are undergoing(Al-Khatib et al. 2024) . Student satisfaction in online learning is a key indicator in assessing the quality of their learning experience(Walia et al. 2025) . This satisfaction is not only influenced by technological factors, but also by other factors, such as teaching quality, technical support, and social interaction that occurs in the online learning environment(Jiang et al. 2021)

Interactions between students and content, students and tutors, and among students greatly influence student satisfaction in online learning(Zhang and Lin 2020) . Good interactions can increase positive perceptions of online learning and student satisfaction(Rahyasih, Wijaya, and Syarifah 2023) . The quality of technology and services provided by online learning platforms also plays an important role in increasing student satisfaction (Walia et al. 2025) . Platforms that provide useful, understandable, interesting, and reliable information will increase user satisfaction(Alhusban et al. 2024) .

This study aims to explore the relationship between two main factors that influence student satisfaction in online learning, namely technology perception and learning engagement. Technology perception in the context of online learning includes how students assess the quality, ease of use, and benefits of the technology used, such as Learning Management Systems (LMS), video conferencing platforms, and other digital learning tools. Positive perceptions of technology can increase students' comfort in using these tools, while negative perceptions can hinder the effectiveness of online learning.

On the other hand, learning engagement reflects how actively students participate in online learning. This engagement is not only related to interaction with teaching materials, but also includes communication with lecturers and fellow students, as well as participation in discussion forums and other activities that support the learning process. High engagement tends to be directly related to an increase in student motivation and quality of understanding of the material being taught, which in turn can affect their level of satisfaction with online learning.

By conducting a research study to analyze indicators involving other variables, this study will provide a comprehensive understanding of the extent to which student engagement in online learning influences student satisfaction. It is hoped that this study will provide useful insights for the development of teaching policies and strategies in online learning. This is very important, considering that online learning will continue to be an integral part of the education system in the future. The research hypothesis is

H1 online learning engagement has a positive effect on technology perception

H2 online learning engagement has a positive effect on student satisfaction.

H3 technology perception has a direct effect on student satisfaction.

H4 technology perception acts as a mediator of online learning engagement on student satisfaction.

3. Materials and Method

In this section, you need to describe the proposed method step by step. Explanations accompanied by equations and flow diagrams as illustrations will make it easier for readers to understand your research.

This study adopts a quantitative approach with a cross-sectional survey design(Kata et al. 2024; Levitt et al. 2018) to assess the impact of online learning on student motivation, with time management as a mediating variable. The research sample was obtained through cluster sampling, which resulted in 150 students from the UPPBJ UT Makassar Program as sample participants.

The variables used in this study were developed by the researchers by adapting existing instruments. Student engagement in online learning was measured with 4 items, technology perception was measured with 3 items, and student satisfaction was measured with 5 items. All variables used reflective measures using a 5-point Likert scale, namely: 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree).

The data was analyzed using Smart PLS version 4.0 software. According to Hair(2014) , the measurement model evaluation analysis was carried out by examining the factor loading values, where values above 0.70 indicate that the indicators can adequately describe the variable construct. Indicators with factor loading values below 0.70 are considered inappropriate for measuring the construct and must be removed from the model. To measure reliability, Cronbach's alpha and composite reliability are used, both of which must be greater than 0.70. Convergent validity is tested using the Average Variance Extracted (AVE) value, which must be greater than 0.50. Discriminant validity is tested using the Heterotrait-Monotrait Ratio (HTMT), which should be below 0.90, which is considered valid in research in the field of education(Hair et al. 2019) . In addition, the Fornell-Larcker criterion was used to test discriminant validity by ensuring that the latent construct had a more dominant explanatory power over its own indicators than over the indicators of other constructs in the model, as well as empirically distinguishing between the constructs(Henseler, Ringle, and Sarstedt 2015) . The PLS algorithm test is conducted to obtain solutions from structural and measurement models by estimating the relationships between latent variables and their indicators, as well as the relationships between latent variables in the model. The results of the algorithm test produce path coefficients that describe the relationships between variables and measure the validity and reliability of constructs. Bootstrapping was used to test the stability and significance of path coefficients by repeatedly resampling the data, producing an estimation distribution used to calculate t-statistics, p-values, and confidence intervals, which

were then used to determine the statistical significance of the relationships between latent variables(Streukens and Leroi-Werelds 2016) .

Structural model evaluation involves testing hypotheses of influence between variables. Hypothesis testing and 95% confidence intervals for path coefficient parameters include direct effects at the structural level. These direct effects are measured using f^2 with values indicating the level of effect, namely: 0.02 (low), 0.15 (moderate), and 0.35 (high)(Hair Jr. et al. 2017) . For the mediation effect, the statistical measure Upsilon V is used, which is calculated by squaring the mediation coefficient according to Lachowicz et al.(2018) , with the interpretation of the mediation effect categorized as low (0.02), moderate (0.075), and high (0.175)(Ogbeibu et al. 2021) .

The overall model evaluation involves R Square analysis interpreted based on the criteria from Chin(Chin 1998) , namely: 0.19 (low effect), 0.33 (moderate effect), and 0.66 (high effect). Additionally, Q^2predict, which must be greater than 0, as stated by Hair, Jr. et al. (2022), is also part of the model evaluation. For the SRMR value, the criterion used is a value below 0.08, and if it is in the range of 0.08-0.10, it is considered an "acceptable fit" according to Schermelleh-Engel et al.,(2003) . The overall model evaluation consists of R Square with criteria(Chin 1998) , namely 0.19 (low effect), 0.33 (moderate effect), and 0.66 (high effect), and Q^2predict above 0(Hair, Jr. et al. 2022) . The SRMR values are below 0.08, according to Schermelleh-Engel et al.,(2003) , who classify SRMR values between 0.08 and 0.10 as "acceptable fit."

4. Results and Discussion

In this section, the author needs to explain the hardware and software used, dataset sources, initial data analysis, results, and results analysis/discussion. Presenting the results with pictures, graphs and tables is highly recommended. Formulas or evaluation measuring tools also need to be included here. There must be discussion/analysis, and you can't just rewrite the results in sentence form, but you need to provide an explanation of their relationship to the initial hypothesis. In addition, this section needs to discuss and elaborate on important findings.

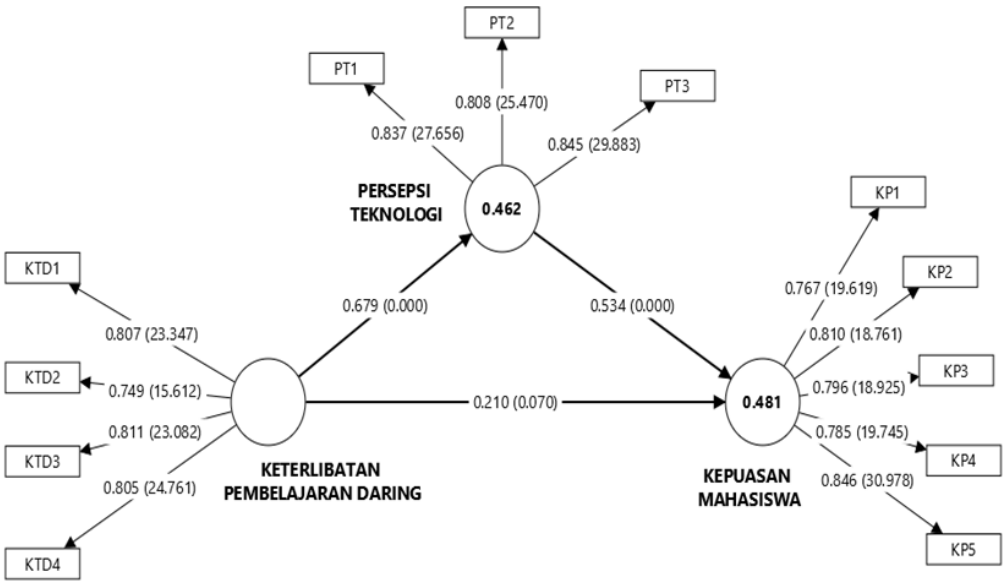

Figure 1. PLS Algorithm and Bootstrapping Test Model.

Table 1. Construct Reliability And Validity.

Variable	Measurement Items	Indicator	Factor Loadings	CA	CR	AVE
Student Engagement in Online Learning	KTD1	Participation in online discussions	0.807	0.804	0.808	0.630
	KTD2	Interaction with instructors	0.749			
	KTD3	Use of online learning features	0.811			
	KTD4	Frequency of submitting online assignments	0.805			
Perception of Technology	PT1	Ease of use of technology	0.837	0.775	0.775	0.690
	PT2	Technology reliability	0.808			
	PT3	Data security and privacy	0.845			
Student satisfaction	KP1	Online learning experience	0.767	0.860	0.861	0.642
	KP2	Access to learning materials	0.810			
	KP3	Interaction with lecturers	0.796			
	KP4	Use of technology	0.785			
	KP5	Online assessment and examinations	0.846			

Table 1 presents data on the reliability and construct validity for the three variables measured: student engagement in online learning, technology perception, and student satisfaction. Student engagement in online learning, four measurement items (KTD1 to KTD4) showed fairly high *factor loadings*, ranging from 0.749 to 0.811, which means that these indicators contribute significantly to the variable. *The Cronbach's Alpha* (CA) value of 0.804 and *Composite Reliability* (CR) of 0.808 indicate that this variable has excellent internal consistency, although the slightly lower *Average Variance Extracted* (AVE) value (0.630) indicates room for improvement in convergent validity.

In the technology perception variable, three measurement items (TP1 to TP3) have *factor loadings* between 0.808 and 0.845, indicating an excellent contribution from each indicator. The CA value for this variable is 0.775, which is slightly lower than the other variables, but still acceptable. The CR value of 0.775 indicates adequate internal consistency, while the AVE value of 0.690 indicates that this variable has fairly high convergent validity, explaining nearly 69% of the variance in the measured indicators.

The student satisfaction variable consists of five measurement items (KP1 to KP5), all of which show good *factor loadings*, ranging from 0.767 to 0.846. The KP5 indicator (Online assessment and exams) has the highest *factor loading*, indicating that this indicator is highly relevant to the student satisfaction variable. With a CA value of 0.860 and a CR of 0.861, this variable shows excellent reliability and internal consistency. In addition, an AVE of 0.642 indicates that 64% of the indicator variance can be explained by this variable, which shows good convergent validity.

The three variables in this study show adequate results in terms of reliability and construct validity. The student satisfaction variable has the strongest results, with the highest reliability and convergent validity values. Although there is a slight variation between the CA, CR, and AVE values among these variables, all variables show good ability in measuring the intended aspects, with relevant indicators and significant contributions to the measured construct.

Table 2. Discriminant Validity Criteria.

Heterotrait-Monotrait (HTMT) Ratio	Student Satisfaction	Online Learning Engagement	Technology Perception
Student Satisfaction			
Online Learning Engagement	0.685		
Perception of Technology	0.827	0.858	
Fornell Larcker Criterion			
Student Satisfaction	0.801		
Online Learning Engagement	0.572	0.793	
Perception of Technology	0.676	0.679	0.830

Table 2 shows the results of discriminant validity testing using two methods: Heterotrait-Monotrait Ratio (HTMT) and Fornell-Larcker Criterion. Based on HTMT, the value between student satisfaction and online learning engagement variables was recorded at 0.685, indicating that the two have a significant but not very high correlation. Similarly, the

relationship between student satisfaction and technology perception has an HTMT value of 0.827, indicating a fairly close relationship but still within acceptable limits. Meanwhile, the HTMT value between online learning engagement and technology perception is 0.858, indicating a fairly strong relationship between the two variables.

The results of the Fornell-Larcker Criterion show a student satisfaction value of 0.801, which is greater than the correlation values between student satisfaction and the other two variables (online learning engagement and technology perception), which have values of 0.572 and 0.676, respectively. This indicates that student satisfaction has a higher level of convergence than the other two variables. The online learning engagement variable, with a Fornell-Larcker value of 0.793, shows lower strength than Technology Perception, which has a value of 0.830. This indicates that technology perception has stronger discriminant validity than online learning engagement, although both still show adequate validity. Overall, this discriminant validity test shows that the three constructs in this study have a significant relationship with each other, each with a good level of validity according to the criteria tested.

Table 3. R-square and Q2 predict values.

Variable	R square	Q2 predict	SRMN
Student satisfaction	0.481	0.305	0.660
Perception of technology	0.462	0.447	

Based on Table 3, it can be explained that student satisfaction has an R square value of 0.481, which means that the model explains approximately 48.1% of the variability in student satisfaction. This shows that the category model is quite good at explaining the factors that influence student satisfaction, but there is still 51.9% of variability that is not explained by the model. The Q2 predict value of 0.305 shows that the model has a fairly good predictive ability in predicting student satisfaction, with this value exceeding zero, which indicates that the model can provide better predictions than models that do not use any information at all. Technology perception has an R square value of 0.462, which shows that 46.2% of the variability in technology perception can be explained by the model. The R square value is moderate, and the model is still able to provide a significant explanation for the measured technology perception. For Q2 predict of 0.447, this value is higher than 0, which indicates that this model has a high predictive ability for technology perception.

Based on the data, both variables have moderate R square values, indicating that the model explains most of the variability, although there are still other factors that remain unexplained. Positive Q2 predict values for both variables indicate that this model has reliable predictive capabilities in both cases, although the prediction for technology perception is slightly stronger than the prediction for student satisfaction.

In the model fit test, the SRMR value is a measure of model accuracy used to evaluate how well the estimated model fits the observed data. A lower SRMR value indicates a better model fit. An SRMR value of 0.066 indicates that the estimated model fits the observed data well because this value is below the threshold of 0.08, which is considered good. Based on this SRMR value, the tested model shows a good fit with the data, indicating that the model can be used for further analysis.

Table 4. Direct and Indirect Effects.

Variable	Path coefficient β	P value	PCI 5%	PCI 95%	Sig Supported	f^2 Upsilon V
Direct effect						
Online Learning Engagement -> Student Satisfaction	0.210	0.070	0.035	0.496	No	0.046
Online Learning Engagement -> Technology Perception	0.679	0.000	0.500	0.825	Yes	0.857
Perception of Technology -> Student Satisfaction	0.534	0.000	0.216	0.740	Yes	0.295
Indirect influence						
Online Learning Engagement -> Technology Perception -> Student Satisfaction	0.636	0.000	0.163	0.492	Yes	0.131

The effect of online learning engagement on student satisfaction shows a path coefficient of 0.210, with a 95% confidence interval between 0.035 and 0.496. The p-value of 0.070, which is greater than 0.05, indicates that the effect is not significant. In addition, the f^2

value of 0.046 indicates a low effect size. Based on these results, the first hypothesis (H(1))is rejected, which means that online learning engagement does not have a significant effect on student satisfaction.

The effect of online learning engagement on technology perception shows a path coefficient of 0.679, indicating a positive effect of online learning engagement on technology perception. With a 95% confidence interval between 0.500 and 0.825. The p-value of 0.000 is less than 0.05, indicating that this effect is significant. The f^2 value of 0.857 indicates that the effect is at a high level. Based on these results, the second hypothesis (H(2))is accepted, meaning that online learning engagement has a significant effect on technology perception.

The effect of technology perception on student satisfaction shows a path coefficient of 0.534, indicating a positive effect between technology perception and student satisfaction. With a 95% confidence interval between 0.216 and 0.740. The p-value of 0.000 is less than 0.05, indicating a significant effect. The f^2 value of 0.295 indicates that this influence has a moderate effect in explaining student satisfaction. Based on these results, the third hypothesis (H(3))is accepted, meaning that technology perception has a significant effect on student satisfaction.

The indirect effect of technology perception acts as a mediator of online learning engagement on student satisfaction. The path coefficient of 0.636 shows the indirect effect of online learning engagement on student satisfaction through technology perception. With a 95% confidence interval between 0.163 and 0.429, the p-value of 0.000 is less than 0.05, indicating that this effect is significant. To calculate the mediation effect size upsilon (v), the f^2 value of 0.131 shows that this indirect effect is high, indicating that technology perception plays an important role as a partial mediator in the relationship between online learning engagement and student satisfaction.

Engagement in online learning during the pandemic shows that its impact on student satisfaction is not always significant. Research conducted shows that online learning does not have a significant effect on improving grades, with an emphasis on the lack of interaction that is characteristic of online learning, which has an impact on student satisfaction(Khosyi'in and Budisusila 2021) .

One important aspect that reinforces the lack of satisfaction is technological barriers and some students' lack of understanding in using online platforms. Research reveals that a lack of understanding of new digital learning media hinders the effectiveness of learning, creating frustration among students(Cahyawati and Gunarto 2021) . In this context, the results of the study show that even though online learning has been implemented, the expected results have not been fully achieved, which affects the level of satisfaction(Ode and Sari 2021) . This shows that simply implementing online learning is not enough to guarantee satisfactory results.

Furthermore, a study by Rahayu et al.(2021) found that the chaos that arose in the implementation of online learning caused students to feel dissatisfied. This suggests that even though there have been efforts to adapt through online learning, challenges related to connectivity and the approaches used remain major obstacles. Teachers who are less trained in using online technology also contribute to lowering student satisfaction levels, as shown in another study that observed the effectiveness of interaction in learning(Maman, Ramdhani, and Nuryadin 2021) .

Considering all these factors, it can be concluded that although online learning has found its way as a temporary solution during the pandemic, this new method of engagement does not necessarily increase student satisfaction. Limited social interaction, technological challenges, and a lack of proper teaching preparation are hindering factors. Therefore, it is important for educational institutions to not only focus on the transition from face-to-face to online learning but also ensure that online learning actively supports students' academic and emotional development in a more significant way(Andriyani et al. 2022) .

Contextual factors such as teaching quality and instructor support greatly influence students' perceptions of satisfaction. Research by Sudrajat et al.(2024) reveals that even though student engagement in online learning is high, their satisfaction does not always increase along with that engagement. This is reinforced by research revealed by Jaya(2024) which emphasizes the importance of the role of instructors and system quality in creating a positive learning experience. If teaching quality and instructional support are low, student engagement will not directly contribute to their satisfaction(Rahman 2023) .

Research by R.i.r et al.,(2022) shows that even though access to technology has increased and most students have devices to access online learning, they still face difficulties in understanding the material presented. This shows that even though students are actively

engaged, challenges in material interaction and learning monitoring can lead to feelings of dissatisfaction. Suboptimal learning interactions and academic support can exacerbate this situation, emphasizing that engagement without sufficient support does not guarantee satisfaction(Ridha et al. 2023) .

Research shows that self-motivation can play a role in student satisfaction(Junaedi and Agung 2022) states that even though there is engagement in online learning, students' personal motivation and how they interact with the material are also very important. If motivation is low, high engagement does not contribute to significant satisfaction. This study shows that there is a need to improve internal factors (motivation) if we want to see a stronger relationship between engagement and satisfaction.

Knowledge about learning outcomes can also be an important factor. The quality of teaching and the ability of lecturers to facilitate interaction are key in determining student satisfaction(Kasmawati and Kuncoro 2021; Rahman 2023) . Without an adequate teaching process, student engagement in online learning cannot have a substantial positive impact on their satisfaction.

Considering these various aspects, it can be concluded that engagement in online learning does not always have a significant effect on student satisfaction. The positive effects of engagement are often hindered by the quality of teaching, instructional support, and student self-motivation. This shows that educational institutions must focus not only on increasing engagement but also on the quality of teaching and academic support to ensure greater student satisfaction.

Student engagement in online learning has significant implications for their perceptions of the technology used in education. In the context of online learning, student engagement can be influenced by various factors, including the ease of use and effectiveness of the technology applied in the teaching and learning process.

Student engagement in online learning can increase positive perceptions of technology. Research shows that the use of interactive learning tools, such as video conference-based platforms and discussion forums, can increase student participation and strengthen their social and technological skills(Fadly et al. 2021; Hermila and Bau 2023; Maulana 2021) . At the same time, the efficient and interactive use of technology during the learning process allows students to feel more involved and enthusiastic, which in turn improves their perception of the efficiency of the technology(Rais 2021; Setia et al. 2024) .

The results of research by Harnawati and Hidayati(2024) reveal that prospective teacher students show a high readiness to integrate artificial intelligence technology into learning, even though their knowledge of this technology is still limited. This shows that direct experience in using technology in an academic context can contribute to an increase in students' understanding and trust in this technology. In addition, the study shows that students' perceptions of the use of different learning media can vary, depending on the interactions that support the use of this technology in learning activities(Cahyaningrum et al. 2024)

Support from lecturers and the availability of technology-based learning materials also have a significant effect on student perceptions. The involvement of lecturers as guides on online platforms has been proven to create a more inclusive and engaging learning atmosphere, thereby indirectly improving students' perceptions of the effectiveness of technology use(Herlina 2021; Satianingsih et al. 2024) . Students who feel supported and have good interaction with lecturers tend to have a more positive view of the technology used in the online learning process(Elok 2022)

The challenges faced by students in using educational technology, such as accessibility and technical issues, can reduce their positive perception of the technology(Anasti, Syafii, and L.N 2022) . Therefore, in order to increase student engagement and perception of technology, it is important for educational institutions to ensure that students have adequate access to technological devices and the necessary support in using these educational tools.

Thus, student engagement in online learning not only enhances their learning experience but also significantly influences their perceptions of educational technology. Active engagement, support from lecturers, and accessibility to technology are important factors that educational institutions must consider in order to improve the quality of online learning.

Students' perceptions of technology play a significant role in determining their satisfaction with online learning. In the context of digitized learning, these perceptions are shaped by various factors, including technological readiness, the effectiveness of the platform used, and the user experience during the learning process.

Technological readiness is one of the crucial aspects that influence student perceptions. Research shows that students who have received good technological training tend to have positive perceptions of online learning. Conversely, the inability to operate technology can cause frustration and reduced learning satisfaction(Kurniati and Kusumawati 2021; Kusumawati 2021) . Technological readiness, which includes optimism and adaptation to information technology, is directly related to students' online learning outcomes, making technological readiness a variable that must be considered in learning design.

User experience when using learning platforms such as Google Classroom or Zoom also plays an important role. Research shows that the use of information technology in education can increase student engagement and facilitate access to materials, which in turn can increase their satisfaction(Jamil 2022) . However, if the platform used is inefficient or not user-friendly, this can lead to a negative learning experience(Sunur and Nasution 2023; Yuliani and Saputri 2021) . Therefore, it is important to choose the right platform and provide training for lecturers and students in its use.

Social interactions that occur during online learning also influence students' perceptions(Hasmawaty et al. 2023) . Research reveals that good interaction between lecturers and students, as well as among fellow students, can improve the overall learning experience ((Rachmawati and Utami 2023) . When students feel connected to their instructors and peers, they are more likely to feel greater satisfaction with the learning process.

The teaching methods used also contribute to students' perceptions. The implementation of blended learning methods that combine online and face-to-face learning is often considered more effective and satisfying for students, as it allows them to have a more diverse learning experience(Permatasari 2023; Rifiyanti and Dewi 2022) . This is also acknowledged by Sudihartinih and colleagues, who state that the use of digital technology in lectures can optimize student learning outcomes(Sudihartinih, Hajizah, and Marzuki 2021)

Perceptions of technology in online learning have a significant influence on student satisfaction. Technological readiness, platform effectiveness, user experience, social interaction, and teaching methods are considered determining factors in building positive student perceptions of online learning. Efforts to improve these variables will contribute to increasing student satisfaction in learning in the digital age.

In the context of online learning, perceptions of technology play an important role as a partial mediator between online learning engagement and student satisfaction. Researchers found that students' positive perceptions of educational technology can increase their engagement in online learning, which in turn can increase student satisfaction with their learning experience in an online environment.

Student engagement in online learning is greatly influenced by how they perceive the use of technology in the learning context. A number of studies show that students' perceptions of the effectiveness of educational technology applications contribute to their enthusiasm and motivation in learning(Kumar et al. 2023; Pan 2022) that elements such as IT infrastructure, educational support, and ease of use of technology have a significant effect on student acceptance of online learning.

Positive perceptions of technology can increase learning engagement through support provided by both the educational environment and social interactions facilitated by the technology itself. For example, research by Amiruddin et al.(2024) notes that students' technological skills and positive attitudes toward the use of learning methods such as HyFlex can lead to increased self-regulation in online learning, which acts as a link between their

engagement and learning experiences. Meanwhile, Tan et al.(2024) highlight that online learning requires the selection of appropriate materials and assignments to increase the effectiveness of the learning process, an aspect that is influenced by students' perceptions of technology.

Student satisfaction with online learning experiences is highly dependent on their perceptions of the technology used. Reflecting on the findings by Oktaria and Rahmayadevi(2021) , students with positive perceptions of online learning platforms such as Google Classroom reported higher levels of satisfaction than students who had more negative perceptions. This reinforces that the perception of technology as a partial mediator not only serves to encourage engagement but also to boost satisfaction levels, which is very important in the context of higher education.

Throughout this process, it is clear that students' perceptions of educational technology play an important mediating role. Active engagement in online learning is built on students' trust and understanding of technology, which in turn increases their satisfaction with the learning experience. With the rise of technology in education, educational institutions need to focus on developing and evaluating students' perceptions of technology implementation in order to achieve a better online learning experience

5. Conclusion

Online learning engagement does not have a significant effect on student satisfaction. Although there is a positive relationship, the effect is not strong enough to be considered significant. However, online learning engagement has a significant effect on technology perceptions, which in turn has a significant effect on student satisfaction. Perceptions of technology play an important role as a mediator in the relationship between online learning engagement and student satisfaction, reinforcing the influence of online learning engagement on student satisfaction. These findings indicate that although online learning engagement does not directly affect student satisfaction, its influence occurs through perceptions of technology as a significant mediator. This study has limitations in that the sample only involved students from one institution, so the results may not be representative of a wider population. The measurement of online learning engagement is subjective, while other variables that affect student satisfaction, such as social support or material quality, are not taken into account. In addition, this study uses a cross-sectional method that does not allow for causal analysis, and focuses on the perception of technology as a mediator without considering other factors in the online learning experience.

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