

School Digital Learning Management and Students' Self-Regulated Learning: An Exploratory Study in Indonesian Secondary Schools

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ABSTRACT

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Digital Learning Management Quality, Self-Regulated Learning, Secondary Education, Digital Learning

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This study examined the relationship between Digital Learning Management Quality (DLMQ) and Self-Regulated Learning (SRL) among Indonesian senior high school (SMA) and vocational high school (SMK) students and identified the DLMQ dimensions most strongly associated with SRL. An exploratory quantitative correlational study using an ex post facto approach was conducted with 27 students recruited through convenience sampling in East Kalimantan, Indonesia. Data were collected through a questionnaire comprising 16 DLMQ items and 24 SRL items on a five-point Likert scale. We used descriptive statistics, reliability testing, Pearson correlation, Spearman correlation, and simple linear regression for analysis. Students reported high levels of DLMQ ($M = 3.98$) and SRL ($M = 3.89$). DLMQ was strongly and positively associated with SRL ($r = .82$, $R^2 = .67$, $p < .001$), supporting the proposed hypothesis. Instructional/content design showed the strongest dimension-level association with SRL. These findings suggest that schools should prioritize well-organized digital learning materials, consistent instructional guidance, and accessible support. However, the small, non-random sample and cross-sectional design limit generalizability and causal interpretation. Future research should employ larger samples and further validate the measurement instruments.

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INTRODUCTION

Digital transformation has changed how educational institutions plan, deliver, and evaluate teaching and learning. Digital platforms now influence access to knowledge, instructional continuity, student participation, and institutional accountability. However, their educational value depends on more than purchasing technology or introducing online applications. Schools need coordinated policies, adequate infrastructure, capable staff, and leadership that

connects technology with learning objectives (Bisri et al., 2023; Díaz-García et al., 2023; Zulkhairi et al., 2025). This issue matters to society because students' ability to learn independently increasingly affects their educational opportunities and future participation. Therefore, managing digital learning effectively is an institutional responsibility, not merely a technical choice, and deserves systematic investigation in secondary education.

Despite wider digital adoption, institutions may struggle to provide consistent and equitable learning experiences. Weak connectivity, limited technical assistance, unclear responsibilities, uneven teacher capability, and poorly designed digital content can prevent students from using platforms productively. In Islamic education, researchers emphasize that successful transformation requires deliberate management of policy, human resources, and technological infrastructure (Arifin et al., 2024; Nasir, 2026; Sofiah et al., 2026). However, adoption can remain fragmented, relying on individual initiative instead of a structured institutional framework (Latifah et al., 2025; Ripai et al., 2026). When school arrangements are inconsistent, students may receive different guidance and support, potentially undermining their capacity to regulate learning effectively and independently across learning settings.

These challenges are relevant to Indonesian senior high schools (SMA) and vocational high schools (SMK), where digital learning management may vary across institutions. A principal's digital leadership and digital literacy are considered important conditions for effective digital learning (Dasruth et al., 2024; Hanafi et al., 2025). Evidence from an Indonesian vocational high school indicates that principals' digital strategies influence digital resources, teacher development, and stakeholder engagement (Darlina et al., 2026). In practice, students may encounter different levels of platform access, technical support, governance, content quality, and school assistance. These differences raise an empirical question: whether students who perceive stronger digital learning management also report stronger self-regulated learning. This institutional issue warrants attention.

Previous studies have examined how institutional support and digital learning provision relate to students' experiences and outcomes. Perceived institutional support has been associated with online learning satisfaction through self-regulated learning (SRL) as a mediator (Khong et al., 2023). Research has also linked e-learning quality with learning outcomes (Haddadi et al., 2026; Hijazeen et al., 2024; Shraih et al., 2026; Zamani Roodsari, 2024), while work in Islamic education connects e-learners' self-regulation with learning success (Sulistiani et al., 2022). Separately, studies informed by the Technology Acceptance Model identify perceived usefulness and usability as factors shaping platform adoption (Basyah et al., 2025; Sesmiarni et al., 2024; Sulaiman et al., 2023). Overall, these findings establish the topic's institutional relevance.

However, these studies do not fully explain how school management relates to secondary students' SRL. Prior work examines institutional support, e-learning quality, or individual technology acceptance. Research on SRL measurement in secondary education has focused on adapting instruments, including the Online Self-Regulated Learning Questionnaire (K.-L. Lau, 2022) and a self-regulated online learning scale tested with vocational high school students (Ismiyati et al., 2026). Among 640 Indonesian senior high school students, most had moderate SRL (Andrianie et al., 2025). Other studies connect SRL with social support, procrastination, and online participation (Habibi et al., 2022; Sidiyanto & Heng, 2022; K. L. Lau & Jong, 2023). This limits practical guidance for school leaders.

This study advances the discussion by conceptualizing digital learning management quality (DLMQ) as a school-level condition perceived by students, rather than as technology access or platform acceptance. DLMQ comprises four dimensions: infrastructure and technical support, digital governance and school leadership, instructional and content design, and school support services. Student self-regulated learning is examined through six dimensions: goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation. The study's novelty lies in bringing these institutional management dimensions into one analytical framework and examining their relationship with SRL among SMA and SMK students in Indonesia. This approach can clarify which aspects of school management deserve attention when developing supportive digital learning environments.

The study addresses two questions: to what extent is perceived digital learning management quality associated with students' self-regulated learning, and which DLMQ dimensions show the closest relationship with SRL? DLMQ is treated as the explanatory variable, while SRL is the outcome variable. The argument is that coherent management, reliable infrastructure, supportive leadership, well-designed content, and accessible assistance can create conditions that help students plan, organize, monitor, and evaluate learning. Accordingly, the study proposes that higher perceived DLMQ is positively and significantly related to students' SRL (H1). By testing this relationship among SMA and SMK students, the research seeks to provide evidence that can inform school decisions about digital learning management and student support services.

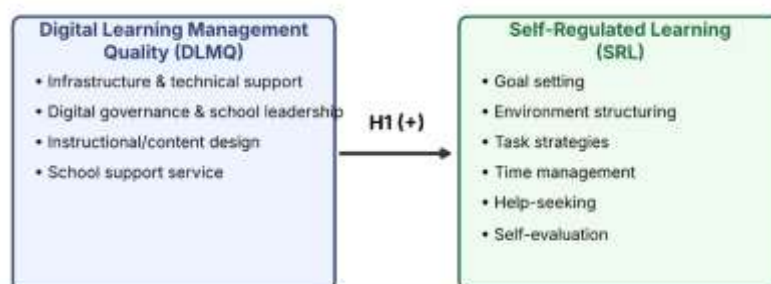


Figure 1. Conceptual framework of the study

METHOD

This study employed an exploratory quantitative correlational design using an ex post facto approach to examine the relationship between students' perceived digital learning management quality (DLMQ) and self-regulated learning (SRL). A quantitative approach was selected because the study aimed to measure students' perceptions numerically and determine the direction and strength of the relationship between the two variables without manipulating learning conditions. The correlational design was appropriate because the research examined naturally occurring differences in students' experiences of digital learning management and their learning regulation. The ex post facto approach allowed the researchers to investigate these existing conditions without introducing experimental treatments. The study was exploratory because of its limited sample size and non-probability sampling technique. Consequently, the findings were intended to provide preliminary empirical evidence rather than establish causal relationships or support generalizations to the wider student population.

The research was conducted in East Kalimantan, Indonesia, covering Samarinda City, Kutai Kartanegara Regency, and Bontang City. These locations were selected to obtain preliminary data from SMA and SMK students experienced in digital learning. Participants were recruited through convenience sampling based on accessibility and willingness to participate. Data collection occurred on 16–17 October 2026. Of the 29 students who completed the questionnaire, two were excluded because they did not use digital learning platforms, leaving 27 valid respondents: 15 female and 12 male students. Most used Google Classroom ($n = 24$), Zoom or Google Meet ($n = 22$), and WhatsApp groups ($n = 21$). Nineteen used platforms several times weekly, six once weekly or less, and two almost daily. School type and grade data were incomplete. Participation was voluntary and anonymous.

Data were collected using Google Forms distributed through participating schools. The questionnaire used simple Indonesian and a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Part A measured digital learning management quality (DLMQ) through 16 items covering infrastructure and technical support, digital governance and school leadership, instructional and content design, and school support services. These indicators drew on digital learning quality, leadership, and institutional support frameworks (Dasruth et al., 2024; Khong et al., 2023; Zulkhairi et al., 2025). Part B measured self-regulated learning (SRL) through 24 items covering goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation. We adapted items from Barnard et al. (2009), informed by previous adaptations (Ismiyati et al., 2026; K.-L. Lau, 2022; Na et al., 2025). Sample indicators appear in Tables 1 and 2.

Table 1. Draft Indicators of the Digital Learning Management Quality Scale

Dimension	Indicator	Sample item
Infrastructure and Technical Support	Reliability and accessibility of digital platforms and school internet	The digital learning platform my school uses can be accessed whenever I need it.
Digital Governance and School Leadership	Clarity of school policies and direction regarding digital learning	My school has clear rules on how digital learning should be carried out.
Instructional and Content Design	Quality and organization of learning materials and tasks	The materials and tasks on the platform are well organized and easy to follow.
School Support Services	Availability of assistance from teachers and school staff	I can easily get help from teachers or staff when I have problems with digital learning.

Table 2. Draft Indicators of the Self-Regulated Learning Scale

Dimension	Sample item
Goal Setting	I set specific goals for what I want to achieve in each online lesson.
Environment Structuring	I choose a study space with few distractions.
Task Strategies	I try to relate the material to what I already know.
Time Management	I set aside specific times to study the materials online.
Help-Seeking	I ask my friends or teachers when I do not understand something.
Self-Evaluation	I reflect on how well I understood the material after each lesson.

Data analysis involved data reduction, display, and verification. Responses were screened, coded from 1 to 5, and examined for missing or inconsistent patterns. Mean scores were calculated for each dimension and scale, using equal-interval categories from very low (1.00–1.80) to very high (4.21–5.00). Descriptive statistics, reliability results, and variable relationships were presented in tables. Instrument quality was assessed using corrected item-total correlations $r \geq .30$ and Cronbach's alpha ($\alpha \geq .70$). Normality was tested using Shapiro–Wilk. H1 was examined using Pearson correlation, Spearman's rho, and simple linear regression at $\alpha = .05$. Bootstrap confidence intervals used 1,000 resamples. Sensitivity analyses excluded uniform-response cases and one contradictory response pattern. Analyses used Python and SciPy. Validity checks included screening, consistency testing, and result verification. No pilot study or formal expert content validation was conducted. Findings remain exploratory because of the small, non-random sample and cannot establish causation or population-wide generalizability.

RESULT AND DISCUSSION

Result

Both scales demonstrated excellent internal consistency (DLMQ and SRL: $\alpha = .95$), although Environment Structuring showed below-threshold reliability ($\alpha = .63$). All corrected item-total correlations exceeded .30. Descriptive results indicated that students perceived both DLMQ ($M = 3.98$, $SD = 0.67$) and SRL ($M = 3.89$, $SD = 0.61$) at high levels. Digital Governance & School Leadership received the highest DLMQ rating ($M = 4.15$), while Infrastructure & Technical Support received the lowest ($M = 3.77$). For SRL, Help-Seeking ($M = 4.11$) and Task Strategies ($M = 4.02$) were the highest-rated dimensions, whereas Time Management received the lowest rating ($M = 3.65$). Figure 2 presents the distribution of responses across dimensions.

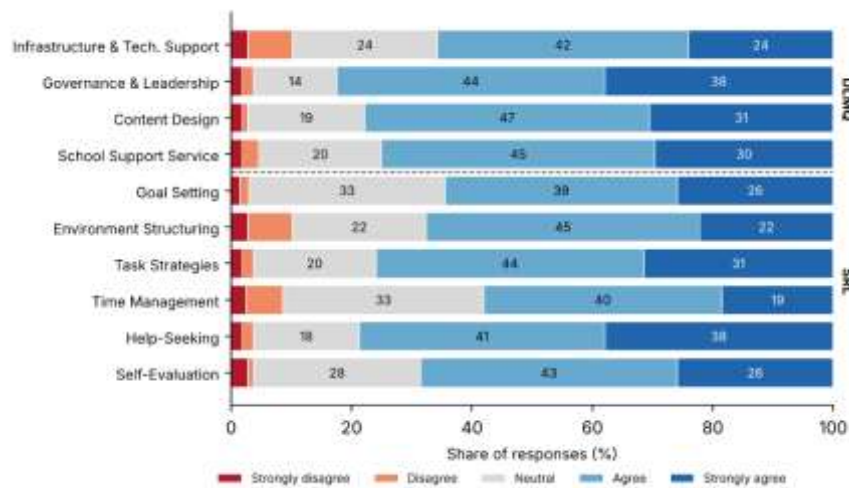


Figure 2. Distribution of student responses by dimension (n = 27)

Table 3. Descriptive statistics, reliability, and correlation with the other variable (n = 27)

Variable / dimension	Items	M	SD	α	r
DLMQ (total)	16	3.98	0.67	.95	.82
Infrastructure & Technical Support	4	3.77	0.82	.86	.69
Digital Governance & School Leadership	4	4.15	0.72	.85	.75
Instructional/Content Design	4	4.04	0.71	.87	.80
School Support Service	4	3.98	0.75	.86	.71
SRL (total)	24	3.89	0.61	.95	.82
Goal Setting	5	3.86	0.68	.84	.72
Environment Structuring	4	3.77	0.60	.63	.69
Task Strategies	4	4.02	0.75	.87	.82
Time Management	3	3.65	0.72	.75	.61
Help-Seeking	4	4.11	0.72	.82	.70
Self-Evaluation	4	3.88	0.79	.89	.69

Note. Items scored 1-5. r = Pearson correlation of each dimension with the total score of the other variable; all $p < .001$.

Relationship between DLMQ and SRL. Shapiro-Wilk tests indicated that the DLMQ ($W = .96$, $p = .34$) and SRL ($W = .98$, $p = .75$) scores did not deviate significantly from normality. DLMQ was strongly and positively correlated with SRL, $r(25) = .82$, $p < .001$, 95% CI [.64, .91] (Spearman's $\rho = .76$, $p < .001$; Figure 3). Simple linear regression showed that DLMQ was a significant predictor of SRL, $F(1, 25) = 51.08$, $p < .001$, $R^2 = .67$ (adjusted $R^2 = .66$), with $b = 0.75$, $SE = 0.10$, 95% CI [0.53, 0.96], $t(25) = 7.15$, $p < .001$, $\beta = .82$. The bootstrapped 95% confidence intervals were consistent (r : [.61, .93]; b : [0.48, 0.97]). Thus, H1 was supported.

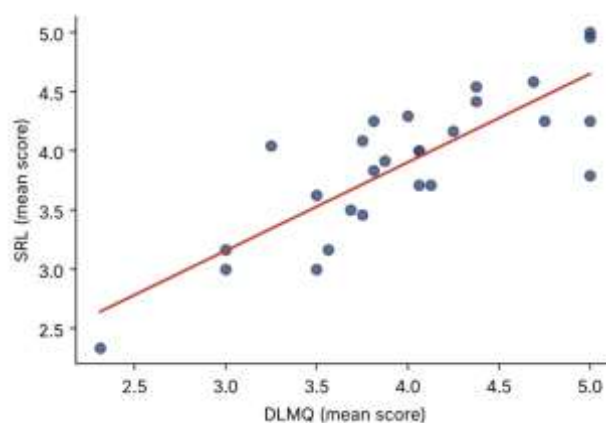


Figure 3. Scatterplot of DLMQ and SRL (n = 27)

As shown in Table 3, every DLMQ dimension correlated positively with total SRL, with Instructional/Content Design showing the strongest association ($r = .80$) and Infrastructure & Technical Support the weakest ($r = .69$). Conversely, every SRL dimension correlated positively with total DLMQ, ranging from $r = .61$ (Time Management) to $r = .82$ (Task Strategies).

Sensitivity analysis. Two respondents gave an identical answer to all 40 items. When they were excluded ($n = 25$), the correlation remained strong and significant, $r(23) = .78$, $p < .001$. When one further respondent with a contradictory pattern (alternating strongly disagree and agree answers across items) was also excluded ($n = 24$), the correlation decreased to $r(22) = .68$, $p < .001$, but remained significant.

Discussion

This study found a strong positive relationship between Digital Learning Management Quality (DLMQ) and Self-Regulated Learning (SRL), with DLMQ explaining approximately two-thirds of the variance in SRL in the present sample. (Mahmudi & Aimah, 2026; Sholihah & Amalia, 2026). This finding is consistent with Khong et al. (2023), who highlighted the relationship between institutional support and self-regulation in online learning, and Sidiyanto and

Heng (2022), who reported an association between social support and SRL among senior high school students. It also supports the view that e-learning quality matters for learning outcomes. (Arifin et al., 2025; Hijazeen et al., 2024). However, the cross-sectional design precludes causal conclusions.

Among the DLMQ dimensions, instructional/content design showed the strongest association with SRL, suggesting that well-structured learning materials and tasks may be particularly relevant to students' self-regulatory practices. Students rated Digital Governance & School Leadership highest and Infrastructure & Technical Support lowest. (Mulyadi et al., 2025; Suratman & Sugiyono, 2025). This pattern is consistent with research emphasizing principals' digital leadership in organizing digital learning (Darlina et al., 2026; Dasruth et al., 2024), although those studies focused on principals' and teachers' perspectives. Similarly, Hanafi et al. (2025) found that ICT facilities did not significantly affect principals' digital literacy, suggesting that organizational and human factors may complement infrastructure.

Students' SRL was classified as high, in contrast to the predominantly moderate SRL reported among 640 senior high school students by Andrianie et al. (2025). This difference may reflect variations in measurement instruments, the small convenience sample of active digital-platform users, or socially desirable responses. Help-Seeking received the highest rating, whereas Time Management and Environment Structuring received lower ratings, indicating potential areas for targeted school support. (Kotowski et al., 2022; Ratanasiripong et al., 2022). However, Environment Structuring demonstrated relatively low reliability ($\alpha = .63$). This concern aligns with Ismiyati et al. (2026), who identified validity concerns in an adapted self-regulated online learning scale among vocational students, and Na et al. (2025), who found cross-cultural differences in the OSLQ factor structure.

Theoretically, these findings provide preliminary support for connecting school-level digital learning management with individual-level self-regulated learning. They suggest that instructional design, school leadership, and organizational support may be relevant contextual factors associated with students' capacity to regulate their learning (Adeoye et al., 2025; Credo & Marwa, 2025). In practice, school principals and teachers could strengthen digital learning policies, provide consistent instructional guidance, organize accessible learning materials, and improve academic and technical support. Targeted support for time management and distraction-free study environments may also be beneficial. Nevertheless, these implications should be interpreted as evidence-informed recommendations rather than proven interventions, because the study establishes associations rather than causal effects (Saleh et al., 2025; Suratman & Sugiyono, 2025).

Several limitations constrain the interpretation and generalizability of these findings. The sample was small ($n = 27$), non-random, and convenience-based, while school type and grade level were recorded for only two respondents, preventing meaningful subgroup comparisons. The nested structure of students within schools was not modeled. Self-reported measures may introduce common-method bias, potentially compounded by uniform responses from two participants and high mean scores. Furthermore, formal expert assessment of DLMQ content validity was not conducted, and separate parental consent was not collected. (Khomairohtusshiyamah et al., 2025; Rozi et al., 2026). Future research should employ larger, randomly selected multi-school samples, longitudinal or multilevel designs, objective learning indicators, and further instrument validation, particularly for Environment Structuring.

CONCLUSION

Students in this sample perceived Digital Learning Management Quality (DLMQ) and Self-Regulated Learning (SRL) at high levels. DLMQ was strongly and positively associated with SRL ($r = .82$, $R^2 = .67$, $p < .001$), supporting H1, with instructional/content design showing the strongest dimension-level association. The key insight is that effective digital learning management may be closely linked to students' capacity to regulate their learning, highlighting the importance of instructional organization alongside technological infrastructure. Scientifically, this study contributes preliminary evidence connecting school-level digital management and individual-level SRL in secondary education. Practically, school leaders and teachers should prioritize well-structured learning materials, consistent guidance, accessible support, and strategies to improve students' time management and study environments. However, the small, non-random convenience sample ($n = 27$), self-reported measures, and cross-sectional design limit generalizability and preclude causal conclusions. Future research should use larger, more diverse multi-school samples; longitudinal or multilevel designs; objective learning indicators; and further instrument validation, particularly for the Environment Structuring dimension.

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