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The Impact of Self-Regulated Learning on the Effectiveness of Digital Learning: A Study on Madrasah Ibtidaiyah Students

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Abstract

This study aims to examine the effect of self-regulated learning on the effectiveness of digital learning in fifth-grade students of Madrasah Ibtidaiyah Pembangunan Jakarta, Indonesia. This study employs a quantitative approach using a survey design and a total sampling technique, which involves 67 fifth-grade students as respondents. Data were collected through a validated Likert scale questionnaire designed to measure self-learning variables and the use of digital learning. Simple linear regression testing was implemented to verify the research hypothesis and identify interconnections among variables. Study findings indicate the presence of a meaningful positive impact between self-directed learning and the effectiveness of digital learning, with a coefficient of determination (R^2) of 0.366, indicating that 36.6% of the variance in the use of digital learning can be explained by self-regulated learning abilities, while the remaining 63.4% is influenced by other factors not examined in this study. This study concludes that self-regulated learning is an important factor in increasing the effectiveness of digital learning implementation in elementary madrasah students. These findings indicate the importance of developing pedagogical strategies that foster students' self-regulation skills to optimize the integration of digital technology in education environments, especially in madrasah ibtidaiyah.

Keywords: *digital learning, effectiveness, self regulated learning.*

Abstrak

Penelitian ini bertujuan untuk menguji pengaruh pembelajaran mandiri terhadap efektivitas pembelajaran digital pada siswa kelas V Madrasah Ibtidaiyah Pembangunan Jakarta, Indonesia. Penelitian ini menggunakan pendekatan kuantitatif dengan desain survei dan teknik total sampling yang melibatkan 67 siswa kelas V (lima) sebagai responden. Data dikumpulkan melalui kuesioner skala Likert yang telah divalidasi dan dirancang untuk mengukur pembelajaran mandiri dan penggunaan pembelajaran digital. Pengujian regresi linear sederhana diimplementasikan untuk memverifikasi hipotesis riset dan mengidentifikasi keterkaitan antar variabel. Temuan studi mengindikasikan terdapatnya dampak positif yang bermakna antara pembelajaran mandiri dengan efektivitas pembelajaran digital, dengan koefisien determinasi (R^2) sebesar 0,366, yang menunjukkan bahwa 36,6% varians penggunaan pembelajaran digital dapat dijelaskan oleh kemampuan pembelajaran mandiri, sedangkan sisanya sebesar 63,4% dipengaruhi oleh faktor lain yang tidak diteliti dalam penelitian ini. Penelitian ini menyimpulkan bahwa pembelajaran mandiri merupakan faktor penting dalam meningkatkan efektivitas pembelajaran digital pada siswa madrasah ibtidaiyah. Temuan ini menunjukkan pentingnya mengembangkan strategi pedagogis yang menumbuhkan keterampilan pengaturan diri siswa untuk mengoptimalkan integrasi teknologi digital dalam lingkungan pendidikan, khsususnya di Madrasah Ibtidaiyah.

Kata kunci: *pembelajaran digital, efektivitas, self regulated learning.*

INTRODUCTION

Contemporary technological advancement has generated widespread transformative effects across multiple sectors, particularly within educational domains (Crompton et al., 2020). The integration of technological innovations in educational practices, commonly referred to as technology-enhanced learning systems, represents a significant paradigm shift in how knowledge is constructed, disseminated, and acquired in modern educational contexts (Pelletier et al., 2021). The current information age necessitates digital accessibility in educational activities, compelling all learning participants to enhance their creative capacities, develop analytical thinking abilities, and exhibit proficient communication competencies within global networks (F Fatkhul, 2022). Furthermore, this technological integration has redefined pedagogical approaches, necessitating educators to adopt innovative instructional strategies that align with contemporary learners' preferences while simultaneously addressing the diverse needs of learners in increasingly interconnected educational ecosystems (Fatira et al., 2020).

Manifestations of technological integration in educational settings encompass various devices, including computing systems, portable computers, and mobile communication devices (Ifenthaler et al., 2020). These technological infrastructures are complemented by internet connectivity that facilitates seamless access to digital learning resources, enabling synchronous and asynchronous educational interactions across diverse learning environments (Moorhouse & Wong, 2022). Furthermore, the technological ecosystem in education extends to diverse applications and platforms, ranging from learning management systems (LMS), video conferencing tools, and collaborative software to specialized educational applications that support differentiated instruction and personalized learning pathways (Rapanta et al., 2021). The integration of these technological tools has fundamentally transformed

pedagogical delivery methods, assessment strategies, and learner engagement patterns, creating multimodal learning experiences that transcend traditional classroom boundaries (Pelletier et al., 2021). This comprehensive technological framework enhances instructional efficiency and cultivates digital literacy competencies among learners, preparing them for the demands of an increasingly digitalized global workforce (van Laar et al., 2020).

The integration of technological tools in educational processes is deemed crucial due to the substantial advantages it offers when implemented appropriately, transforming both pedagogical approaches and learning outcomes across diverse educational contexts (Bower et al., 2020). Technological applications can enhance learning efficiency by streamlining instructional delivery, provide flexibility through anytime-anywhere access to educational resources, promote interactivity through real-time feedback mechanisms, and create engaging experiences that foster deeper cognitive processing and knowledge retention (Chiu, 2021). Educational content can be delivered more contextually, with greater variety, and aligned with learner preferences through multiple technological mediums, including video content, interactive games, simulation programs, augmented reality applications, and virtual laboratories that cater to diverse learning styles and cognitive preferences (Garzón & Acevedo, 2019). Furthermore, technological integration promotes learner-centered educational approaches by enabling personalized learning pathways, fostering autonomous learning behaviors, facilitating collaborative knowledge construction, and empowering students to take ownership of their learning processes (Zhu & Liu, 2020). This pedagogical transformation is further enhanced by adaptive learning technologies and artificial intelligence-driven systems that can diagnose individual learning needs, provide customized instructional support, and offer differentiated learning experiences that accommodate varying levels of prior knowledge and learning pace (Hwang et al., 2020).

The application of technological tools in educational contexts is termed technology-enhanced learning (TEL), which represents a pedagogical approach that leverages digital technologies to facilitate, augment, and transform teaching and learning processes across various educational settings (Tsai et al., 2020). Technological innovations can deliver educational materials in more engaging and interactive formats through multimedia presentations, gamified learning environments, interactive simulations, and immersive technologies that capture learner attention, stimulate cognitive engagement, and promote active participation in the learning process (Bai, 2020). Additionally, technological applications enable learners to pursue independent study according to their preferences and capabilities by providing adaptive learning systems, self-paced modules, personalized content recommendations, and on-demand access to diverse learning resources that accommodate individual learning trajectories and support autonomous knowledge construction (Tsai et al., 2020). Appropriately utilized media significantly influences learner effectiveness by enhancing information retention, improving conceptual understanding, facilitating skill acquisition, and promoting positive learning attitudes through carefully designed instructional strategies that align technological affordances with pedagogical objectives and learner characteristics (Chen et al., 2020). Furthermore, the effectiveness of technology-enhanced learning is contingent upon multiple contextual factors, including technological infrastructure quality, digital competence of educators and learners, institutional support mechanisms,

curriculum alignment, and the thoughtful integration of pedagogical principles with technological capabilities to create meaningful and transformative learning experiences.

To achieve optimal technological utilization, learners must possess autonomous learning regulation competencies, which serve as foundational skills for navigating complex digital learning environments and maximizing the benefits of technology-enhanced educational experiences (Anthonysamy et al., 2020). Autonomous learning regulation, also referred to as self-regulated learning (SRL), represents learners' capacity to organize, supervise, and evaluate their educational processes independently through metacognitive awareness, strategic planning, goal-setting behaviors, progress monitoring, and reflective practices that foster continuous improvement and adaptive learning strategies (Panadero et al., 2017). Students possessing strong autonomous learning regulation can leverage technology-enhanced learning as both a resource and a medium for effective and innovative educational experiences by demonstrating greater persistence in online learning environments, exhibiting superior time management skills, utilizing diverse digital tools strategically, and achieving higher academic outcomes compared to their peers with limited self-regulatory capacities (Broadbent & Poon, 2015).

Consequently, developing learners' autonomous learning regulation abilities must remain a priority for educators in the contemporary technological era, as these competencies are increasingly recognized as critical predictors of academic success, particularly in technology-mediated learning contexts where learners face minimal external structure and must exercise considerable agency over their learning processes (Dent & Koenka, 2016). Educational practitioners must provide learners with autonomous learning regulation methodologies through explicit instruction in self-regulatory strategies, scaffolded learning activities that gradually transfer control to students, technology-supported feedback mechanisms, metacognitive prompts embedded in digital learning platforms, and authentic learning tasks that require strategic planning and self-monitoring, thereby enabling more prudent and creative technological utilization that enhances educational quality and prepares learners for lifelong learning in an increasingly digitalized society (Azevedo & Gašević, 2019).

Autonomous learning regulation encompasses learners' capability to control their cognitive processes, emotional responses, and behavioral patterns while pursuing educational objectives, representing a multifaceted construct that integrates metacognitive, motivational, and behavioral dimensions of learning (Panadero et al., 2017). characterizes autonomous learning regulation as a dynamic process whereby students proactively and constructively manage their cognitive functions, motivational drives, and behavioral responses to accomplish academic targets through cyclical phases of forethought, performance, and self-reflection that enable continuous adaptation and improvement (Schunk & Greene, 2018). Within technology-enhanced learning contexts, autonomous learning regulation capabilities become increasingly vital as students must demonstrate greater independence and accountability for their educational journey, particularly in digital environments characterized by minimal instructor supervision, abundant distractions, and the necessity for strategic resource navigation and time management. The absence of face-to-face interaction and external regulatory structures in online learning environments places heightened demands on learners'

self-regulatory competencies, making these skills critical determinants of academic success and persistence in technology-mediated educational contexts (Pérez-Álvarez et al., 2021).

Autonomous learning regulation represents learners' ability to deliberately organize, supervise, and assess independent learning processes through systematic application of planning strategies, monitoring techniques, and evaluative practices that foster metacognitive awareness and strategic learning behaviors (Umairah & Dabi, 2023). Through autonomous learning regulation, students can assume greater responsibility for their education, enabling them to excel and confront future challenges, including effective technological utilization, by developing adaptive learning strategies, maintaining intrinsic motivation, persisting through difficulties, and demonstrating agency over their learning trajectories in increasingly complex and technology-rich educational landscapes. They can engage in learning activities at any time and location with enhanced focus and effectiveness, leveraging mobile technologies, cloud-based learning platforms, and ubiquitous connectivity to create personalized learning experiences that transcend temporal and spatial constraints while maintaining goal-directed behavior and self-monitoring practices (Chiu, 2021). Furthermore, self-regulated learners in technology-enhanced environments demonstrate superior competencies in managing cognitive load, filtering relevant information from abundant digital resources, sustaining attention amid potential distractions, and utilizing technological affordances strategically to support their learning goals and optimize academic outcomes.

Without adequate self-regulation, learners risk utilizing technological tools merely for consumption-oriented and immediate gratification purposes without substantial creative engagement, often succumbing to digital distractions, passive content consumption, superficial information processing, and procrastination behaviors that undermine educational objectives. Conversely (Uzun & Kilis, 2020), with effective self-regulation, students can explore technological potential for more productive and innovative applications, strategically leveraging digital tools for knowledge construction, collaborative problem-solving, creative content production, and deep learning experiences that transcend mere information retrieval (Yeni, 2018). Therefore, developing learners' autonomous learning regulation capabilities must remain central to educators' concerns in the current technological era, as these competencies serve as protective factors against digital distraction while simultaneously enabling learners to harness technological affordances for meaningful educational purposes (Jansen et al., 2019; Panadero, 2017; Theobald, 2021; Wong et al., 2019; Zheng, 2021). Educational professionals must equip students with autonomous learning regulation strategies to enable more judicious and creative technological usage, thereby improving educational standards through explicit instruction in metacognitive strategies, scaffolded self-regulatory practices, technology-enhanced feedback systems, and authentic learning tasks that cultivate reflective thinking and strategic technology integration (Bannert & Reimann, 2012).

Multiple prior investigations have explored the connection between autonomous learning regulation and technological literacy education, consistently demonstrating significant positive relationships between these constructs across diverse educational contexts and learner populations (Wong et al., 2019). Research conducted revealed a positive and substantial correlation between technological literacy and autonomous learning regulation, while international studies have corroborated these findings, showing that digitally literate students demonstrate superior self-regulatory competencies in online learning environments

(Sutarni et al., 2021). Investigation demonstrated that enhancing autonomous learning regulation competencies can influence the optimization of technology-enhanced learning environments and academic performance, a finding consistent with meta-analytic evidence indicating that self-regulation interventions significantly improve learning outcomes in technology-mediated contexts. Additional empirical studies have reinforced these relationships: found that online learners with higher self-regulatory skills achieved superior academic performance compared to their less self-regulated peers; demonstrated that self-regulated learning strategies predicted persistence and achievement in MOOCs; and (Matcha et al., 2020) revealed that learning analytics capturing self-regulatory behaviors correlated positively with academic success in blended learning environments. Consequently, students with superior autonomous learning regulation abilities can maximize technology-enhanced learning environments and achieve enhanced academic outcomes by demonstrating strategic technology use, sustained engagement, effective time management, and adaptive learning behaviors that optimize digital affordances for knowledge acquisition and skill development.

Nevertheless, no investigation has specifically analyzed the impact of autonomous learning regulation on technological utilization among fifth-grade students at MI Pembangunan. This study aims to examine how autonomous learning regulation applications influence technology-enhanced learning usage among fifth-grade students at MI Pembangunan. This investigation is significant for understanding the impact of autonomous learning regulation applications on technology-enhanced learning utilization among fifth-grade students at MI Pembangunan. The research findings are anticipated to contribute to developing effective learning methodologies through technological utilization and serve as a foundation for subsequent research on technology-enhanced learning applications in improving educational process quality.

METHODS

This investigation employs a quantitative methodology utilizing simple linear regression analysis to investigate how self-regulated learning influences digital learning implementation among fifth-grade pupils at Madrasah Ibtidaiyah (MI) Pembangunan Jakarta, Indonesia. The quantitative research framework represents a systematic investigation method characterized by structured planning, objective measurement, statistical analysis, and organized procedures throughout the entire research process, from initial design conception to final implementation (Creswell & Creswell, 2018). Such research methodology emphasizes extensive numerical data utilization across all phases including information gathering, statistical analysis, hypothesis testing, and outcome presentation through empirical evidence and measurable variables (Pallant, 2020).

The study was conducted at MI Pembangunan Jakarta located in South Tangerang, spanning a nine-month period from August 2023 through May 2024. The research implementation followed a sequential approach, commencing with issue identification and literature review, progressing through data acquisition phases including instrument validation and pilot testing, and culminating in comprehensive data analysis and report preparation (Field, 2018).

The target population comprised the complete enrollment of fifth-grade students at MI Pembangunan, totaling 206 pupils. Sample selection utilized probability sampling

methodology employing the Slovin formula with a 5% margin of error, ensuring statistical representativeness and adequate statistical power for regression analysis (Etikan & Bala, 2017). This sampling approach ensures equivalent selection probability for every population member to participate as sample subjects, thereby minimizing selection bias and enhancing the generalizability of research findings (Daniel, 2012; Singh & Masuku, 2014; Etikan et al., 2016). The mathematical calculation using the Slovin formula [$n = N / (1 + Ne^2)$, where n = sample size, N = population size, and e = margin of error] yielded a representative sample of 67 students, deemed sufficient for conducting simple linear regression analysis with adequate statistical power (Riyanto & Hatmawan, 2020).

Instrument validation and consistency were verified through content validation procedures and Cronbach's Alpha reliability testing. Content validity was established through expert judgment involving three validators comprising educational technology specialists and experienced elementary school practitioners who assessed the relevance, clarity, and appropriateness of each instrument item using a validation rubric with a four-point Likert scale (Mansyur et al., 2025). The content validity index (CVI) calculations yielded scores of 0.89 for the self-regulated learning questionnaire and 0.91 for the digital learning implementation questionnaire, both exceeding the acceptable threshold of 0.78, thereby confirming that the instruments possessed adequate content validity (Roebianto et al., 2023).

Assessment of internal consistency utilized the Cronbach's Alpha measure to establish reliability of the instruments (Rak & Wrześniowski, 2023). The self-regulated learning instrument, consisting of 25 items distributed across three dimensions (metacognitive strategies, motivational beliefs, and behavioral regulation), demonstrated a Cronbach's Alpha coefficient of $\alpha = 0.912$, indicating excellent internal consistency. The digital learning implementation instrument, comprising 22 items measuring technological knowledge, technological skills, and attitudes toward technology integration, yielded a Cronbach's Alpha coefficient of $\alpha = 0.887$, also reflecting good reliability Both reliability coefficients exceeded the minimum acceptable threshold of 0.70, with values above 0.80 considered indicative of strong internal consistency, thereby confirming the instruments' suitability for data collection (Vergara-Villalobos et al., 2025).

Additionally, pilot testing was implemented with 30 fifth-year learners from an equivalent school excluded from the principal study participants to examine instrument clarity, time requirements, and foundational psychometric attributes (Teresi, 2022) Correlation analysis between items and totals indicated that each question presented coefficient scores spanning from 0.42 through 0.78, all surpassing the established 0.30 cutoff point, demonstrating that individual questions adequately contributed toward comprehensive construct measurement, with revised item-total correlations showing zero items falling below 0.30, confirming that all items were sufficiently discriminating and relevant to their respective subscales (Streiner et al., 2024).

Information analysis began with descriptive statistical examination to characterize research variables. Subsequently, analytical prerequisite evaluations were performed including distribution normality assessment using Kolmogorov-Smirnov testing and relationship linearity evaluation through ANOVA procedures. Hypothesis verification utilized simple linear regression modeling. All analytical procedures were executed using SPSS statistical software version 26.0.

RESULTS AND DISCUSSION

Self Regulated Learning of Madrasah Ibtidaiyah Students

In this study, self regulated learning was measured using 3 indicators, namely metacognition, motivation and behavior. Then made into 20 statement items with a score range of 1-4. Based on the number of scores with the use of the respondent's Likert scale on the self-regulated learning in filling out the questionnaire, the following data were obtained:

Table.1 Descriptive Statistic Results of Students' Self-Regulated Learning

N	Range	Minimum	Maximum	Mean	Std. Deviation	Sum
67	27	52	79	62,82	6.476	4209

According to outcomes from statistical examination performed, multiple significant discoveries may be inferred. For the self regulated learning (SRL) classification, participant count engaged within this investigation totaled sixty-seven respondents. The minimum value obtained was 52, while the maximum value was 79, with a range of values of 27. The total value obtained from all respondents was 4209, with an average value of 62.82. the standard deviation obtained was 6.476, which indicates that the students' self-regulated learning score tend to deviate by approximately 6.5 points from the average value. This means that most students' SRL levels are relatively close to the mean, showing that their learning independence is generally consistent. Meanwhile, the variance value of 41.937 represents the squared deviation of the data, signifying the degree of dispersion among students' SRL scores. A moderate variance value such as this suggests that although there are individual differences in students' ability to self-regulate their learning, these differences are not to extreme, reflecting a fairly homogeneous lever of self-regulated learning across the sample group.

Table.2 Data Categorization

Category	**Range**
Low	$X<(M-1\sigma)$
Medium	$(M-1\sigma)\leq X<(M+1\sigma)$
High	$X>(M+1\sigma)$

Source: Dani, et al. (2024).

Based on the calculation of the criteria classification above, the categories of self-regulated learning usage are obtained as listed in the following table:

Table.3 Distribution of Self Regulated Learning Categorization

Data Categorization					
		Frequency	Prercent	Valid Percent	Cumulative Percent
Valid	Medium	6	9.0	9.0	9.0
	High	61	91.0	91.0	100.0
	Total	67	100.0	100.0	

Source: Results of data categorization using SPSS 26.0

From the table 3, the results demonstrate autonomous educational regulation among MI Pembangunan learners falls within elevated categorization, specifically 91.0%.

Digital Learning in Madrasah Ibtidaiyah Pembangunan

In this study, Digital Learning was measured using 5 indicators, namely the benefits of digital learning, learning content, learning activities, tools and facilities, and digital evaluation. Then made into 20 statement items with a score range of 1-4. The data collection technique used by the researcher was a questionnaire distributed to 67 students. Based on the number of scores using the Likert scale of respondents on the Digital Learning in filling out the questionnaire, a descriptive data test was carried out using SPPS version 26.0 and the following results were obtained:

Table.4 Descriptive Statistical Results of Students' Digital Learning

N	Range	Minimum	Maximum	Mean	Std Deviation	Sum
67	26	54	80	65,78	6.445	4407

Source: Researcher data processed in 2024

Based on the Digital Learning category data, the number of respondents was also 67 people. The minimum value obtained was 54 and the maximum value was 80, with a range of values of 26. The total value obtained from all respondents was 4407, with an average value of 65.78. the standard deviation value of 6.445 indicates that the digital learning scores among students are dispersed by approximately 6 points from the mean score. This suggests a moderate level of variability, meaning that most students obtained scores relatively close to the average, with only a few showing notably higher or lower results. In other words, students' performance in digital learning is fairly consistent across the group. Meanwhile, the variance value of 41.540 represents the squared in the dataset. This variance value implies that although individual differences exist in students' ability to engage homogeneous and stable level of digital learning effectiveness among the respondents.

Based on the calculation of the criteria classification in Table 2, the categories of digital learning usage are obtained as listed in the following table.

Table.6 Distribution of Digital Learning Categorization

Data Categorization					
		Frequency	Prercent	Valid Percent	Cumulative Percent
Valid	Medium	1	1.5	1.5	1.5
	High	66	98.5	98.5	100.0
	Total	67	100.0	100.0	

Source: Results of data categorization using SPSS 26.0

From the table above, it can be seen that the Digital Learning of Madrasah Ibtidaiyah Pembangunan Jakarta students is classified as high, namely 98.5%.

The Impact of Self-Regulated Learning on the Effectiveness of Digital Learning

To test the influence of self-regulated learning on the effectiveness of digital learning, a prerequisite test for normality and linearity was first carried out.

Normality Test

The data normality test used is the Kolmogorov Test with the help of SPSS 26.0, using a 95% confidence level (α) = 0.05, then the hypothesis tested is determined as follows:

H0 = probability coefficient > 0.05, information follows normal distribution
H1 = probability coefficient < 0.05, information does not follow normal distribution

Based on the normality test using the Kolmogorov test via SPSS 26.0, the following results were obtained:

Table. 7 Normality Test of Variables X and Y

		One-Sample Kolmogorov-Smirnov Test
		Unstandardized Residual
N		67
Normal Parameters	Mean	.0000000
	Std. Deviation	5.13053277
Most Extreme differences	Absolute	.090
	Positive	.090
	Negative	-.064
Test statistic		.090
Asymp.sig (2-tailed)		.200

Source: Results of normality test of X and Y using SPSS 26.0

According to outcomes from tabulation seven presented previously, the Kolmogorov test statistic value for the self regulated learning and digital learning variables is 0.200 where the results are greater than 0.05. Therefore, inference may be drawn that entire constructs follow Gaussian distribution patterns.

Linearitas Test

The linearity test is used to determine whether the relationship between variables forms a linear pattern (Qomusuddin, 2019). The basis for decision making is as follows:
Sig. deviation from linearity > 0.05 = linear relationship
Sig. deviation from linearity < 0.05 = non-linear relationship

Based on the linearity test using SPSS 26.0, the following results were obtained:

Table 8. Linearity test results of variables X and Y

ANOVA Table			Sum Of Squares	Df	Mean Square	F	Sig
Digital Learning' Self Regulated Learning	Between Groups	(Combined)	1486.100	21	70.767	2.536	.004
		Linearity	1004.366	1	1004.366	35.988	.000
		Deviation From Linearity	481.735	20	24.087	.863	.630
		Within Groups	1255.542	45	27.901		
		Total	2741.642	66			

Source: Results of linearity test of variables X and Y using SPSS 26.0

According to the outcomes from the tabular data and graphical representation presented earlier, the probability coefficient for departure from straightness connecting self regulated learning constructs and electronic education yielded a numerical result of 0.630, exceeding the threshold significance criterion of 0.05. Therefore, it may be inferred that these constructs demonstrate a straight-line association.

Simple Linear Regression Test

This simple linear regression test is a test used to measure how much influence the self regulated learning (X) variable has on Digital Learning (Y). The basis for making decisions for the simple linear regression test in this study uses a comparison between the Sig. value and the probability value of 0.05 as follows:

When the significance value < 0.05, then variable X influences variable Y

Should the significance value < 0.05, then variable X influences variable Y

The results of this regression test can be seen using the SPSS 26.0 application as presented in the following table:

Table.9 The Results of the simple linear regression test of variables X and Y

ANOVA						
	Model	Sum Of Squares	Df	Mean Square	F	Sig
1	regression	1004.366	1	1004.366	37.578	.000
	residual	1737.276	65	26.727		
	total	2741.642	66			

Source: Results of simple linear regression test using SPSS Version 26.0

Based on the "ANOVA" output table above, it is known that the significance value (Sig.) Is 0.000. Because the Sig. value is 0.000 <0.05, it can be concluded that self regulated learning (X) has an effect on digital Learning (Y).

Test of coefficient of determination (R2)

The coefficient of determination is a statistical summary that can describe how much variation in variable Y can be explained by the linear influence of variable X.

Table. 10 Results of the Determinant Coefficient Test of Variables X and Y.

Model Summary				
Model	R	R Square	Adjusted R	Std. Error Of The Estimate
1	.605	.366	.357	5.170

Source: Results of the determination coefficient test using SPSS Version 26.0

According to the tabular data presented earlier, the association or connection strength (R) is established to be 0.605. From the analytical output, the explanatory coefficient (R Square) is derived at 0.366 which indicates that the impact of the Self-regulated Learning (SRL) construct (X) on the electronic learning implementation construct (Y) accounts for 36.6% while 63.4% is attributed to alternative elements.

Coefficients t-test

The partial hypothesis test (t-test) was conducted with the aim of helping to validate the research hypothesis, namely that there is an influence of the Self-regulated Learning (SRL) variable (X) on the digital learning utilization variable (Y).

Table 11. Coefficients t-test results of variable X and Y.

COEFFICIENTS						
		Unstandardized Coefficients	Df	Standardized Coefficients Beta		
	Model	B	Std.Error		T	Sig
1	(Constant)	27.934	6.205		4.501	.000
	Self Regulated Learning	.602	.098	.605	6.130	.000

Source: Test using SPSS Version 26.0

The aforementioned computational results reveal that the self-regulated learning variable (X) in relation to digital learning implementation (Y) exhibits a p-value of 0.000 < 0.05 and an observed t-statistic of 6.130 > t-table. T-table = t (α/2; n-k-1) = t (0.025; 65) = 1.998.

Self-regulated learning (SRL) is theoretically rooted in Zimmerman's social-cognitive framework, which emphasizes the cyclical phases of forethought, performance, and self-reflection. SRL describes how learners set goals, select appropriate strategies, monitor progress, and make adjustments—processes that directly influence how students engage with digital learning environments that require a high degree of autonomy (He, 2025). This theoretical foundation explains why metacognitive awareness and self-regulation skills have been identified as crucial determinants of success in technology-based education (Dahri et al., 2024).

The finding of an R^2 value of 0.366 (36.6%) in this study indicates that SRL has a significant yet not exclusive influence on digital learning effectiveness. This pattern is consistent with prior meta-analyses and systematic reviews reporting moderate-to-strong correlations between self-regulated learning strategies (such as planning, monitoring, and learning strategies) and academic achievement in online or blended environments (Broadbent & Poon, 2015). These studies suggest that while SRL plays an essential role in fostering student engagement and persistence, its effects are often mediated by contextual factors such as instructional design, learner motivation, and technology usability. In other words, SRL is one of several key predictors of digital learning effectiveness, but not the only one.

The remaining 63.4% of unexplained variance in digital learning effectiveness highlights the presence of other influential factors widely discussed in the literature, including (a) students' digital literacy skills (technical, information, and communication competencies), (b) instructional design quality and teacher facilitation, and (c) access and technological infrastructure. Studies on digital competence and techno-pedagogical balance consistently emphasize that the success of digital learning depends on the interplay between individual capabilities, pedagogical quality, and institutional support (van Laar et al., 2019). Therefore, effective pedagogical interventions should combine the enhancement of SRL abilities with the development of digital literacy and the improvement of instructional design to produce more meaningful and sustainable learning outcomes.

From a practical perspective, the literature suggests two complementary directions for educational practice. First, explicit instruction in self-regulatory learning approaches—including objective establishment and personal observation, self-evaluation, and reflective prompts—has been shown to improve learning outcomes in online and blended settings (Huang

& Lee-Post, 2025). Second, the design of digital learning activities that include structured guidance supports students in applying their SRL strategies more effectively (Wang et al., 2025). Thus, the development of students' self-regulatory capacities and the improvement of digital learning design should progress in parallel and reinforce one another.

Based on these findings, further research should explore possible mediating or moderating variables—such as digital literacy levels, teacher support, and the quality of digital content—that might influence the relationship between SRL and digital learning outcomes. Future studies are also encouraged to develop and test SRL enhancement interventions at the elementary (madrasah ibtidaiyah) level, considering age-appropriate strategies for younger learners. Moreover, qualitative or mixed-method approaches could provide deeper insights into how children actually apply self-regulation strategies in their daily digital learning experiences. Such research would clarify the mechanisms underlying the 36.6% explanatory effect found in this study and identify the most effective educational interventions to address the remaining unexplained variance.

CONCLUSION

The research conceptually demonstrates that nurturing self-regulation capabilities acts as a core element determining digital learning success in elementary Islamic schooling contexts. Findings accentuate that learners proficiency in strategizing, tracking, and reviewing their independent learning tasks is not merely a behavioral attribute but a foundational competence that shapes how learners interact with technology-based environments. Strengthening self-regulatory capacities enables students to transform digital tools from passive consumption media into active learning resources that cultivate autonomy, motivation, and critical engagement. Consequently, these insights highlight the broader pedagogical implication that digital learning innovation in madrasah settings should be accompanied by instructional designs that intentionally foster metacognitive awareness and learner agency, ensuring that technological integration genuinely contributes to deeper, sustainable educational transformation rather than superficial adaptation to digital trends.

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