

Analysis of Elementary School Pre-Service Teachers' Self-Regulated Learning in Deep Learning-Based Instruction under the Merdeka Curriculum

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Abstract

Self-Regulated Learning (SRL) is essential in learning environments that require students to independently plan, monitor, and reflect on their learning. However, empirical evidence describing SRL across the forethought, performance, and self-reflection phases, particularly among postgraduate students in Elementary Education within the broader context of the *Merdeka Curriculum* and deep learning, remains limited. This study examined the SRL profiles of postgraduate Elementary Education students at Universitas Pendidikan Indonesia using a quantitative descriptive survey. Forty-six students were purposively selected based on their exposure to the *Merdeka Curriculum* and elementary education policies and their willingness to participate. Data were collected using a 20-item self-report questionnaire based on Zimmerman's cyclical model and analyzed descriptively. The overall SRL score reached 86.17% (SD = 9.27), with 71.74% of participants classified as very high and 28.26% as high. Among the three phases, self-reflection recorded the highest score (87.01%), followed by performance (86.09%) and forethought (84.96%), indicating a relatively balanced SRL profile. These findings provide preliminary empirical evidence regarding learning regulation among postgraduate Elementary Education students and may inform efforts to strengthen SRL within teacher education. However, the findings should not be interpreted as evidence of readiness to implement deep learning, as such readiness was not directly assessed.

Keywords: Deep learning, Elementary Education, Forethought, Postgraduate students, Self-Regulated Learning.

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I. INTRODUCTION

The implementation of Deep Learning within the *Merdeka Curriculum* requires a shift in teachers' roles from primarily transmitting information to facilitating learning experiences that enable students to construct knowledge actively, reflectively, and meaningfully. Such demands require teachers to continually adapt to curricular changes, advances in knowledge, and increasingly diverse learning needs. The capacity to independently plan, monitor, and evaluate one's own learning is therefore particularly relevant to teacher development. Within this context, Self-Regulated Learning (SRL) represents an important capacity for prospective teachers because it supports purposeful learning, self-monitoring, reflection, and adaptation throughout their professional development.

SRL has been associated with a range of academic and developmental outcomes. Individuals with stronger self-regulation tend to demonstrate better academic achievement, learning motivation, critical thinking, and adaptability to changing learning environments (Alhazbi et al., 2024; Ni et al., 2025). Within teacher education, Syukri and Raldiastrari (2025) reported that stronger self-regulation among prospective teachers was associated with greater preparedness for field experiences and instructional planning. Evidence concerning prospective elementary teachers has likewise suggested generally favorable SRL levels, although opportunities for further development remain (Al-Abyadh et al., 2022). Collectively, these findings position SRL as a relevant foundation for the academic and professional development of future educators.

Conceptually, SRL is not a single learning behavior but a cyclical process through which learners regulate their cognition, motivation, and actions. Zimmerman's framework organizes this process into three interconnected phases: forethought, performance, and self-reflection. Forethought involves processes that precede learning, such as goal setting and strategic planning; performance concerns the regulation and monitoring of learning while a task is being undertaken; and self-reflection involves evaluating learning outcomes and responding to one's performance. Examining

these phases separately is important because a high overall SRL score may conceal differences in how effectively learners plan, regulate, and reflect on their learning.

Despite extensive research on SRL, important gaps remain within teacher education. Much of the literature has examined school students or university students more generally, while empirical evidence concerning students preparing for or advancing professional competence in elementary education remains comparatively limited. Previous studies have also frequently investigated SRL as a predictor or correlate of academic achievement rather than describing how its different phases are represented within this specific population. Consequently, less is known about whether forethought, performance, and self-reflection develop at comparable levels among Elementary Education students, particularly within an educational environment increasingly emphasizing independent, reflective, and meaningful learning.

This issue is relevant to the current orientation toward Deep Learning in the Merdeka Curriculum, which emphasizes mindful, meaningful, and joyful learning. Recent literature has highlighted the importance of teacher learning autonomy and readiness in responding to these instructional demands (Hasanah & Pujiati, 2025; Pravesti et al., 2022). However, a conceptual distinction is necessary: SRL and readiness to implement Deep Learning are related but not equivalent constructs. A descriptive assessment of SRL can identify students' capacity to regulate their own learning, but it cannot by itself establish whether they possess the pedagogical knowledge, instructional competence, or practical readiness required to implement Deep Learning. SRL should therefore be examined as a potentially relevant foundation for professional learning rather than treated as a direct measure of implementation readiness.

Accordingly, this study aimed to describe the Self-Regulated Learning profile of postgraduate Elementary Education students at Universitas Pendidikan Indonesia, both overall and across the forethought, performance, and self-reflection phases. By examining the three phases separately, the study seeks to provide empirical evidence regarding the relative strengths of students' learning-regulation processes within the broader context of contemporary teacher education. The findings are expected to provide preliminary information for teacher education programs seeking to strengthen independent, reflective, and adaptive professional learning, without assuming that SRL scores directly represent readiness to implement Deep Learning.

II. METHOD

This study employed a quantitative descriptive survey design to systematically describe the Self-Regulated Learning (SRL) profile of postgraduate Elementary Education students. The descriptive approach was selected because the study focused on characterizing participants' current SRL levels rather than examining causal relationships among variables. A survey method enabled standardized collection of self-reported SRL data across participants and was considered appropriate for describing patterns of learning regulation within the study context (Hendrianty et al., 2024).

Participants were 46 postgraduate students in Elementary Education at Universitas Pendidikan Indonesia, selected using purposive sampling (Creswell, 2009). The inclusion criteria were: (1) having conceptual knowledge of curriculum policies in elementary education; (2) having been exposed to the Merdeka Curriculum through academic activities; and (3) voluntarily agreeing to participate in the study. These criteria were intended to ensure that participants had relevant educational experience for the context in which their SRL profiles were examined.

Data were collected using a 20-item Self-Regulated Learning questionnaire developed with reference to Zimmerman's cyclical model. The instrument covered three SRL phases: forethought, performance, and self-reflection. Each statement was rated on a four-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). The four-point format excluded a neutral response option to encourage participants to indicate a directional response to each statement. The distribution of items across the three SRL phases is presented in Table 1.

Table 1. Self-Regulated Learning Instrument Blueprint

No.	SRL Phase	Indicator	Item No.	No. of Items
1	Forethought	Setting learning goals	1, 2	2
		Planning learning strategies	3, 4	2
		Managing learning time	5	1

2	Performance	Maintaining focus during learning	6, 7	2
		Applying learning strategies	8, 9	2
		Monitoring understanding	10, 11	2
		Seeking additional learning resources	12	1
3	Self-Reflection	Evaluating learning outcomes	13, 14	2
		Reflecting on the learning process	15, 16	2
		Improving learning strategies	17, 18	2
		Determining subsequent learning actions	19, 20	2
		Total		20

As shown in Table 1, the instrument comprised **5 forethought items, 7 performance items, and 8 self-reflection items**. The forethought phase addressed goal setting, strategic planning, and time management; the performance phase covered learning focus, strategy use, monitoring of understanding, and the use of additional learning resources; and the self-reflection phase assessed evaluation, reflection, strategy adjustment, and decisions regarding subsequent learning actions.

Instrument quality was examined through **content validity, empirical item validity, and internal consistency reliability**. Content validity was evaluated by three experts in education and curriculum with expertise relevant to educational and psychological measurement. The experts assessed the relevance, clarity, and representativeness of each item in relation to its intended indicator, and their feedback was used to revise the questionnaire before empirical testing. Empirical validity was subsequently examined using **Pearson product-moment item-total correlations**, with items considered acceptable when the item-total correlation coefficient was ≥ 0.30 (Kusmaryono et al., 2022). Internal consistency was assessed using **Cronbach's alpha**, with a coefficient of ≥ 0.70 used as the reliability criterion. The overall instrument yielded a **Cronbach's alpha of 0.87**, indicating good internal consistency.

Data were analyzed using **descriptive statistics** at two levels: the overall SRL profile and the three individual SRL phases. Each participant's total score was converted into a percentage using the formula **(obtained score/maximum possible score) $\times$ 100**. The maximum possible score for the complete instrument was **80 points** (20 items $\times$ 4). Mean scores, percentages, standard deviations, and frequency distributions were calculated to describe the overall pattern and variability of participants' SRL. Phase-level analyses were additionally conducted to compare descriptive patterns across forethought, performance, and self-reflection. Percentage scores were interpreted using the criteria presented in Table 2.

Table 2. Classification of Self-Regulated Learning Scores

Percentage Score	Category
81–100%	Very High
61–80%	High
41–60%	Moderate
21–40%	Low
0–20%	Very Low

These analyses were intended solely to provide a **descriptive profile of SRL**. Accordingly, the SRL scores were not treated as a direct measure of participants' readiness or competence to implement Deep Learning within the *Merdeka Curriculum*, as those constructs were not independently assessed in this study.

III. RESULTS AND DISCUSSION

A. Results

Data were obtained from 46 postgraduate students in Elementary Education. Of the participants, 35 (76.09%) were female and 11 (23.91%) were male. Most were enrolled in the second semester ($n = 43$; 93.48%), while 3 students (6.52%) were in the first semester. These characteristics describe the demographic composition of the participants included in the present study. Given the purposive sampling procedure, however, the sample should not be assumed to statistically represent the broader population of postgraduate Elementary Education students. Descriptive analysis of the Self-Regulated Learning (SRL) questionnaire is presented in Table 3.

Table 3. Descriptive Statistics of Students' Self-Regulated Learning

Statistic	Value	Description
Number of participants (N)	46	-
Minimum score	68	Out of 100
Maximum score	100	Maximum score
Mean	86.17	86.17% (Very High)
Standard deviation	9.27	-
Very High category	33 (71.74%)	Score $\geq$ 81%
High category	13 (28.26%)	Score 61–80%

As shown in Table 3, SRL scores ranged from 68 to 100, with an overall mean of 86.17 (SD = 9.27). Based on the predetermined classification criteria, the mean score was categorized as Very High. The lowest observed score (68) remained within the High category, indicating that none of the participants were classified as Moderate, Low, or Very Low. Of the 46 participants, 33 (71.74%) were classified as Very High and 13 (28.26%) as High. The distribution of SRL categories is illustrated in Figure 1.

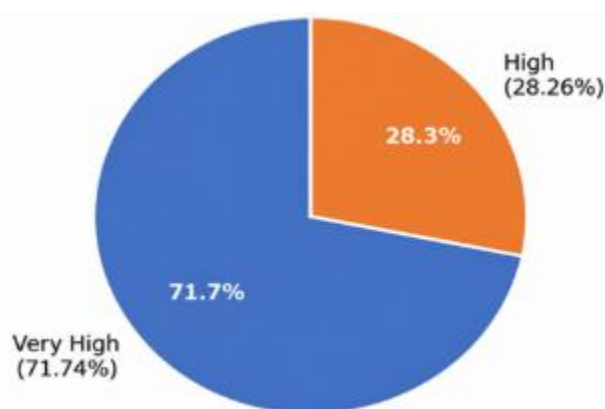


Figure 1. Distribution of Self-Regulated Learning Categories among Elementary Education Students (N = 46)

To examine the SRL profile in greater detail, descriptive analyses were conducted separately for the three phases of Zimmerman's cyclical model: forethought, performance, and self-reflection. The results are presented in Table 4.

Table 4. Self-Regulated Learning Profile across the Three SRL Phases

SRL Phase	No. of Items	Mean Score	Percentage	SD	Category
Forethought	5	21.24 / 25	84.96%	10.02%	Very High
Performance	7	30.13 / 35	86.09%	10.05%	Very High
Self-Reflection	8	34.80 / 40	87.01%	10.05%	Very High
Overall SRL	20	86.17 / 100	86.17%	9.27%	Very High

All three SRL phases were classified as Very High. Self-reflection recorded the highest percentage (87.01%), followed by performance (86.09%) and forethought (84.96%). The difference between the highest and lowest phase scores was only 2.05 percentage points, showing relatively limited descriptive variation across the three phases. Thus, rather than being concentrated in a single phase, the participants' SRL profile was relatively balanced across planning, regulation during learning, and reflection after learning.

Although self-reflection recorded the highest descriptive score and forethought the lowest, these differences should not be interpreted as statistically significant differences among the three phases, because the study employed descriptive rather than inferential analysis. The findings therefore primarily demonstrate that the participants reported consistently high levels of SRL across all three phases of Zimmerman's cyclical model.

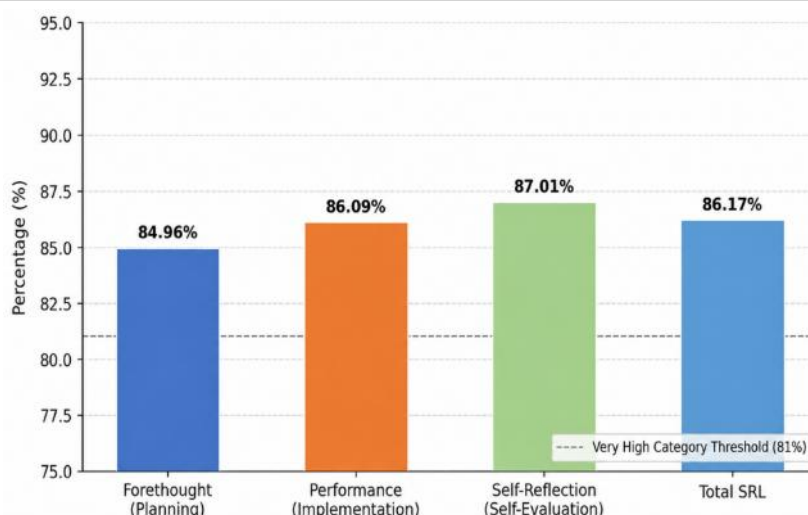


Figure 2. Self-Regulated Learning Scores across the Three SRL Phases

As illustrated in Figure 2, all three SRL phases were classified as Very High, with relatively small differences across dimensions. Self-reflection recorded the highest score (87.01%), followed by performance (86.09%) and forethought (84.96%). The difference between the highest and lowest scores was only 2.05 percentage points, indicating limited descriptive variation across the three phases. The overall pattern is further illustrated in the radar chart presented in Figure 3.

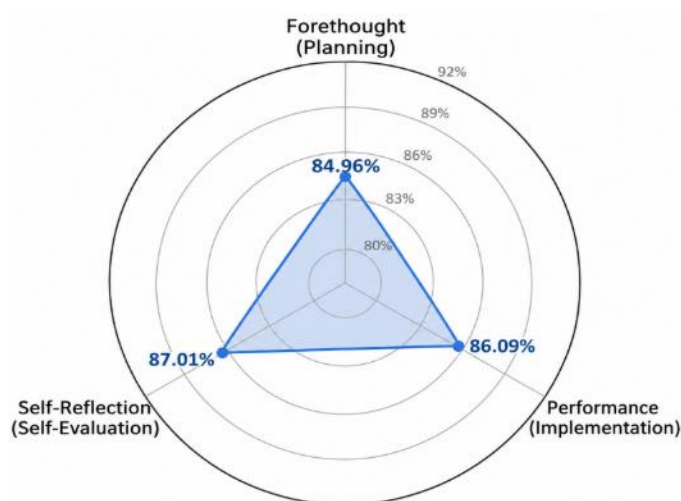


Figure 3. Radar Profile of Self-Regulated Learning across the Three SRL Phases

The radar profile in Figure 3 shows a relatively balanced pattern across forethought, performance, and self-reflection. Rather than displaying a pronounced strength or weakness in a particular phase, the three scores were closely distributed, suggesting that participants reported consistently high levels of learning regulation across the SRL cycle. Nevertheless, because these differences were examined descriptively and no inferential comparison among phases was conducted, the pattern should be interpreted as relative descriptive balance rather than statistical equivalence among the three SRL phases.

B. Discussion

The findings revealed a very high overall Self-Regulated Learning (SRL) profile among postgraduate Elementary Education students, with a mean score of 86.17% (SD = 9.27). Most participants (71.74%) were classified in the Very High category, while the remaining 28.26% were in the High category. This pattern differs descriptively from previous findings reporting

lower SRL levels among prospective elementary teachers (Fadilah et al., 2023). However, such differences should be interpreted cautiously because variations in educational level, participant characteristics, instruments, and research settings may contribute to differences across studies. The present participants were postgraduate students who had accumulated substantial academic experience, which may have provided greater opportunities to develop learning strategies, metacognitive awareness, and reflective learning practices. This interpretation is consistent with Zimmerman's (2002) view of SRL as a cyclical capacity that can develop through repeated learning experiences and reflection.

Despite the high overall mean, the distribution of scores indicates meaningful individual variation. Scores ranged from 68 to 100, and 13 participants (28.26%) remained in the High rather than Very High category. The SD of 9.27 further suggests that students did not report identical levels of learning regulation. This variation is relevant to teacher education because students may require different forms of support to strengthen their SRL. Rather than assuming uniformly strong self-regulation across the cohort, teacher education programs may benefit from identifying individual learning-regulation needs and providing differentiated support where appropriate (Edisherashvili et al., 2022).

Across the three phases, forethought recorded the lowest descriptive score (84.96%), although it remained within the Very High category. In Zimmerman's (2002) cyclical model, forethought encompasses processes preceding learning, particularly goal setting and strategic planning. The findings suggest that participants generally perceived themselves as capable of establishing learning goals, planning appropriate strategies, and managing their learning time. Nevertheless, because forethought was slightly lower than performance and self-reflection, it represents a potential area for further development. Teacher education programs could therefore reinforce structured goal setting, academic time management, and strategic learning planning. These capacities are relevant to professional learning because teachers are continually required to establish instructional goals, select appropriate strategies, and organize resources in response to educational demands.

The performance phase reached 86.09%, indicating a similarly high level of self-reported regulation during learning. This phase involves maintaining attention, applying learning strategies, and monitoring understanding while performing academic tasks. Within Zimmerman's framework, these processes reflect self-control and self-monitoring, both of which enable learners to adjust their behavior while learning is taking place. The findings therefore suggest that participants generally perceived themselves as capable of regulating their learning activities and monitoring their understanding. Such capacities are conceptually relevant to mindful learning, which emphasizes conscious and active engagement rather than passive participation (Feriyanto & Anjariyah, 2024). Nevertheless, attention management remains an area warranting consideration, particularly in learning environments characterized by substantial academic demands and potential digital distractions.

Among the three phases, self-reflection recorded the highest score (87.01%). In Zimmerman's (2002) model, self-reflection involves evaluating one's performance and responding adaptively to learning outcomes. The comparatively high score suggests that participants perceived themselves as particularly capable of evaluating their understanding and reflecting on their learning experiences. This capacity is important because learners who critically evaluate their understanding are better positioned to identify knowledge gaps and modify subsequent learning strategies (Schunk & DiBenedetto, 2021). For postgraduate students, such reflective processes may also be reinforced through academic activities such as seminars, presentations, scholarly discussions, and academic writing, all of which routinely require critical evaluation of knowledge and performance.

The prominence of self-reflection also has potential relevance to contemporary teacher education. Reflective capacity can support teachers in evaluating instructional practices, responding to diverse learning needs, and continually developing their professional competence. Similarly, the emphasis on meaningful learning within current educational discourse requires learners and educators to connect new knowledge with prior understanding and consider its relevance to authentic contexts. However, the present findings should not be interpreted as

evidence that participants are ready to implement Deep Learning within the Merdeka Curriculum. The questionnaire measured regulation of participants' own learning rather than their pedagogical knowledge, instructional competence, or actual classroom implementation of Deep Learning. SRL is therefore more appropriately regarded as a potentially supportive capacity for professional learning rather than a direct indicator of instructional readiness.

Another notable finding was the relatively small difference among the three SRL phases. Scores ranged only from 84.96% for forethought to 87.01% for self-reflection, a difference of 2.05 percentage points. Descriptively, this pattern suggests a relatively balanced SRL profile rather than a pronounced strength concentrated in one phase. This balance is theoretically relevant because Zimmerman conceptualizes SRL as a cyclical process in which forethought informs performance, performance provides information for self-reflection, and reflection subsequently influences future planning (Chen, 2022). Nevertheless, because the present study did not conduct inferential comparisons among the three phase scores, their close values should be interpreted as descriptive similarity rather than statistical equivalence.

From a teacher education perspective, the findings provide preliminary information for designing initiatives to sustain and strengthen students' learning regulation. Although the overall profile was high, the relatively lower forethought score suggests that goal setting, time management, and strategic planning could receive particular attention. At the same time, individual variation in overall scores indicates that a uniform approach may not address the needs of all students. Diagnostic assessment of SRL, structured reflection activities, learning-planning exercises, and differentiated academic support may therefore be useful components of teacher education programs. Importantly, these implications concern the development of students' own learning regulation; whether stronger SRL subsequently contributes to higher-quality Deep Learning implementation requires direct empirical investigation.

Several limitations should be considered when interpreting these findings. First, SRL was measured using a self-report questionnaire, making the results susceptible to response tendencies such as social desirability and differences between perceived and actual learning behavior. Second, the descriptive survey design does not permit causal conclusions or explanations of why participants reported high SRL. Third, purposive sampling and the relatively small sample of 46 students from a single institution limit the generalizability of the findings. Future research could combine self-report measures with interviews, observations, learning portfolios, or behavioral indicators of SRL. Longitudinal studies could also examine how forethought, performance, and self-reflection develop throughout teacher education, while further research should directly investigate whether and how SRL relates to prospective teachers' actual competence in designing and implementing Deep Learning.

IV. CONCLUSION

This study identified a **Very High Self-Regulated Learning (SRL) profile** among postgraduate Elementary Education students ($M = 86.17\%$; $SD = 9.27$), with **71.74%** of participants classified as Very High and **28.26%** as High. All three SRL phases were also categorized as Very High, comprising **forethought (84.96%)**, **performance (86.09%)**, and **self-reflection (87.01%)**, indicating a relatively balanced profile, although forethought represents an area that could receive further strengthening. These findings provide preliminary evidence of strong perceived capacities to plan, regulate, and reflect on learning, but should not be interpreted as direct evidence of readiness to implement Deep Learning within the *Merdeka Curriculum*. Teacher education programs may therefore strengthen SRL through structured learning planning and reflection, while future research should incorporate direct or mixed-method measures and examine the relationship between SRL and actual competence in implementing Deep Learning.

CONFLICT OF INTEREST

The authors declare that they have no competing financial, personal, or institutional interests that could have influenced the conduct, interpretation, or reporting of this study.

AUTHOR CONTRIBUTIONS

Rizka Ananda contributed to the conceptualization, instrument development, data collection, data analysis, and preparation of the original manuscript. **Effy Mulyasari** contributed to the research methodology, interpretation of the findings, and critical review of the manuscript. **Atep Sujana** contributed to the theoretical framework, academic supervision, interpretation of the results, and substantive manuscript revision. All authors reviewed and approved the final version of the manuscript.

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DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES

Generative AI and AI-assisted tools were used solely to support language editing, proofreading, and improvement of the manuscript's academic readability. These tools were not used to generate research data, perform statistical analyses, or determine the study findings and conclusions. All AI-assisted revisions were reviewed and verified by the authors, who retain full responsibility for the accuracy and integrity of the final manuscript.

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