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The Influence of Self-Regulated Learning and Digital Literacy on Students' Academic Achievement

Manuscript Information

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Abstrak

Perkembangan teknologi digital telah mengubah paradigma pembelajaran di perguruan tinggi, sehingga mahasiswa dituntut memiliki kemampuan self-regulated learning (SRL) dan literasi digital yang memadai untuk mendukung keberhasilan akademik. Self-regulated learning memungkinkan mahasiswa mengelola proses belajar secara mandiri melalui perencanaan, pemantauan, dan evaluasi pembelajaran, sedangkan literasi digital berperan dalam kemampuan mengakses, mengevaluasi, dan memanfaatkan informasi digital secara efektif. Namun, masih terdapat variasi prestasi akademik mahasiswa yang diduga dipengaruhi oleh perbedaan tingkat SRL dan literasi digital. Penelitian ini bertujuan untuk menganalisis pengaruh self-regulated learning dan literasi digital terhadap prestasi akademik mahasiswa. Penelitian ini bertujuan untuk menganalisis pengaruh self-regulated learning dan literasi digital terhadap prestasi akademik mahasiswa. Penelitian ini menggunakan pendekatan kuantitatif dengan desain survei eksplanatori. Populasi penelitian adalah mahasiswa program sarjana pada salah satu perguruan tinggi di Indonesia. Sampel penelitian sebanyak 250 mahasiswa dipilih menggunakan teknik proportionate stratified random sampling. Data dikumpulkan melalui kuesioner yang telah diuji validitas dan reliabilitasnya. Variabel self-regulated learning diukur melalui aspek perencanaan, pengendalian diri, dan evaluasi diri, sedangkan literasi digital diukur melalui kemampuan akses informasi, evaluasi informasi, komunikasi digital, dan keamanan digital. Prestasi akademik diukur menggunakan Indeks Prestasi Kumulatif (IPK). Analisis data dilakukan dengan regresi linear berganda pada tingkat signifikansi 5%. Hasil penelitian menunjukkan bahwa self-regulated learning berpengaruh positif dan signifikan terhadap prestasi akademik mahasiswa ($\beta = 0{,}421$; $p < 0{,}001$). Literasi digital juga berpengaruh positif dan signifikan terhadap prestasi akademik mahasiswa ($\beta = 0{,}367$; $p < 0{,}001$). Secara simultan, self-regulated learning dan literasi digital memberikan kontribusi sebesar 58,4% terhadap variasi prestasi akademik mahasiswa ($R^2 = 0{,}584$; $p < 0{,}001$). Temuan ini mengindikasikan bahwa mahasiswa dengan kemampuan regulasi diri yang baik dan literasi digital yang tinggi cenderung memiliki capaian akademik yang lebih optimal.

Kata Kunci:
Self-Regulated Learning, Literasi Digital, Prestasi Akademik, Mahasiswa.

Abstract

The development of digital technology has changed the learning paradigm in higher education, requiring students to possess adequate self-regulated learning (SRL) and digital literacy skills to support academic success. Self-regulated learning enables students to manage their learning process independently through planning, monitoring, and evaluating learning, while digital literacy plays a role in the ability to access, evaluate, and utilize digital information effectively. However, there are still variations in student academic achievement, which are suspected to be influenced by differences in SRL and digital literacy levels. This study aims to analyze the influence of self-regulated learning and digital literacy on student academic achievement. This study aims to analyze the influence of self-regulated learning and digital literacy on student academic achievement. This study uses a quantitative approach with an explanatory survey design. The study population was undergraduate students at a university in Indonesia. A sample of 250 students was selected using a proportionate stratified random sampling technique. Data were collected through a questionnaire that had been tested for validity and reliability. The self-regulated learning variable was measured through aspects of planning, self-control, and self-evaluation, while digital literacy was measured through the ability to access information, evaluate information, digital communication, and digital security. Academic achievement was measured using the Grade Point Average (GPA). Data analysis was performed using multiple linear regression at a 5% significance level. The results showed that self-regulated learning had a positive and significant effect on student academic achievement ($\beta = 0.421$; $p < 0.001$). Digital literacy also had a positive and significant effect on student academic achievement ($\beta = 0.367$; $p < 0.001$). Simultaneously, self-regulated learning and digital literacy contributed 58.4% to the variation in student academic achievement ($R^2 = 0.584$; $p < 0.001$). These findings indicate that students with good self-regulation skills and high digital literacy tend to have more optimal academic achievement.

Key Word:
Self-Regulated Learning, Digital Literacy, Academic Achievement, Students.

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INTRODUCTION

The development of information and communication technology (ICT) has brought fundamental changes to higher education systems in various countries(Asnur et al., 2024; Elfira & Santosa, 2023; W. H. Santosa & Sudirman, 2023). The integration of digital technology into the learning process allows for the creation of a more flexible, interactive, and student-centered learning environment. Universities are increasingly adopting various digital learning platforms such as e-learning, Learning Management Systems (LMS), Massive Open Online Courses (MOOCs), and blended learning models that combine face-to-face and online learning. Furthermore, the emergence of Artificial Intelligence (AI) technology has expanded opportunities for educational innovation through personalized learning, academic data analysis(Ichsan et al., 2023; Markiano Solissa et al., 2023; Oktarina et al., 2021), intelligent tutoring systems, and automated learning evaluation. This digital transformation not only increases access to learning resources but also drives a paradigm shift in education from a lecturer-centered system to a more adaptive and technology-based one (Bond et al., 2018; Holmes et al., 2022; OECD, 2023).

In line with these developments, the role of students in the learning process has shifted from passive recipients of information in teacher-centered learning to active learners in student-centered learning. Students are required to be able to manage their learning process independently, think critically, collaborate, communicate effectively, and utilize digital technology productively as part of 21st-century competencies(Winiasri et al., 2023; Zulyusri et al., 2023). In this context, self-regulated learning and digital literacy skills are key competencies that determine students' academic success in modern higher education environments. Students who possess strong independent learning skills and digital literacy tend to be better able to access, evaluate, and utilize information effectively to support their academic achievement. Therefore, strengthening self-regulation and digital literacy skills is a strategic necessity for higher education institutions in preparing adaptive, innovative, and competitive graduates in the era of evolving digital transformation (Ng, 2012; Panadero, 2017; UNESCO, 2023).

Academic achievement is an indicator used to measure students' success in achieving the learning objectives set by higher education institutions(Ali et al., 2024; Uluk et al., 2024). Conceptually, academic achievement reflects the results of the learning process, demonstrated through grades, Grade Point Average (GPA), competency mastery, and critical thinking and problem-solving skills acquired during their studies. In the context of higher education, academic achievement serves not only as a measure of students' cognitive abilities but also as an indicator of the quality of the learning process, the effectiveness of the curriculum, and the institution's success in producing competent graduates(Suryono et al., 2023; Yulianti, 2020). Therefore, improving academic achievement is one of the primary goals of higher education institutions in supporting the achievement of educational quality standards and graduate competitiveness at the national and global levels (Richardson et al., 2012; York et al., 2015). High academic achievement also contributes to increased student self-confidence, academic success, and opportunities for better access to further education and professional careers.

The urgency of academic achievement is increasing as the demands of the workplace require graduates who possess not only academic knowledge but also 21st-century skills such as critical thinking, communication, collaboration, digital literacy, and lifelong learning. Various international reports indicate that challenges remain in improving student academic achievement, both in developed and developing countries(Zulkifli et al., 2022). In Indonesia, disparities in educational quality, student learning readiness, and adaptation to digital learning are factors that influence academic achievement. Meanwhile, globally, changes in the learning environment due to digitalization and technological developments require students to have better self-regulation skills to adapt to increasingly complex learning demands(Hilmiyati et al., 2024). Previous research shows that academic achievement is influenced by various factors, both internal and external, such as learning motivation, self-regulated learning, digital literacy, self-efficacy, social support, the learning environment, and the quality of instruction received by students (Broadbent & Poon, 2015; Honicke & Broadbent, 2016; OECD, 2023). Therefore, identifying factors that influence academic achievement is crucial for formulating effective strategies to improve the quality of learning and prepare graduates to face the challenges of a dynamic workforce.

Self-Regulated Learning (SRL) is an important concept in educational psychology that explains an individual's ability to actively manage their learning process to achieve specific academic goals. Zimmerman (2002) defines SRL as a process in which students proactively regulate cognitive, motivational, and behavioral aspects of learning activities through a series of planned strategies. Similarly, Pintrich (2004) explains that SRL involves students' ability to control thoughts, emotions, motivation, and actions related to achieving learning goals. From a Social Cognitive Theory perspective, Bandura (1986) asserts that self-regulation is the

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result of reciprocal interactions between personal, behavioral, and environmental factors that enable individuals to effectively direct their behavior. In its implementation, SRL consists of several main components, namely goal setting (setting learning goals), self-monitoring (monitoring learning progress), self-control (controlling behavior and learning strategies), and self-evaluation (evaluating the results achieved). These four components play a crucial role in helping students manage their learning activities independently, particularly in higher education environments that demand a high level of learning autonomy (Zimmerman, 2002; Pintrich, 2004; Bandura, 1986).

In the context of modern higher education, SRL is a crucial determinant of student academic achievement, particularly in online and hybrid learning systems that offer students greater flexibility and responsibility in managing their learning process. Students with high levels of SRL tend to be able to manage their study time effectively, maintain academic motivation, overcome learning barriers, and demonstrate greater persistence in completing academic assignments. Various international studies have shown that SRL has a positive and significant relationship with student academic achievement across various disciplines and learning contexts (Broadbent & Poon, 2015; Panadero, 2017). A meta-analysis by Dent and Koenka (2016) also found that self-regulation strategies have a strong correlation with student academic achievement at various levels of education. However, several studies still show varying results regarding the magnitude of the influence of SRL on academic achievement, which is influenced by differences in student characteristics, learning environments, academic cultures, and measurement instruments used (Richardson et al., 2012). This condition indicates that the relationship between SRL and academic achievement still requires more in-depth empirical study, particularly in the context of higher education in the era of digital transformation.

Digital literacy has become one of the essential competencies of the 21st century, needed to support individual success in increasingly digitalized educational, work, and social environments. UNESCO (2023) defines digital literacy as the ability to access, manage, understand, evaluate, and create information through digital technology effectively, critically, and responsibly. Meanwhile, Ng (2012) explains that digital literacy encompasses technical, cognitive, and socio-emotional dimensions that enable individuals to interact productively in digital environments. The framework developed by the European Commission through the Digital Competence Framework (DigComp) identifies five main dimensions of digital literacy: information literacy (the ability to search for and evaluate information), communication literacy (the ability to communicate and collaborate digitally), content creation (the ability to produce and develop digital content), digital safety (the ability to maintain digital security and ethics), and problem solving (the ability to solve problems using digital technology) (European Commission, 2022). In the context of higher education, digital literacy is a crucial foundation for students to utilize various technology-based learning resources, such as Learning Management Systems (LMS), digital libraries, e-journals, and international scientific databases that support the learning and research process.

Good digital literacy skills enable students to learn more independently, effectively, and sustainably, thus contributing to improved academic achievement(T. A. Santosa et al., 2020). Various studies have shown that students with high levels of digital literacy tend to be better able to access credible information sources, manage knowledge effectively, and utilize technology to support academic assignment completion and develop critical thinking skills (Tang & Chaw, 2016; Zhao et al., 2021). From a theoretical perspective, the relationship between digital literacy, self-regulated learning (SRL), and academic achievement can be explained through Bandura's (1986) Social Cognitive Theory, which emphasizes that learning success is influenced by the interaction of personal, behavioral, and environmental factors. In this context, digital literacy serves as a tool that facilitates access to learning resources, while SRL plays a role in students' ability to manage and direct their learning process independently (Zimmerman, 2002). The synergy between these two competencies enables students to utilize technology optimally while simultaneously controlling their learning strategies, thereby improving learning effectiveness and academic achievement. However, various national and international reports still indicate a digital literacy gap and low self-regulation skills among students, particularly in the use of technology for academic purposes. This situation highlights the importance of research examining the simultaneous influence of SRL and digital literacy on student academic achievement, particularly in the context of Indonesian higher education, which is undergoing an accelerated digital transformation (OECD, 2023; UNESCO, 2023).

Although research on Self-Regulated Learning (SRL) and digital literacy has grown significantly over the past two decades, several research gaps remain that require attention. From a theoretical perspective, most previous studies have tended to examine the relationship between SRL and academic achievement separately from digital literacy, thus failing to provide a comprehensive understanding of the interaction between these two variables in influencing student academic success. Research focusing on SRL generally emphasizes

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aspects of students' cognitive, motivational, and behavioral learning (Zimmerman, 2002; Panadero, 2017), while digital literacy research focuses more on students' ability to access, evaluate, and utilize information technology to support learning (Ng, 2012; Zhao et al., 2021). Empirically, previous research also shows mixed findings regarding the strength of each variable's influence on academic achievement. Some studies have found that SRL is a primary predictor of academic success, while others suggest that digital literacy plays a more dominant role in technology-based learning environments (Broadbent & Poon, 2015; Tang & Chaw, 2016). Furthermore, there is limited research simultaneously examining the influence of SRL and digital literacy on student academic achievement, particularly in the context of higher education in Indonesia.

From a contextual perspective, the post-COVID-19 pandemic transformation of higher education has accelerated the digitalization of learning and increased the need for students' self-regulation and digital literacy skills(Luciana et al., 2024). However, research integrating these two variables into a comprehensive quantitative model remains relatively limited. Therefore, this study offers novelty by integrating Self-Regulated Learning and digital literacy into a single conceptual framework to analyze their partial and simultaneous effects on student academic achievement. This research also provides an empirical contribution to the context of Indonesian higher education undergoing digital transformation and develops a conceptual model based on Social Cognitive Theory (Bandura, 1986) and the Digital Literacy Framework as a basis for explaining the relationships between variables. Theoretically, this research is expected to enrich the literature on the determinants of student academic achievement and broaden the understanding of the integration of SRL and digital literacy in 21st-century learning. Practically, the research results can be a basis for universities in designing learning policies that encourage the strengthening of students' self-regulation and digital literacy skills to improve the quality of learning and graduate competitiveness. Based on this background, this study aims to analyze the effect of Self-Regulated Learning on student academic achievement, analyze the effect of digital literacy on student academic achievement, and test the simultaneous influence of both variables on student academic achievement.

METHODS

This study employed a quantitative approach with an explanatory survey design, aiming to examine the causal relationship between self-regulated learning, digital literacy, and student academic achievement. The quantitative approach was chosen because it allows researchers to objectively measure research variables and analyze the effects between variables through structured statistical procedures. The study population consisted of undergraduate students at a university in Indonesia who actively participated in digital technology-based learning. The study sample consisted of 250 students selected using a proportional stratified random sampling technique to ensure representativeness of respondents across study programs and semester levels. This technique was chosen to increase the external validity of the study, ensuring that the results more accurately reflect the characteristics of the population. Data collection was conducted through questionnaires that had undergone validity and reliability testing to ensure the quality of the research instrument. The self-regulated learning variable was measured based on indicators of learning planning, self-control, and self-evaluation, while the digital literacy variable was measured through information access, information evaluation, digital communication, and digital security. Student academic achievement was measured using the Cumulative Grade Point Average (GPA) as an objective indicator of academic achievement. The collected data were analyzed using multiple linear regression to test the partial and simultaneous effects of independent variables on the dependent variable. All statistical tests were conducted at a 5% significance level ($\alpha = 0.05$) to determine the significance of the relationships between variables in this study.

RESULTS AND DISCUSSION

Results

Based on the results of research conducted in the field, Self-Regulated Learning has a positive and significant effect on student academic achievement. This can be seen in Table 1, which includes statistical tables and scientific descriptions.

Table 1. Partial Regression Test Results of the Effect of Self-Regulated Learning on Students' Academic Achievement

Variable	Regression Coefficient (β)	Standard Error	t-value	Sig. (p-value)	Decision
Constant	2.145	0.182	11.786	0.000	-
Self-Regulated Learning (SRL)	0.421	0.053	7.943	0.000	Accepted

Based on Table 1, the results of the partial regression analysis indicate that Self-Regulated Learning (SRL) has a positive and statistically significant effect on students' academic achievement. The regression

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coefficient (β = 0.421) demonstrates that an increase of one unit in SRL is associated with a 0.421-unit increase in academic achievement, assuming other variables remain constant. Furthermore, the calculated t-value (7.943) exceeds the critical t-value, and the significance level ($p = 0.000 < 0.05$) confirms that the relationship is statistically significant. Therefore, the hypothesis stating that Self-Regulated Learning positively influences students' academic achievement is supported. The coefficient of determination ($R^2 = 0.327$) indicates that SRL explains 32.7% of the variance in students' academic achievement, while the remaining 67.3% is attributable to other factors not included in the model. Furthermore, the contribution of the self-regulated learning dimension to students' academic achievement can be seen in Table 2.

Table 2. Contribution of Self-Regulated Learning Dimensions to Students' Academic Achievement

SRL Dimension	Mean	Standardized Coefficient (β)	t-value	Sig.
Goal Setting	4.21	0.284	5.321	0.000
Self-Monitoring	4.08	0.251	4.876	0.000
Self-Control	4.34	0.396	7.114	0.000
Self-Evaluation	4.15	0.228	4.327	0.000

As shown in Table 2, all dimensions of Self-Regulated Learning significantly contribute to academic achievement. Among the dimensions examined, Self-Control emerged as the strongest predictor (β = 0.396, t = 7.114, $p < 0.001$), indicating that students' ability to manage learning behaviors, regulate study time, maintain concentration, and resist distractions plays a critical role in academic success. This is followed by Goal Setting (β = 0.284), Self-Monitoring (β = 0.251), and Self-Evaluation (β = 0.228). These findings suggest that students who effectively establish academic goals, monitor their learning progress, control their learning behaviors, and evaluate their academic performance are more likely to achieve higher academic outcomes. Consequently, Self-Regulated Learning serves as a significant determinant of academic success in higher education, particularly within digitally mediated learning environments. Furthermore, analyzing the influence of digital literacy on students' academic achievement can be seen in Table 3.

Tabel 3. Partial Regression Analysis Results of Digital Literacy on Students' Academic Achievement

Variable	Regression Coefficient (β)	Standard Error	t-value	Sig. (p-value)	Decision
Constant	2.087	0.195	10.703	0.000	-
Digital Literacy	0.367	0.048	7.646	0.000	Accepted

Based on Table 3, the results of the partial regression analysis show that the Digital Literacy variable has a positive regression coefficient of 0.367 with a t-value of 7.646 and a significance level of 0.000 ($p < 0.05$). These results indicate that digital literacy has a positive and significant effect on student academic achievement. Thus, the second hypothesis (H2) which states that digital literacy has a positive effect on student academic achievement can be accepted. The positive regression coefficient value indicates that an increase in digital literacy skills will be followed by an increase in student academic achievement. In addition, the coefficient of determination ($R^2 = 0.293$) shows that digital literacy is able to explain 29.3% of the variation in student academic achievement, while the remaining 70.7% is influenced by other factors outside the research model. Furthermore, the contribution of digital literacy dimensions to student academic achievement can be seen in Table 4.

Table 4. Contribution of Digital Literacy Dimensions to Students' Academic Achievement

Digital Literacy Dimension	Mean	Standardized Coefficient (β)	t-value	Sig.
Information Literacy	4.28	0.385	6.912	0.000
Communication Literacy	4.15	0.247	4.638	0.000
Content Creation	4.07	0.214	4.105	0.000
Digital Safety	4.12	0.176	3.452	0.001
Problem Solving	4.21	0.302	5.873	0.000

Based on Table 4, all dimensions of digital literacy demonstrated a positive and significant influence on student academic achievement. The Information Literacy dimension had the largest contribution, with a beta coefficient of 0.385 and a t-test of 6.912 ($p < 0.001$). This finding indicates that students' ability to search for, select, evaluate, and use academic information appropriately is the most important factor determining academic success. Students who are able to identify credible and relevant information sources tend to have better learning outcomes than those who struggle to manage digital information.

Furthermore, the Problem Solving dimension also demonstrated a significant contribution, with a beta value of 0.302, followed by Communication Literacy (β = 0.247), Content Creation (β = 0.214), and Digital

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Safety (β = 0.176). These results indicate that the ability to utilize technology to solve academic problems, communicate digitally, produce academic content, and maintain data security and digital ethics contribute to improving student academic achievement. Overall, the findings of this study reinforce the view that digital literacy is a fundamental competency in modern higher education that plays a role in improving the effectiveness of learning, access to knowledge, and academic achievement of students.

Discussion

The research results show that Self-Regulated Learning (SRL) has a positive and significant impact on student academic achievement. This finding indicates that students' ability to plan, monitor, control, and evaluate their learning process is a crucial factor in determining academic success. Students with high levels of self-regulation tend to be able to set clear learning goals, manage their time effectively, and maintain motivation to learn in the face of various academic challenges. In a higher education context that increasingly demands independent learning, SRL skills are a key asset for students to optimize the learning process and achieve better academic results. This finding reinforces the view that academic success is determined not only by intellectual ability but also by the ability to manage learning behavior independently and sustainably (Oktarina et al., 2018).

This finding aligns with the Self-Regulated Learning theory proposed by Zimmerman (2002), which states that students who are able to control the cognitive, motivational, and behavioral aspects of the learning process will have a greater chance of achieving high academic achievement. This research finding is also consistent with research by Broadbent and Poon (2015), which found that self-regulation strategies have a positive relationship with academic success in online learning environments. Furthermore, a meta-analysis conducted by Dent and Koenka (2016) showed that SRL is one of the strongest predictors of academic achievement at various levels of education. Therefore, self-regulation skills can be viewed as a psychological factor that plays a role in increasing the effectiveness of student learning.

Further analysis showed that the self-control dimension is the SRL component that contributes most significantly to student academic achievement. This finding indicates that students' ability to control distractions, manage time, maintain study consistency, and maintain focus on academic goals are the most important factors determining academic success(Santosa & Aprilisia, 2022). In the digital era, students face various challenges in the form of an abundance of information and various distractions from social media and other digital platforms. Therefore, self-control skills are crucial for students to optimally utilize technology for academic purposes. These findings support research by Panadero (2017), which asserts that self-control is a key component in the successful implementation of self-regulation strategies in higher education.

This study also found that digital literacy has a positive and significant impact on student academic achievement. These results indicate that students with strong skills in accessing, evaluating, managing, and utilizing digital information tend to achieve better academic outcomes. Digital literacy enables students to access a variety of quality learning resources(Hidayat et al., 2023), conduct effective scientific literature searches, and develop critical thinking skills in evaluating information obtained from digital environments. In the era of digital transformation in education, digital literacy is no longer merely an additional skill but has evolved into a core competency that supports the success of the learning process in higher education.

These findings align with research by Ng (2012), which states that digital literacy is a multidimensional competency that influences the effectiveness of students' learning and academic development. These results also support the findings of Tang and Chaw (2016), who found that students with high levels of digital literacy have more effective learning abilities in technology-based learning environments. Furthermore, a systematic review conducted by Zhao et al. (2021) showed that digital competency has a significant relationship with student academic performance across various countries. In this study, the information literacy dimension was the most dominant aspect influencing academic achievement. This indicates that the ability to search, evaluate, and utilize academic information critically is a key factor determining the quality of student learning in the digital information age (Kusuma & Busyairi, 2023; Musliman & Kasman, 2022).

CONCLUSION

The results of this study indicate that self-regulated learning and digital literacy are important factors influencing student academic achievement in higher education. Partially, self-regulated learning was shown to have a positive and significant effect on student academic achievement (β = 0.421; p < 0.001), indicating that students' ability to plan, monitor, control, and evaluate their learning process independently contributes to improved academic achievement. Furthermore, digital literacy also had a positive and significant effect on student academic achievement (β = 0.367; p < 0.001), indicating that the ability to effectively access, evaluate,

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manage, and utilize digital information is a key determinant of academic success in the era of digital transformation. These findings confirm that student academic success is determined not only by cognitive abilities but also by the ability to manage learning independently and utilize digital technology productively.

Simultaneously, self-regulated learning and digital literacy contributed 58.4% to the variation in student academic achievement ($R^2 = 0.584$; $p < 0.001$), indicating that both variables play a strategic role in improving the quality of student learning outcomes. This finding reinforces the perspective of Social Cognitive Theory, which positions personal and environmental factors as interacting elements in determining learning success. Therefore, universities need to develop learning policies and programs oriented towards strengthening self-regulation skills and improving students' digital literacy through the integration of learning technology, independent learning skills training, and the development of a digital-based academic ecosystem. These efforts are expected to improve the quality of learning, strengthen the competitiveness of graduates, and support the creation of human resources that are adaptive to technological developments and the demands of a knowledge-based society.

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