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The Relationship of Perceived Digital Competence and Attitude, and Learning Agility in Student Engagement

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Abstract: This study explores the relationships between perceived digital competence, attitude towards digital technology, learning agility, and student engagement among 246 junior high school students in Muaro Jambi Regency. Using a quantitative approach and Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis, the research investigates how these variables interact to influence sustainable student engagement in a digitally enriched academic environment. The findings indicate that perceived digital competence significantly influences learning agility (β = 0.70), while its direct impact on student engagement is negligible (β = -0.02). Similarly, attitudes toward digital technology positively predict learning agility (β = 0.70) and moderately affect student engagement (β = 0.34). Learning agility emerges as a critical mediator, significantly contributing to student engagement (β = 0.48). These results emphasize the pivotal role of learning agility in bridging digital competence, attitudes, and engagement in academic contexts. The study underscores the importance of fostering adaptable and motivated learners to enhance engagement and calls for targeted interventions to strengthen students' digital capabilities and attitudes. Future research should consider broader sample diversity and include additional antecedents to refine the model and enhance its generalizability.

Keywords: Attitude; Learning agility; Perceived digital competence; Student engagement

Introduction

In the era of rapid globalization and digitalization, digital technology has changed many aspects of life, including in education (Rachmad et al., 2023). The ability to master digital competencies is becoming increasingly crucial, especially for students who need these skills to participate in online learning and use digital resources effectively (Martzoukou et al., 2020; Sukmawati et al., 2024). In Muaro Jambi Regency, where students' access to technology and digital readiness may still be diverse, it is important to understand how Junior High School (SMP) students perceive their digital competencies as well as their impact on their engagement in learning. *Perceived Digital Competence* includes the extent to which students feel capable of using digital technology, both for learning purposes and daily activities (Sukmawati et al., 2022). Good digital competence can facilitate the learning process, increase students' confidence in using technology, and expand their involvement in digital-based learning activities (Martzoukou et al., 2022). Previous research has found that perceived digital competencies are closely related to learning effectiveness and help students adapt to new technological challenges (Patwardhan et al., 2023).

In addition, students' attitudes towards digital technology play an important role in influencing the extent to which they utilize this technology in learning. A positive attitude towards technology can strengthen a sense of comfort and increase the frequency of

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technology use, thereby creating a more immersive learning experience (Albion et al., 2024). In the context of education, a good attitude towards technology not only encourages students to master digital skills, but also has an effect on their active involvement in online and technology-based learning (Leonardsen et al., 2023). Conversely, a less supportive attitude can hinder adaptation to technology, ultimately limiting student involvement in the learning process (Štemberger et al., 2021).

In addition to digital competencies and attitudes towards technology, *learning agility* is also a significant factor in creating sustainable learning engagement. Learning agility refers to the ability of students to learn from experience and adapt to changing learning situations. In a digital context, learning agility is important because it helps students to quickly adapt to ever-evolving technology tools and platforms, so that they stay engaged in learning (Aygül et al., 2022). Learning agility has been shown to mediate the relationship between digital competence and learning effectiveness, especially in an environment that demands rapid adaptation to new technologies (Yim et al., 2021). Research also shows that learning agility can predict engagement rates and reduce the risk of academic burnout among students (Novianti et al., 2023).

Student engagement is the expected result of a combination of digital competence, a positive attitude towards technology, and learning agility. Students' learning involvement plays an important role in ensuring that they are not only physically but also emotionally and cognitively involved in learning activities (Pedler et al., 2020). In the context of online learning, learning engagement can be increased through the use of relevant technology and the development of a positive attitude towards its use (Chiu, 2022). On the other hand, low learning engagement can negatively impact students' academic outcomes and learning experiences (Dubey et al., 2023).

Against this background, this study aims to explore the relationship between perceived digital competence, attitudes towards digital technology, learning agility, and continuous learning involvement in junior high school students in Muaro Jambi Regency. It is hoped that this research can contribute to the understanding of the factors that support student learning engagement, as well as provide insights for the development of learning strategies in accordance with technological developments in the digital era.

Method

Data Collection and Sample Characteristics

The population that is the focus of this study is junior high school (SMP) students in Muaro Jambi Regency. A self-filled online questionnaire has been prepared to test our research model, and data is collected over a week in September 2024. The design of the online survey is used to collect data. The population sample was selected from several public and private junior high schools in the region. An email explaining the purpose of the study was sent to school staff, asking them to invite enrolled students to voluntarily participate in the study. The participants were recruited through mass sending of emails to all students at the participating schools. Students are asked to click on a link in the email that gives them access to the online questionnaire. Respondents are allowed to stop their participation at any time during the survey filling process.

The data in this study were collected as part of a larger study of the factors that affect student engagement. The average time it takes to fill out a survey is about 15 minutes. Students participate voluntarily, and they receive a certificate of appreciation as a token of gratitude after completing the online survey.

A total of 246 valid surveys were successfully completed, consisting of 116 male students and 130 female students, with a sampling margin of error of 6.24% at a 95% confidence level. The age range of participants ranged from 12 to 15 years, with an average age of 13.5 years and a standard deviation of 1.0.

Measures

For the constructs in this study, we produced a multi-item scale based on previously proven studies. The measurement of student engagement was carried out using a scale developed by Hoeppner et al. (2009). The scale for learning agility was adopted from the research of Schnotz & Wagner (2018). The scale of attitude toward digital technologies is adopted from the guidelines set by the OECD (2015). The scale for perceived digital competence is adapted from Worthington & Levasseur (2015), which has been validated through a research project.

All variables were operationalized using a five-point Likert scale, which ranged from 1 (strongly disagree) to 5 (strongly agree). To ensure the validity of the content and reliability of the construct, all items are adapted from existing studies.

By using this approach, we hope to gain a comprehensive understanding of the relationship between perceived digital competence, attitudes towards digital technology, learning agility, and student engagement among junior high school students in Muaro Jambi Regency.

Table 1. Survey Item

Scale	Adapted From	Item
Perceived digital competence	of Hong and Kim	PD1. I can use the fundamental functions of a presentation program for class presentations.
		PD2. I can use the fundamental functions of word processing programs to create and edit documents for class assignments.
		PD3. I can generate keywords to search information for academic work.
		PD4. I can share my files with classmates using online software.
		PD5. I can share my files with classmates using online software.
Attitude toward digital technologies	OECD	AT1. It is very important to me to study with a digital technology
		AT2. I use a digital technology because I am very interested.
		AT3. I can accomplish work faster with digital technology
		AT4. I think that digital technology skills will be important for learning process
		AT5. Digital technology motivates me to continue learning continuously
Learning Agility	Gravett and Caldwell	LA1. New experiences are learning opportunities for me.
		LA2. I easily retain new information.
		LA3. I'm optimistic that I can learn new information.
		LA4. I enjoy researching new information.
		LA5. I look for ways to use new knowledge.
Student Engagement	Handelsman et al.	SE1. I enjoy researching new information.
		SE2. Applying course material to my life.
		SE3 Finding ways to make the course interesting to me.
		SE4. Thinking about the course between class meetings.
		SE5. Thinking about the course between class meetings.

Statistical Analysis

In this study, we used the Partial Least Squares–Structural Equation Modeling (PLS-SEM) technique for data analysis. PLS-SEM is a structural equation modeling approach that allows statistical analysis and measurement of latent variables using several observed variables (Hair et al., 2011; Sarstedt et al., 2021). In contrast to traditional structural equation modeling that generally relies on maximum estimation of likelihood, PLS-SEM uses a regression-based method, so it is very effective for the development of theories with fewer data assumptions, such as multivariate normality and smaller sample sizes (Henseler et al., 2016). For this analysis, we used SmartPLS 3.0 to assess both the measurement model and the structural model (Ringle et al., 2015).

The validity of the measurement model is determined through an assessment of the validity of discrimination and reliability. Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability. The convergence validity is set when the T-value exceeds 1.96, indicating that each item effectively measures the theoretical construct in question. We evaluated the validity of convergence through average variance extracted (AVE) and standard factor loads. The existence of multicollinearity between constructs is assessed using the variance inflation factor (VIF). The validity of the discrimination is confirmed by ensuring that the square root of the AVE value is greater than the correlation between constructs, suggesting that each measurement item is better described by the construct in question than by the other constructs (Hair, 2016).

For path significance assessment, we applied a bootstrap resampling routine, performing 123 resamples to estimate the precision of the PLS estimate and determine the significance level of the estimate (Hair et al., 2017; Ringle et al., 2015). The significance of each hypothesis is evaluated based on the path coefficient, and the R^2 value indicates the variance described by each path. The significance level of the T-test of 0.05 requires a T-value greater than 1.96, while a significance level of 0.01 requires a T-value greater than 2.58.

Result and Discussion

Overview of the Measurement Model

To test the measurement model, the reliability of the internal consistency is checked. Cronbach's alpha of all factors ranges from 0.75 to 0.86, which surpasses the minimum critical value of 0.70 recommended by Chin and Lohmöller. In addition, the Composite Reliability (CR) of the latent variable is between 0.82 to 0.90, indicating a good level of internal consistency and adequate reliability.

The validity of convergence is also checked through the Average Variance Extracted (AVE) value. All multi-item constructions meet the AVE guideline > 0.50, indicating that more than 50% of the indicator's variance is explained by latent variables. The results show that all latent constructions meet the criteria of convergent validity.

For the validity of discrimination, the square root of the AVE is compared to the value of the inter-construction correlation. All diagonal values (square root AVE) are greater than the inter-construction correlation values, as shown in Table 3. This confirms the validity of the discrimination.

Furthermore, the loading factor results show that all items have a loading value higher than 0.50 without cross-loading items above 0.40, meeting the criteria of convergent validity and discrimination.

Table 2. Construction Analysis Results

Construct	Mean	SD	Ave	Alpha	CR	AT	PD	IA	SE	t-Value
Attitude on Digital Technologi										
AT1	3.98	0.76	0.63	0.86	0.90	0.76				36.60
AT2	3.98	0.85				0.86				27.03
AT3	3.94	0.80				0.78				28.58
AT4	4.05	0.73				0.78				16.79
AT5	3.89	0.84				0.78				23.99
Perceived Digital Competence										
PD1	3.56	0.70	0.58	0.84	0.88		0.75			20.55
PD2	3.70	0.78					0.74			15.65
PD3	4.00	0.69					0.77			21.65
PD4	4.00	0.77					0.74			24.63
PD5	3.70	0.76					0.83			53.95
Learning Agility										
LA1	4.21	0.64	0.61	0.86	0.89			0.66		12.86
LA2	3.84	0.77						0.76		22.47
LA3	3.99	0.71						0.77		27.89
LA4	4.01	0.66						0.82		25.91
LA5	3.96	0.76						0.87		61.24
Student Engagement										
SE1	3.55	0.75	0.48	0.75	0.82				0.64	12.81
SE2	3.44	0.63							0.85	34.02
SE3	3.80	0.70							0.70	18.02
SE4	3.84	0.67							0.77	27.24
SE5	0.93	0.81							0.48	6.54

Table 3. Score Each Survey Item

	PD	AT	LA	SE
AT1	0.453	0.764	0.197	0.433
AT2	0.556	0.858	0.397	0.444
AT3	0.427	0.793	0.395	0.436
AT4	0.576	0.782	0.493	0.478
AT5	0.567	0.784	0.375	0.415
LA1	0.428	0.198	0.657	0.402
LA2	0.535	0.457	0.763	0.498
LA3	0.586	0.352	0.766	0.411
LA4	0.495	0.389	0.820	0.484
LA5	0.703	0.438	0.874	0.620
PD1	0.745	0.518	0.392	0.471
PD2	0.737	0.578	0.362	0.408
PD3	0.771	0.426	0.522	0.421
PD4	0.740	0.418	0.660	0.371
PD5	0.832	0.578	0.712	0.433
SE1	0.365	0.360	0.478	0.636
SE2	0.508	0.418	0.488	0.851
SE3	0.423	0.510	0.382	0.700
SE4	0.359	0.442	0.480	0.765
SE5	0.192	0.133	0.356	0.479

Using this approach, the measurement model successfully demonstrates good internal consistency reliability, adequate convergent validity, and strong discriminatory validity

The results of the analysis showed that perceived digital competence significantly affected learning agility with a path coefficient of 0.70. This confirms that students' perception of their digital competencies contributes directly to their ability to learn agilely. However, perceived digital competence did not have a significant direct influence on student engagement, with a pathway coefficient of -0.02, so this relationship was considered not to support the initial hypothesis.

Furthermore, attitudes towards digital technology have a significant positive influence on learning agility, with a path coefficient of 0.70, and on student engagement, with a path coefficient of 0.34. These findings show that positive attitudes towards digital technology play an important role in improving learning agility and student engagement.

Finally, learning agility was found to significantly affect student engagement, with a path coefficient of 0.48. This confirms that students who have good learning agility are more likely to be actively involved in learning. Overall, these results underscore the importance of perceived digital competence, attitude towards digital technology, and learning agility in supporting student engagement in learning, even though perceived digital competence does not directly affect student engagement.

These findings are relevant to understand how these factors work together to create a more effective and adaptive learning environment for students in the digital age.

Table 4. Hypothesis Analysis Results

Hypothesis	Path	Path Coefficient	Result
H1	Perceived digital competence > Learning Agility	0.70	Supported
H2	Perceived digital competence > Student Engangement	-0.02	Not Supported
H3	Attitude > Learning Agility	0.70	Supported
H4	Attitude > Student Engangement	0.34	Supported
H5	Learning Agility > Student Engangement	0.48	Supported

Discussion

This study aims to explore the influence of Perceived Digital Competence, Attitude on Digital Technology, Learning Agility, and Student Engagement in student learning in high school. The results of the study using Partial Least Squares–Structural Equation Modeling (PLS-SEM) show a significant relationship between these variables, as well as provide new insights into how students' digital competencies and attitudes affect their engagement in technology-based learning.

The results of the study confirmed that Perceived Digital Competence had a significant effect on Learning Agility (β = 0.70). Students' perceived digital competencies support their ability to learn with agility, allowing them to adapt and overcome challenges in a technology-based learning environment. However, this digital competency does not have a significant direct influence on Student Engagement (β = -0.02). This shows that while digital competence is an important foundation, there needs to be other mediators, such as learning agility, to increase student engagement in learning.

Attitude towards Digital Technology was also found to have a significant effect on Learning Agility (β = 0.70) and Student Engagement (β = 0.34). A positive attitude towards technology helps students to better integrate technology in their learning. This attitude is the basis of students' motivation in adopting technology, increasing their involvement in technology-based academic activities.

The role of Learning Agility as a mediator is very important in this research model. Learning agility, which includes the components of potential, motivation, and adaptability, has a direct influence on Student Engagement (β = 0.48). These results show that learning agility helps students to integrate their learning experience with the use of digital technology, which ultimately increases their engagement. These findings are in line with previous literature that states that learning agility plays an important role in improving student learning outcomes in a dynamic learning environment.

Conclusion

This study shows that four main variables – Perceived Digital Competence, Attitude towards Digital Technology, Learning Agility, and Student Engagement – interact with each other in shaping the student learning experience in the digital era. Digital competence and a positive attitude towards technology are important foundations that support the development of learning agility. Learning agility, in turn, is key in increasing student engagement in learning. However, there is still room to understand more deeply how digital competencies and student attitudes can be optimized to improve their engagement. An integrated educational approach is needed, which focuses not only on the development of technical competencies, but also on students' ability to use technology as a tool to solve academic problems. Well-designed digital education can help students to discover, process, and utilize digital technology effectively. This will not only increase their current engagement but also have a positive impact on the quality of their careers and lives in the future. Therefore, educators need to develop strategies that focus on strengthening learning agility as a bridge between digital competence, positive attitudes towards technology, and student involvement in technology-based learning

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Author Contributions
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Conflicts of Interest
In writing this article, we sincerely declare that there are no relevant conflicts of interest that could affect the objectivity and integrity of the results.

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