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Phase-Differential Digital Scaffolding: Self-Regulated Learning Among Japanese Language Learners Outside Jawa

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ABSTRACT

Purpose: This study examines how fifth- and sixth-semester Japanese as a Foreign Language (JFL) students at Universitas Negeri Manado (UNIMA), an outer-island public university in North Sulawesi, Indonesia, use digital technologies to support self-regulated learning (SRL). It explores students' technology-use patterns, the SRL dimensions these tools support, and how local contextual factors shape technology-enhanced language learning. **Methods**: Using a qualitative case study design within an interpretive constructivist framework, data were collected over eight weeks from 30 participants through semi-structured interviews, an adapted Motivated Strategies for Learning Questionnaire (MSLQ, α = .87), classroom observation, and document analysis. Data were analyzed using thematic analysis alongside descriptive statistics. **Findings**: Participants showed a moderate overall SRL profile (M = 3.55), with goal-setting as the strongest dimension (M = 3.82) and self-evaluation as the weakest (M = 3.29). Four themes emerged: (1) tool selection driven by cost and peer recommendation, dominated by YouTube (93%), Duolingo (90%), and Anki (80%); (2) uneven digital support across SRL phases, with stronger support for practice than for self-reflection; (3) learning strategies adapted to limited local digital infrastructure; and (4) peer-based self-regulation supported through WhatsApp study groups. **Research Implications**: These findings suggest a need for explicit teaching strategies that build students' self-reflection skills, greater investment in campus digital infrastructure, and formal recognition of peer study groups as part of language learning support. **Originality**: This study introduces the concept of *phase-differential digital scaffolding* uneven technological support across different stages of self-regulated learning and shows how students adapt their strategies within an under-resourced, outer-island setting, extending existing research that has mainly focused on urban, well-resourced contexts. **Limitations**: As a single-site case study with 30 participants, findings may not generalize to other institutions or regions; self-reported data may also be subject to social desirability bias.

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INTRODUCTION

The increasing global demand for Japanese language proficiency reflects the expansion of cultural, economic, and diplomatic relations between Japan and other countries, particularly across Asia. Indonesia occupies a strategic position in this landscape, as it is recognized as one of the largest contributors to Japanese language learners worldwide. This phenomenon indicates that Japanese as a Foreign Language (JFL) has become an important area of language education research, particularly in contexts where learners engage with the language beyond formal classroom settings (Japan Foundation, 2024). The growth of independent and technology-mediated language learning practices further highlights the need to understand how learners regulate their learning processes in increasingly digital educational environments (Thorne, 2014).

The rapid development of digital technology has transformed language learning by providing learners with broad access to mobile applications, online learning platforms, artificial intelligence-based tools, and multimedia resources that extend learning opportunities beyond institutional boundaries (Alam & Mohanty, 2022). These tools create flexible pathways for learners to engage in vocabulary acquisition, grammar practice, listening comprehension, and interactive

communication. However, the availability of technological resources alone does not guarantee effective learning outcomes. Successful digital learning depends largely on learners' ability to manage, monitor, and evaluate their own learning processes through self-regulated learning (SRL), which refers to the active metacognitive, motivational, and behavioral control learners exercise over their academic activities (Zimmerman, 2000). Studies have consistently shown that inadequate self-regulation contributes to lower persistence and higher dropout rates in online and autonomous learning contexts (Xu et al., 2023).

The significance of SRL becomes particularly evident in Japanese language learning due to the distinctive linguistic and orthographic complexity of the language. Indonesian learners must simultaneously acquire three writing systems hiragana, katakana, and kanji while also mastering intricate grammatical structures and culturally embedded honorific systems. These features impose substantial cognitive demands that often exceed those encountered in learning alphabet-based foreign languages (Yamashita, 2023). Consequently, learners are required to adopt deliberate learning strategies and sustained self-regulatory practices to maintain progression, particularly in intermediate and advanced stages where attrition rates are frequently observed (Mori, 2012).

Technology-mediated learning offers a potentially powerful solution to these challenges by enabling learners to personalize study routines and access authentic language input. Digital tools such as spaced-repetition systems, online dictionaries, video platforms, and interactive language exchange applications can scaffold learning processes across planning, performance, and reflection stages (Lai & Gu, 2011), a pattern more recently confirmed in studies linking individual interest and self-regulation to self-directed language learning with technology beyond the classroom (Lai et al., 2011). Yet, the effectiveness of these tools depends not merely on access but on learners' capacity to strategically select and integrate them into coherent self-regulated learning routines (McDaniel & Einstein, 2020). Existing research suggests that structured digital engagement is positively associated with stronger self-monitoring and goal-setting behaviors, whereas passive consumption of digital content often fails to generate meaningful learning gains (Roffarello & Russis, 2023).

In Indonesia, the integration of digital technology into higher education has accelerated significantly in recent years. Nevertheless, this transformation remains unevenly distributed across geographical regions. While institutions located in major urban centers, particularly on Java Island, generally benefit from relatively advanced technological infrastructure, outer-island regions often face limited connectivity, unstable internet access, and restricted access to digital learning resources (Purnomo et al., 2024). Such disparities create contextual constraints that directly influence students' opportunities to engage in technology-enhanced self-regulated learning.

Despite increasing scholarly attention to self-regulated learning and technology-enhanced language education, important gaps remain in the literature. First, most studies conducted in Indonesian higher education focus predominantly on English as a Foreign Language (EFL), leaving JFL learners comparatively underrepresented despite Indonesia's substantial Japanese learner population (Hasnah et al., 2024). Even recent work addressing Indonesian JFL learners has concentrated primarily on quantitative measures of motivational regulation (Yamashita, 2023), leaving the qualitative, technology-mediated dimensions of self-regulated learning largely unexplored in this population. Second, much of the existing technology-enhanced SRL research has been conducted in relatively well-resourced educational environments where stable connectivity is assumed, limiting understanding of how learners regulate their learning in digitally constrained contexts (Reinders & Wattana, 2015). Third, prior research often relies heavily on quantitative measurement instruments that may overlook the situated, adaptive, and socially mediated strategies learners employ in navigating technological limitations (Creswell & Poth, 2018; Braun & Clarke, 2022).

Taken together, these gaps point to a central problem: little is known about how Japanese language learners actually regulate their learning through digital technology when they study in infrastructurally constrained, outer-island settings, where the assumptions of stable connectivity underlying most existing SRL research do not hold. Understanding how learners negotiate technological affordances and infrastructural constraints under these conditions can provide valuable insights into the ways digital learning is shaped by material, institutional, and sociocultural realities (Meilinda et al., 2023; Winne & Hadwin, 2011). Such inquiry is essential for developing contextually responsive pedagogical interventions capable of supporting equitable access to high-quality foreign language education.

Universitas Negeri Manado (UNIMA) was selected as the site for this inquiry because it exemplifies the structural conditions this study seeks to understand: it is a public university located outside Java, in North Sulawesi, where internet connectivity is comparatively unstable and digital infrastructure investment lags behind that of Java-based institutions (Purnomo et al., 2024). At the same time, UNIMA maintains an established Japanese language education program with a sufficient cohort of intermediate-level (fifth- and sixth-semester) learners, making it possible to examine SRL practices at a stage of study where attrition and self-regulatory demands are most pronounced (Mori,

2012). UNIMA therefore offers a theoretically and practically relevant case through which to examine technology-enhanced self-regulated learning under real, rather than assumed, infrastructural constraints conditions that are widely shared across outer-island higher education institutions in Indonesia but remain largely absent from the existing literature.

This study addresses these issues by exploring how fifth- and sixth-semester Japanese language students at Universitas Negeri Manado utilize digital technologies to support self-regulated learning. Grounded in Zimmerman's three-phase SRL framework (Zimmerman, 2000) and interpretive constructivist inquiry (Creswell & Poth, 2018), the study investigates learners' technology choices, self-regulatory strategies, and contextual challenges within an outer-island Indonesian university setting. Specifically, this study seeks to answer the following research questions: (1) What digital technologies do Japanese language students at UNIMA use to support self-regulated learning? (2) What self-regulated learning strategies are enacted through these technologies? and (3) How do contextual factors shape technology-enhanced self-regulated learning practices?.

By addressing these questions, the study aims to contribute theoretically to the growing literature on technology-enhanced language learning by introducing context-sensitive insights into digital self-regulation under conditions of infrastructural limitation. Practically, it seeks to inform Japanese language pedagogy in Indonesia and similar Global South contexts by identifying strategies for strengthening learner autonomy through more equitable and intentional technological integration (Lai & Gu, 2011; Purnomo et al., 2024; Reinders & Wattana, 2015).

METHOD

Research Design

This study employed a mixed-methods case study design to investigate how fifth- and sixth-semester Japanese language students at Universitas Negeri Manado (UNIMA) utilized digital technologies to support self-regulated learning (SRL). This design combines qualitative inquiry with a validated quantitative instrument (the MSLQ) and descriptive statistical analysis, allowing the study to capture both the measurable dimensions of SRL and the situated, experiential meanings learners attach to their technology use. A case study approach is particularly suitable for examining contemporary educational phenomena within real-life contexts where contextual boundaries significantly shape participant experiences and behaviors (Yin, 2018). This design enables a comprehensive exploration of technology-mediated learning practices as they naturally occur within specific institutional settings.

The study was epistemologically grounded in interpretive constructivism, which views learning as a socially constructed process shaped by contextual interactions and individual meaning-making (Creswell & Poth, 2018). Within this perspective, self-regulated learning is understood not as a fixed cognitive attribute, but as a context-dependent, socially situated, and dynamically negotiated process influenced by institutional infrastructure, technological access, and sociocultural conditions. The quantitative MSLQ data were used to map the general SRL profile of the full participant group, while the qualitative strands were used to interpret and contextualize these patterns consistent with an interpretive constructivist stance in which numerical measures are treated as a starting point for deeper meaning-making rather than as standalone conclusions. This framework was particularly appropriate for examining how Japanese language learners at UNIMA construct adaptive self-regulation strategies under outer-island technological constraints. Data collection procedures are detailed through four instruments, summarized in Table 1, alongside clearly defined analysis techniques: a six-phase Reflexive Thematic Analysis assisted by NVivo 14 for the qualitative data, and descriptive statistics computed using SPSS 26 for the MSLQ data, making replication of the study essentially possible.

All 30 participants completed the MSLQ questionnaire, providing the basis for the study's overall SRL profile. From this group, a purposive subsample of 10 participants was selected for naturalistic observation, chosen to represent variation in MSLQ score levels (high, moderate, and low overall SRL) and diversity in reported technology-use patterns, so that observed classroom and self-study behaviors could be interpreted against a range of self-regulatory profiles rather than a single type of learner. A further subsample of 6 participants was selected for member checking, drawn from those who had participated in both the interviews and observation phases and who provided the most information-rich or theoretically significant accounts during initial analysis; this selection followed the principle of information power (Malterud et al., 2016), whereby fewer, more data-rich participants are prioritized over broader but shallower verification.

Research Site and Participants

This study was conducted at the Department of Japanese Language Education, Universitas Negeri Manado (UNIMA), a public university located in Tondano, North Sulawesi, Indonesia. The site was selected due to its contextual relevance

as one of the limited Japanese language teacher education programs outside Java and its location within an outer-island educational setting characterized by constrained digital infrastructure (Purnomo et al., 2024).

Participants consisted of 30 undergraduate students enrolled in the fifth and sixth semesters of the Japanese Language Education program. Purposive sampling was employed to ensure the selection of participants with sufficient academic experience and exposure to independent Japanese language learning practices (Patton, 2015). The inclusion criteria required participants to: (1) be actively enrolled in Semester 5 or 6; (2) have completed foundational Japanese orthography and grammar coursework; and (3) possess prior experience using at least one digital tool for independent Japanese language study. The adequacy of the sample was determined based on theoretical saturation, defined as the point at which no substantially new themes emerged from successive participant responses (Braun & Clarke, 2022). This criterion ensured sufficient depth and richness of qualitative data while maintaining analytical rigor.

Data Collection Instruments and Procedures

Data were collected over an eight-week period using four complementary instruments. This multi-instrument approach was adopted to ensure methodological triangulation and strengthen the credibility of findings through cross-validation of data sources (Denzin, 2018). All research procedures received institutional ethical approval prior to implementation, and written informed consent was obtained from all participants.

Table 1. Data Collection Instruments

Instrument	Purpose	Format	Duration
Semi-structured interviews	Explore SRL strategies and technology use in depth	Individual interviews; audio-recorded in Bahasa Indonesia	45–60 minutes; N = 30
SRL Questionnaire (adapted MSLQ, 30 items)	Measure goal-setting, self-monitoring, and self-evaluation (α = .87)	5-point Likert scale; translated and back-translated	20–25 minutes; N = 30
Naturalistic observation	Document authentic digital learning behaviors	Structured field notes; 10-participant subgroup	3 sessions × 60 minutes
Document analysis	Corroborate self-reported learning practices	Screenshots, study logs, application records	Throughout the 8-week period

Note. MSLQ = Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991).

Semi-structured interviews were piloted with two external participants to improve clarity and relevance. The interview protocol explored three primary areas: (1) digital tools selected and the rationale behind their use; (2) self-regulated learning strategies enacted through technology; and (3) perceived challenges related to digital access and self-regulation in the UNIMA context. The adapted SRL questionnaire was translated into Bahasa Indonesia and back-translated to ensure semantic equivalence and content validity, following established practice in cross-cultural MSLQ adaptation (Wang et al., 2023). Reliability testing produced a Cronbach's alpha coefficient of .87, indicating satisfactory internal consistency (Pintrich et al., 1991).

Naturalistic observations were conducted with a subgroup of ten participants during independent study sessions. These observations documented authentic technology-use behaviors, including note-taking practices, self-testing activities, repeated content engagement, and environmental learning conditions. Document analysis included participant-generated materials such as application screenshots, study logs, and digital learning records. These documents provided supplementary evidence that corroborated interview responses and offered concrete indicators of self-regulatory learning behavior (Bowen, 2009).

Data Analysis

Qualitative data were analyzed using Reflexive Thematic Analysis (RTA), following the six-phase analytical framework proposed (Braun & Clarke, 2006). These phases included data familiarization, initial coding, theme construction, theme review, theme definition, and narrative reporting.

Coding was conducted using NVivo 14 software through a deductive–inductive template analysis approach. An initial coding framework was developed deductively from Zimmerman's three-phase SRL model, comprising forethought, performance, and self-reflection (Zimmerman, 2000). This preliminary framework was subsequently expanded inductively to capture context-specific patterns emerging from participant narratives and observed practices.

Quantitative questionnaire data were analyzed descriptively using SPSS version 26. Statistical procedures included calculation of means, standard deviations, and frequency distributions for each SRL dimension. These descriptive statistics served to map overall self-regulatory tendencies and triangulate qualitative findings (Rickey et

al., 2023). The integration of qualitative thematic interpretation with descriptive quantitative analysis enabled a more comprehensive understanding of technology-mediated self-regulated learning practices within the UNIMA context.

Trustworthiness and Ethical Considerations

Trustworthiness was established through the four criteria of credibility, transferability, dependability, and confirmability Marton & Säljö a framework that continues to serve as the standard basis for rigor in qualitative research (Ahmed, 2024). Credibility was ensured through prolonged engagement over the eight-week data collection period, triangulation across four data collection instruments, and member checking with six participants to verify interpretive accuracy. Transferability was strengthened through detailed contextual descriptions of the research site, participant characteristics, and technological environment, enabling readers to assess the applicability of findings to similar educational contexts (Creswell & Poth, 2018).

Dependability was supported through the maintenance of an audit trail documenting coding decisions, analytical procedures, and thematic development. Peer debriefing with a qualitative language education expert further enhanced analytical consistency. Confirmability was maintained through reflexive journaling throughout the research process, enabling continuous examination of researcher assumptions and interpretive decisions (Braun & Clarke, 2022). Ethical considerations included anonymization of participant identities using coded identifiers (P01–P30), secure storage of all research data on password-protected institutional servers, and explicit communication of participants' unconditional right to withdraw from the study at any stage without consequence. Through this methodological framework, the study aimed to generate contextually grounded and analytically rigorous insights into the self-regulated digital learning practices of Japanese language students in outer-island Indonesian higher education.

RESULTS

This chapter presents the findings derived from four primary data sources, namely semi-structured interviews, the adapted Motivated Strategies for Learning Questionnaire (MSLQ), naturalistic observations, and document analysis collected over an eight-week period at the Department of Japanese Language Education, Universitas Negeri Manado (UNIMA). The findings are organized around four overarching themes generated through Reflexive Thematic Analysis (Braun & Clarke, 2022): (1) digital tool selection and rationale, (2) self-regulated learning strategies enacted through technology, (3) contextual barriers and enabling factors in the UNIMA learning environment, and (4) digital scaffolding across the three phases of self-regulated learning as conceptualized by Zimmerman (2000). Each thematic section integrates quantitative questionnaire data with qualitative insights to strengthen interpretive validity through methodological triangulation (Denzin, 2018). Prior to presenting the thematic analysis, descriptive results from the adapted MSLQ are presented to establish a quantitative baseline of participants' self-regulated learning profiles.

Descriptive Overview of SRL Dimensions

Participants completed the 30-item adapted MSLQ instrument (α = .87), which assessed three dimensions of self-regulated learning: goal-setting, self-monitoring, and self-evaluation.

Table 2. Descriptive Statistics for SRL Dimensions (N = 30)

SRL Dimension	M	SD	Min	Max	Interpretation
Goal-Setting	3.82	0.61	2.40	5.00	Moderately High
Self-Monitoring	3.54	0.74	1.80	5.00	Moderate
Self-Evaluation	3.29	0.78	1.60	4.80	Moderate
Overall SRL Index	3.55	0.65	2.00	4.87	Moderate

Note. All items were measured using a five-point Likert scale (1 = not at all true of me; 5 = very true of me).

The overall SRL index (M = 3.55, SD = 0.65) indicates a moderate level of self-regulatory engagement among participants. Goal-setting recorded the highest mean score (M = 3.82), suggesting that students generally demonstrated purposeful orientation toward Japanese language learning. In contrast, self-monitoring and self-evaluation yielded lower scores, indicating that while participants were relatively effective at establishing learning intentions, systematic reflection and performance assessment remained underdeveloped.

Digital Tool Selection and Usage Patterns

Document analysis identified eight categories of digital tools used by participants for independent Japanese language study.

Table 3. Digital Tools Used by Participants for Independent JFL Study (N = 30)

Tool / Platform	Category	Users (n)	Usage (%)	Primary SRL Function
Duolingo	Vocabulary and gamification	27	90%	Goal-setting, self-monitoring
Anki	Spaced repetition system	24	80%	Retention, self-monitoring
YouTube (JFL channels)	Listening comprehension	28	93%	Input processing
Google Translate	Lexical support	26	87%	Performance scaffolding
WaniKani	Kanji mastery	14	47%	Evaluation, monitoring
HelloTalk / Tandem	Authentic interaction	11	37%	Output practice
Jisho.org	Dictionary and reference	25	83%	Performance scaffolding
Instagram / TikTok (JFL content)	Informal input	20	67%	Incidental exposure

Note. Participants could report multiple tools.

YouTube (93%) and Duolingo (90%) emerged as the most widely used digital platforms, followed by Google Translate (87%) and Jisho.org (83%). Tools offering structured repetition and algorithmic feedback, particularly Anki and WaniKani, were more commonly used by participants demonstrating stronger overall SRL profiles (M = 3.91) compared to those relying primarily on passive content consumption (M = 3.18).

Interview analysis revealed three primary rationales guiding digital tool selection: accessibility and affordability, perceived relevance to Japanese language-specific skills, and peer recommendation. Accessibility emerged as the dominant factor, with 22 participants emphasizing free or low-cost access as essential due to financial constraints and limited internet quotas. One participant explained:

"I always prioritize free applications. Duolingo and YouTube do not require subscription fees, while premium resources are often beyond my financial reach."

Participants also selected tools based on Japanese-specific affordances. Applications such as WaniKani and Anki were valued for their support of kanji memorization through spaced repetition and mnemonic association. Peer recommendation constituted a significant social mechanism of tool diffusion. Seventeen participants reported discovering their most frequently used applications through class WhatsApp groups.

Technology-Enacted Self-Regulated Learning Strategies

Participants demonstrated technology-mediated self-regulated learning behaviors across all three phases of Zimmerman's SRL model (Zimmerman, 2000). In the forethought phase, 24 participants reported deliberate pre-study planning practices. Duolingo's streak system and daily progress notifications functioned as external motivational anchors supporting intention formation and persistence. One participant stated:

"Without the Duolingo streak reminder, I often postpone studying. The streak becomes my daily target."

Observation data supported this finding, with 8 of 10 observed participants initiating study sessions by opening Duolingo or Anki. During the performance phase, participants frequently adopted layered learning sequences involving YouTube for listening input, followed by Anki for vocabulary reinforcement and Jisho.org for lexical clarification. Participants with stronger SRL profiles consistently combined passive input with active retrieval. In contrast, participants engaging exclusively in extended YouTube consumption without follow-up review demonstrated significantly lower self-monitoring scores. The self-reflection phase emerged as the least developed. Only 13 participants reported systematic post-study evaluation practices, such as reviewing JLPT practice scores or monitoring Anki retention dashboards. Six participants used social media exposure as an informal benchmark of comprehension, though these practices lacked structured evaluative criteria.

Contextual Barriers and Enabling Factors

All participants identified infrastructural limitations as the most significant challenge to technology-mediated learning. Three primary barriers were identified:

1. Intermittent internet connectivity
2. Limited mobile data availability
3. Device capability constraints

Twenty-six participants reported internet disruptions at least three times per week. Such instability frequently interrupted access to streaming-dependent tools such as YouTube and language exchange platforms. To cope with

these limitations, students developed adaptive strategies such as downloading videos for offline use, prioritizing offline-capable tools such as Anki, and concentrating data-intensive activities during campus Wi-Fi access periods. One participant explained:

"I usually download learning videos while on campus and watch them later at home when internet access becomes unstable."

The complexity of Japanese orthography also emerged as a language-specific barrier. Nine participants reported that general-purpose language applications inadequately supported intermediate-level kanji acquisition. Despite infrastructural constraints, social support emerged as a powerful enabling factor. WhatsApp groups functioned as digital communities of practice where learners exchanged resources, shared motivational support, and collectively solved learning challenges.

Digital Tool Mapping Across SRL Phases

A cross-thematic synthesis identified differential digital scaffolding across Zimmerman's three SRL phases.

Table 4. Digital Tool Mapping Across SRL Phases

SRL Phase	Key Digital Tools	SRL Processes Supported	Strength of Evidence
Forethought	Duolingo, WhatsApp, calendar apps	Goal-setting, task initiation	Strong
Performance	Anki, YouTube, Jisho.org, WaniKani	Strategy use, monitoring, attention regulation	Very Strong
Self-Reflection	Anki dashboard, JLPT apps, social benchmarking	Self-evaluation, adaptation	Moderate

The performance phase received the strongest technological support, while self-reflection remained comparatively less supported by the tools participants reported using.

DISCUSSION

The findings indicate that digital technologies function as partial and uneven scaffolds for self-regulated learning among Japanese language students at UNIMA. This study extends existing technology enhanced language learning literature by demonstrating that digital support is distributed unevenly across the SRL cycle, with the performance phase receiving markedly stronger technological reinforcement than the self-reflection phase (Table 4). This nuances recent systematic reviews of technology-assisted self-regulated language learning, which have generally characterized digital tools as broadly supportive of SRL without disaggregating their effects by regulatory phase (Noori, 2025). Whereas prior studies often conceptualize technology as uniformly beneficial across self-regulatory processes (Lai & Gu, 2011), the present findings reveal that technological affordances are concentrated primarily in performance-phase activities input processing, vocabulary reinforcement, and lexical clarification while self-reflection remains comparatively underserved by the tools students report using.

This asymmetry is conceptualized here as *phase-differential digital scaffolding*: a pattern in which digital tools do not support the self-regulation cycle evenly, but instead cluster around certain phases while leaving others structurally under-supported. This concept extends (Zimmerman, 2000) three-phase SRL model by drawing attention to how *technological affordance*, rather than learner motivation alone, shapes which regulatory phase develops most strongly. This reframes a common assumption in the technology-enhanced language learning literature that greater technology access straightforwardly improves self-regulation (Lai & Gu, 2011; Reinders & White, 2011) by showing that access does not translate uniformly across the regulatory cycle; a learner may be technologically well-supported in *performing* a task while remaining technologically under-supported in *evaluating* it.

Contrast with studies in well-resourced contexts. This pattern diverges in an important way from studies conducted in more technologically stable environments. For instance, research on structured digital engagement in well-resourced settings has generally linked consistent tool access to stronger self-monitoring and goal-setting behavior overall, without highlighting a systematic phase-based gap (Lai & Gu, 2011). A recent five-year systematic review of self-regulated learning strategies in blended higher-education contexts similarly reports predominantly positive, undifferentiated associations between technology use and SRL outcomes (Luo, 2024), reinforcing that the phase-differential pattern observed at UNIMA may be a distinguishing feature of infrastructurally constrained settings rather than a general property of technology-enhanced SRL. Hadwin et al., (2025) The present findings suggest this optimistic picture may not hold uniformly once infrastructural constraints are introduced: rather than technology

uniformly weakening self-regulation in low-resource settings, it appears to *redistribute* regulatory strength unevenly across phases, strengthening performance-phase behaviors (through tools such as Anki and YouTube) while leaving self-reflection comparatively reliant on informal, unstructured practices such as social media benchmarking. This suggests that phase-differential scaffolding may be a context-dependent phenomenon rather than a fixed property of technology-enhanced SRL, warranting comparison with future studies conducted in other under-resourced or infrastructurally uneven settings, such as rural EFL contexts in other Global South countries.

Resource-adaptive self-regulation under infrastructural constraint

The UNIMA context highlights the importance of considering infrastructural realities when examining digital learning behavior. Economic constraints, unstable connectivity, and limited device access produce what this study terms resource-adaptive self-regulation: a form of self-regulation in which learners develop compensatory strategies such as downloading content in advance, favoring offline-capable tools, and concentrating data-intensive activities during periods of campus Wi-Fi access that are often invisible to standard SRL measurement frameworks (Pintrich, 2004; Creswell & Poth, 2018). Unlike conventional models of self-regulation, which typically treat resource access as a background condition rather than an active object of regulation, resource-adaptive SRL positions infrastructural negotiation itself as a regulatory task that learners must plan for, monitor, and adjust. This suggests a theoretical refinement to (Zimmerman, 2000) model: in infrastructurally constrained contexts, the forethought phase may need to explicitly account for *resource planning* as a sub-process, alongside goal-setting and strategic planning.

This finding also stands in contrast to studies conducted in urban, infrastructurally stable universities, where SRL research has tended to treat digital access as a constant rather than a variable requiring active management (Purnomo et al., 2024; Reinders & Wattana, 2015). Where such studies typically measure self-regulation purely in cognitive or motivational terms, the present findings suggest that in outer-island contexts, self-regulation is inseparable from material and infrastructural negotiation an argument that aligns with, and extends, calls in the literature for more context-sensitive models of digital SRL (Reinders & Wattana, 2015).

Socially distributed regulation through peer networks

Furthermore, the collective nature of digital tool selection challenges purely individualistic interpretations of self-regulation. The central role of peer WhatsApp communities in disseminating tool knowledge, sustaining motivation, and collectively troubleshooting learning obstacles supports socially shared regulation perspectives, which conceptualize learning regulation as distributed across social networks rather than located solely within the individual learner (Winne & Hadwin, 2011). This finding parallels observations from mobile-assisted language learning research in other Asian higher-education contexts, where situated, community-based learning structures have similarly been shown to shape learners' self-regulatory engagement with technology (Li et al., 2022). This raises a theoretical question worth pursuing in future research: whether informally distributed regulation of this kind functions equivalently to the more formally structured shared regulation described in prior collaborative-learning literature, or whether it represents a distinct, lower-intensity form of social regulation that merits its own conceptual treatment.

Pedagogical implications

Three pedagogical implications emerge from these patterns. First, given that self-reflection was the least technologically supported SRL phase, instructors should integrate structured digital reflection activities such as guided journaling prompts or scheduled review checkpoints to compensate for the reflective gap left by students' existing tool ecosystems. Second, given the demonstrated role of peer WhatsApp communities in both resource diffusion and socially shared regulation, these communities should be formally recognized as legitimate pedagogical spaces, for example by having instructors seed curated resources into existing peer groups rather than treating them as purely informal, extracurricular activity. Third, given that tool proliferation alone did not translate into stronger self-reflection, guidance on strategic tool selection and sequencing appears more pedagogically valuable than simply increasing the number of tools made available to students.

Limitations

Although the findings provide important insights, several limitations should be acknowledged. The single-site qualitative case study design limits the generalizability of these findings to other institutions, and the eight-week data collection period may not capture longitudinal changes in SRL development over a full academic term or program (Yin, 2018). In addition, because participants' technology use was self-reported through interviews and an adapted questionnaire, the findings may be subject to social desirability bias, particularly regarding reflection practices that participants may be inclined to overstate. Future research employing longitudinal designs or multi-site comparisons across other outer-island or resource-constrained contexts would help establish whether phase-differential digital

scaffolding and resource-adaptive self-regulation are patterns specific to the UNIMA context or more broadly characteristic of technology-enhanced language learning under infrastructural constraint.
Overall, the findings demonstrate that while digital technologies offer significant opportunities for supporting Japanese language learning, their effectiveness depends on strategic pedagogical integration, infrastructural equity, and explicit support for reflective self-regulation.

CONCLUSION

This study examined how fifth- and sixth-semester JFL students at Universitas Negeri Manado (UNIMA) use digital technologies to support self-regulated learning, guided by Zimmerman's three-phase SRL model. Drawing on eight weeks of interviews, an adapted MSLQ questionnaire, naturalistic observation, and document analysis with 30 participants, the study addressed three research questions concerning tool selection rationale, the phase-specific scaffolding functions of digital tools, and the influence of UNIMA's outer-island context on SRL enactment.

The findings show that participants maintained a moderate overall SRL profile, with goal-setting as their strongest dimension and self-evaluation as their weakest. Digital tools supported the SRL cycle unevenly, offering strong support during the performance phase but comparatively little support for self-reflection. Infrastructural constraints intermittent connectivity, limited data, and device limitations shaped how students selected and used digital tools, while peer WhatsApp communities played a central role in tool discovery, motivation, and informal evaluation.

These findings answer the three research questions by identifying accessibility, language-specific relevance, and peer recommendation as the primary drivers of tool selection; by revealing performance-phase dominance and self-reflection scarcity in phase-specific scaffolding; and by showing that UNIMA's outer-island context shapes SRL through both infrastructural constraint and socially distributed regulation. In doing so, the study contributes three theoretical refinements introduced and elaborated in the preceding Discussion: phase-differential digital scaffolding, resource-adaptive SRL, and empirical evidence for mobile-mediated socially shared regulation in a collectivist Southeast Asian setting.

As a single-site qualitative case study conducted over eight weeks, these findings are bounded by UNIMA's specific context and should not be generalized without further comparative or longitudinal research. Practically, the study points to four priorities: explicit pedagogical scaffolding for self-reflection, formal recognition of peer digital communities, guidance on strategic tool selection rather than tool access alone, and continued investment in digital infrastructure at outer-island institutions.

Overall, this study positions UNIMA's JFL students as resourceful, socially embedded learners who actively adapt digital tools to the constraints of their environment neither passive recipients of technology nor fully autonomous self-regulators. Realizing the potential of technology-mediated SRL in outer-island Indonesian higher education will require not only better tools, but more equitable infrastructure, more intentional curriculum design, and continued attention to the social and material conditions that shape language learning in under-resourced contexts.

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AUTHOR CONTRIBUTION STATEMENT

Mariam Fritka Toliwongi was responsible for conceptualizing the study, formulating the research objectives, designing the qualitative case study framework, conducting data collection through interviews, observations, questionnaires, and document analysis, analyzing the data, and drafting the initial manuscript. Putri Bintang Pratiwi Harahap contributed to the development of the theoretical framework, literature review, interpretation of findings related to self-regulated learning and technology-enhanced language learning, and the contextualization of the study within Japanese language education. Nismawati assisted in the methodological design, validation of data analysis procedures, triangulation of findings, and critical examination of the relationships between digital technology use and self-regulated learning practices. Furthermore, Nismawati contributed to the discussion of research findings, interpretation of pedagogical implications, and refinement of the manuscript's academic arguments. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for the accuracy, integrity, and scholarly rigor of the research.

AI DISCLOSURE STATEMENT

The authors used artificial intelligence (AI)-assisted tools, including ChatGPT, Microsoft Copilot, and QuillBot, during the preparation of this manuscript entitled *"Exploring Self-Regulated Learning Through Digital Technology Among Japanese Language Students at Universitas Negeri Manado"*. These tools were utilized for language editing, academic paraphrasing, grammar checking, sentence refinement, and improvement of the overall clarity, coherence, and readability of the manuscript. The AI-assisted tools were used solely to support the writing and editing process and

were not involved in the design of the study, data collection, data coding, thematic analysis, interpretation of findings, or formulation of conclusions.

All research activities, including the development of the research framework, implementation of interviews, observations, questionnaire administration, document analysis, data interpretation, and the formulation of scholarly arguments, were conducted independently by the authors. The findings and conclusions presented in this study are the result of the authors' own academic analysis and critical reflection.

Following the use of AI-assisted tools, the authors carefully reviewed, verified, revised, and refined all manuscript content to ensure its accuracy, originality, methodological rigor, academic integrity, and compliance with ethical standards for scholarly publication. The authors accept full responsibility for all content presented in this manuscript, including its interpretations, analyses, findings, conclusions, and scholarly contributions.

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