



# Enhancing Self-Regulated Learning in Distance Education through SQ3R and Concept Mapping: Supporting SDG 4 on Quality Education

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Received: February 26, 2026

Revised: March 23, 2026

Accepted: April 25, 2026

Published: April 30, 2026

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DOI: [10.29303/jppipa.v12i4.14686](https://doi.org/10.29303/jppipa.v12i4.14686)

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**Abstract:** This study examines the effectiveness of a dual-strategy intervention—SQ3R and concept mapping—in enhancing students' comprehension and self-regulated learning (SRL) in an online distance learning context at Universitas Terbuka, Indonesia, contributing to SDG 4 (Quality Education). Using an explanatory sequential mixed-methods design, quantitative data were collected from 1.652 students through pretest-posttest measures in a one-semester course in the social sciences, followed by interviews with selected students and two instructors. Results indicate a statistically significant improvement in posttest scores ( $p < 0.001$ ), although the effect size is small ( $d = 0.24$ ). The strongest gains occurred in reading comprehension (SQ3R), with moderate improvements in concept mapping, while SRL gains remained limited. Qualitative findings suggest that students developed better reading structure, organization, and confidence; however, these did not fully translate into sustained metacognitive behaviors such as time management and reflective learning. This indicates that the intervention effectively improved cognitive and organizational skills but had limited short-term impact on deeper SRL habits. The study highlights the need for sustained scaffolding to develop SRL in distance education and supports the integration of structured learning strategies to improve learner autonomy.

**Keywords:** Adult learners; Concept mapping; Distance education; Reading comprehension; SDG 4; Self-regulated learning; SQ3R

## Introduction

Distance education has expanded rapidly over the past decade, yet one of its most persistent challenges lies in developing students' self-regulated learning (SRL). In online and open distance learning (ODL) environments, learners are required to independently plan, monitor, and evaluate their learning processes—three core components of SRL that are critical for academic success. Without direct supervision, students often struggle with time management, sustained attention, and effective learning strategies, leading to suboptimal learning outcomes (Broadbent & Fuller-Tyszkiewicz, 2018; Molin et al., 2020).

These challenges are particularly pronounced in ODL systems, where learners must navigate complex learning materials with a high degree of autonomy. Prior studies indicate that many students rely on surface-level strategies, such as rote memorization, rather than engaging in deeper cognitive and metacognitive processes required for meaningful learning (Cho & Heron, 2015). This limitation highlights the need for structured interventions that explicitly support both cognitive and metacognitive aspects of SRL.

From a theoretical perspective, cognitive and metacognitive strategies play complementary roles in SRL development. The SQ3R strategy (Survey, Question, Read, Recite, Review) supports cognitive engagement by guiding students through structured reading

### How to Cite:

Kuswanti, E., Suryani, P., Arisanty, M., & Sukatmi, S. Enhancing Self-Regulated Learning in Distance Education through SQ3R and Concept Mapping: Supporting SDG 4 on Quality Education. *Jurnal Penelitian Pendidikan IPA*, 12(4), 90-104. <https://doi.org/10.29303/jppipa.v12i4.14686>

processes that enhance comprehension and retention (Majeed, 2020). In contrast, concept mapping—grounded in Ausubel’s meaningful learning theory—functions as a metacognitive tool that enables learners to organize knowledge, visualize relationships among concepts, and monitor their understanding (Novak & Cañas, 2008; Parwati & Nurizka, 2026). When aligned with SRL components, SQ3R primarily facilitates planning and comprehension processes, while concept mapping supports monitoring and reflection.

Despite their strong theoretical foundations, these strategies have largely been studied in isolation. Limited empirical evidence exists regarding the synergistic effect of integrating SQ3R and concept mapping, particularly in large-scale ODL contexts. This gap is important because each strategy addresses different dimensions of SRL: SQ3R structures the initial learning process, while concept mapping supports knowledge integration and metacognitive regulation. Their integration, therefore, has the potential to provide a more comprehensive approach to strengthening SRL.

Furthermore, most existing studies on SRL interventions are conducted in face-to-face or blended learning environments, where instructor support remains available (Broadbent, 2017; Kizilcec et al., 2017). Evidence from fully online, large-scale distance education systems remains limited, particularly in developing countries such as Indonesia, where ODL plays a crucial role in expanding access to education.

Given these gaps, this study aims to examine the effectiveness of a structured learning intervention that integrates SQ3R and concept mapping in enhancing students’ SRL within a fully online distance learning environment. Specifically, the study investigates whether the combined intervention improves students’ ability to plan, monitor, and reflect on their learning processes, and evaluates the magnitude of its impact through a pre-post design.

This study offers three key contributions. First, it provides empirical evidence on the combined use of cognitive and metacognitive strategies in strengthening SRL, addressing the limited research on integrated interventions. Second, it contributes to the literature by examining SRL development in a fully distance learning context with a large sample, which remains underrepresented in prior studies. Third, it offers practical implications for designing structured learning support systems that enhance learner autonomy in ODL environments, aligning with broader efforts to improve the quality and inclusiveness of education (SDG 4).

Self-regulated learning (SRL) has long been recognized as a central construct in educational psychology, particularly in contexts where learners must take active responsibility for their academic progress (Zimmerman, 2000) defines SRL as a cyclical

process in which learners proactively set goals, employ strategies to achieve them, monitor their progress, and reflect on their outcomes. In a similar vein, Pintrich (2004) emphasizes that SRL is not a single skill but rather a coordinated system of cognitive, metacognitive, and motivational processes that enable students to direct their own learning. Together, these perspectives portray SRL as a dynamic form of learner agency that is essential for navigating complex academic tasks.

The SRL framework is typically understood through three interrelated components: cognition, metacognition, and motivation. Cognition refers to the strategies used to process and understand information, such as summarizing, organizing content, or rehearsing key ideas (Pratama et al., 2026). Metacognition involves the higher-order processes of planning how to approach a learning task, monitoring comprehension during study, and evaluating whether strategies were effective. Motivation, meanwhile, encompasses beliefs, values, and affective factors that sustain effort, including self-efficacy and goal orientation. These three dimensions operate together, allowing students to adaptively regulate their learning in ways that support long-term achievement (Nurhayati et al., 2026; Panadero, 2017).

The importance of SRL becomes particularly pronounced in distance learning environments, where learners must operate with less structure and fewer immediate cues from instructors. Research consistently shows that SRL skills are among the strongest predictors of success in online and open learning systems, as students must independently manage their time, maintain focus, and monitor understanding without continuous guidance (Broadbent & Poon, 2015). Learners with stronger SRL skills are more likely to persist in online courses, engage meaningfully with study materials, and achieve higher performance, whereas those with weaker regulatory skills often struggle with procrastination, cognitive overload, and disengagement (Kocdar et al., 2018). In open and distance learning (ODL) settings—where flexibility is high but support may be limited—the ability to regulate one’s own learning becomes not only advantageous but necessary.

Given the increasing adoption of distance learning globally, understanding how SRL can be strengthened through targeted interventions is an important area of inquiry. The role of cognitive strategies, metacognitive monitoring, and motivational regulation remains central to helping learners navigate the distinctive challenges associated with online and remote study.

The SQ3R method—an acronym for Survey, Question, Read, Recite, and Review—is one of the most established cognitive reading strategies designed to promote deeper comprehension and active engagement with text. Originally introduced by Robinson (1946), the

strategy was developed to help learners process complex academic materials systematically rather than relying on passive reading. Each phase of SQ3R serves a specific cognitive function: Survey enables readers to obtain an overview of the material; Question encourages them to generate guiding inquiries; Read involves purposeful engagement with the text to find answers; Recite strengthens memory consolidation by prompting recall; and Review helps integrate and reinforce key concepts. Together, these stages support higher-order comprehension processes that are fundamental to effective academic reading.

Research over the past decades has consistently demonstrated the effectiveness of SQ3R in enhancing reading comprehension across different educational levels. Empirical studies show that students trained in SQ3R tend to perform better on comprehension tests, retain information for longer periods, and engage in more strategic reading behaviors compared to those using conventional reading approaches (Majeed, 2020). For instance Cataraja (2025) found that SQ3R improved university students' ability to identify main ideas, infer concepts, and organize information from expository texts. Similarly, Kasmawati et al. (2020) reported that the method led to significant gains in reading accuracy and comprehension among learners in online learning settings, suggesting that SQ3R is particularly valuable in environments where learners must regulate their own study processes.

The structured yet flexible nature of SQ3R makes it a powerful cognitive tool for learners in distance education contexts. Because ODL students often approach texts independently without direct teacher scaffolding, a strategy like SQ3R can help them approach materials more deliberately, monitor their understanding, and actively construct meaning. In this way, SQ3R not only supports comprehension but also contributes to broader self-regulated learning processes—particularly the cognitive dimension that underpins planning, monitoring, and evaluating academic tasks.

Concept mapping has its theoretical foundations in Ausubel's theory of meaningful learning, which posits that new information is best understood when it can be consciously linked to relevant prior knowledge. Gagné et al. (1969) introduced the notion of advance organizers—cognitive scaffolds presented before learning—that help learners create a conceptual framework for assimilating new material. Building on this idea, Novak and his colleagues operationalized concept mapping as a visual and structural representation of these cognitive connections, enabling learners to externalize their understanding through nodes and links that depict hierarchical and relational

structures within a body of knowledge (Black et al., 2006).

As a metacognitive strategy, concept mapping supports learners in planning, monitoring, and evaluating their understanding throughout the learning process. The act of constructing a concept map requires learners to identify key ideas, determine how these ideas relate to one another, and organize them into a coherent structure. This process encourages deeper processing and reflection, prompting learners to check for misconceptions, reorganize their thinking, and integrate new information more effectively. Novak et al. (2008) argue that concept mapping facilitates metacognitive awareness because learners must continually assess whether the relationships they draw accurately represent their understanding of the material.

Empirical studies have consistently shown that concept mapping improves comprehension, retention, and the ability to transfer knowledge to new contexts. For example, Nesbit et al. (2006), in a meta-analysis of 55 studies, found that concept mapping had a significant positive effect on students' academic achievement, particularly in tasks requiring complex reasoning or conceptual integration. In online and distance learning environments, where learners frequently study independently, concept mapping has been shown to help reduce cognitive overload by providing a clear structure for organizing and synthesizing information (Cicognani, 2000). By externalizing thought processes, concept maps function not only as learning tools but also as metacognitive regulators that guide students in assessing their own understanding and identifying gaps in their knowledge.

Given these strengths, concept mapping represents an important metacognitive strategy that aligns closely with the goals of self-regulated learning. Its emphasis on organization, reflection, and conceptual integration makes it particularly valuable for distance learners, who must take greater responsibility for structuring their learning without continuous instructor support.

Integrating SQ3R and concept mapping represents a complementary approach that leverages both cognitive and metacognitive processes to support deeper comprehension and more effective learning regulation. While SQ3R guides learners through a structured sequence of engagement with text—moving from previewing and questioning to reading, reciting, and reviewing—concept mapping encourages them to organize, visualize, and integrate the information they extract from those texts. Each strategy thus addresses a different facet of learning: SQ3R strengthens comprehension at the processing stage, while concept mapping reinforces understanding by facilitating the consolidation and reorganization of knowledge.

This combined approach is theoretically grounded in models of meaningful learning, which emphasize that deep understanding occurs when students actively connect new information to existing cognitive structures (Gagné et al., 1969). SQ3R supports this connection by prompting learners to ask questions and engage with text purposefully, while concept mapping provides a visual scaffold for linking new ideas to prior knowledge. By integrating these methods, learners are encouraged not only to process information but also to reflect upon and reorganize it—a dual operation that enhances long-term retention and conceptual clarity.

Although research on the explicit combination of SQ3R and concept mapping remains limited, several studies suggest that dual-strategy training can lead to greater learning gains than the use of isolated strategies. For instance, O'Donnell et al. (2002) noted that when students use multiple coordinated learning strategies, they tend to demonstrate improved comprehension and problem-solving outcomes because cognitive and metacognitive processes mutually reinforce each other. More recent evidence from Hwang et al. (2019) indicates that combining reading strategies with visual-organizational tools can reduce cognitive load and promote deeper processing in online learning environments. These findings imply that integrating SQ3R and concept mapping may be particularly advantageous for distance learners, who often face challenges in structuring their learning independently.

The dual-strategy model employed in this study therefore aims to provide students with a systematic framework that supports both the acquisition and organization of new knowledge. By aligning a cognitive reading technique with a metacognitive organizational tool, this approach is designed to enhance not only comprehension but also the broader self-regulatory processes that underpin effective learning in open and distance education.

Self-regulated learning (SRL) plays an increasingly crucial role in distance learning environments, where students must assume greater responsibility for managing their learning processes with limited direct support from instructors. Unlike traditional classrooms, open and distance learning (ODL) models place the burden of pacing, time management, and monitoring comprehension primarily on the learner. As a result, students who lack strong SRL skills often struggle with maintaining motivation, managing distractions, and sustaining engagement over long periods of independent study (You & Kang, 2014). These challenges can lead to lower rates of course completion and reduced academic performance, highlighting the centrality of SRL to successful learning outcomes in fully online settings.

In this context, cognitive and metacognitive strategies become essential tools that help learners regulate their study processes more effectively. Cognitive strategies, such as structured reading techniques, enable learners to process and interpret information more deeply, while metacognitive strategies support the planning, monitoring, and evaluation of learning tasks. Prior research has shown that distance learners who actively employ these strategies tend to demonstrate higher levels of academic persistence, better comprehension of course materials, and increased satisfaction with their learning experience (Broadbent & Poon, 2015). These findings underscore the relevance of integrating structured strategy training into ODL programs to equip learners with the skills necessary for independent learning.

Despite the importance of SRL in distance education, research on targeted SRL-enhancing interventions remains relatively limited. Much of the existing literature focuses on correlational relationships between SRL and learning outcomes rather than experimentally evaluating structured strategy training programs. Moreover, interventions that do exist often examine isolated strategies or are implemented in blended-learning environments rather than fully online contexts. As Park et al. (2018) note, the absence of rigorously tested SRL interventions in ODL settings represents a significant gap in the literature, particularly given the global trend toward expanding online learning modalities. This gap provides a strong justification for the present study, which evaluates the combined effects of SQ3R and concept mapping as an integrated strategy to enhance SRL among distance learners.

## Method

### *Research Design*

This study employed an explanatory sequential mixed-methods design, in which quantitative data were collected and analyzed first, followed by a qualitative phase to further interpret, and explain the quantitative findings (Creswell & Plano Clark, 2017). In the quantitative phase, the study adopted a one-group pretest-posttest pre-experimental design to examine changes in students' learning outcomes after the intervention. Although this design allows the identification of within-subject improvement, it does not fully control for threats to internal validity, such as maturation, history effects, and testing effects. Therefore, the findings are interpreted cautiously as indicative of improvement associated with the intervention rather than definitive causal effects.

To improve clarity of the research procedure, the overall design is illustrated below:

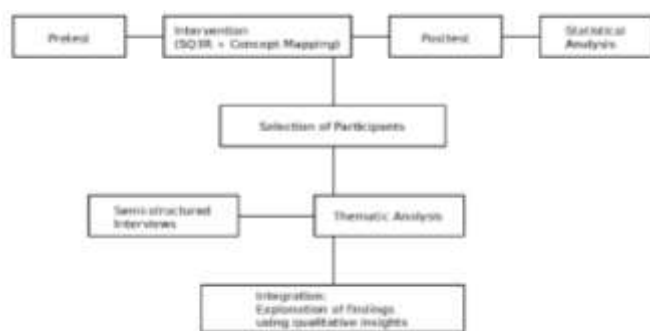


Figure 1. Research design flow

The qualitative phase was conducted to provide deeper insights into students' experiences and to explore the mechanisms underlying the observed changes.

### Participants

#### Quantitative Phase

Participants were undergraduate students of Universitas Terbuka (UT), Indonesia's national open and distance learning university. A total of  $N = 1,652$  students completed both pretest and posttest assessments. The sample reflected the heterogeneity of UT learners, including variation in age, employment status, and academic background. This diversity is characteristic of open and distance learning environments and is known to influence self-regulated learning (Kocdar et al., 2018).

#### Qualitative Phase

A purposive sampling approach was used to select 12 students representing diverse quantitative outcomes (high, moderate, and low gain) as well as varied demographic backgrounds. This sample size was considered sufficient to approach data saturation while capturing a range of learner experiences. In addition, one instructor involved in facilitating the intervention was interviewed to provide triangulation and an instructional perspective (Patton, 2015).

#### Intervention: SQ3R and Concept Mapping Training

The intervention consisted of a structured training program introducing two complementary learning strategies: SQ3R (Survey, Question, Read, Recite, Review) and concept mapping. The training was conducted in two synchronous online sessions (90 minutes each). Given the relatively short duration, the intervention is conceptualized as a short-term instructional exposure, aimed at enhancing students' awareness and initial application of learning strategies rather than producing stable changes in self-regulated learning behavior.

During the first session, students were guided through the stages of the SQ3R method and practiced applying the strategy using academic texts. The second

session focused on concept mapping, where students learned to identify key concepts, construct hierarchical structures, and visualize relationships among ideas using a digital mapping tool. Students were encouraged to integrate both strategies in their reading activities (Hwang et al., 2019).

### Instruments

#### Quantitative Instruments

Three instruments were used in the quantitative phase to assess different aspects of students' learning. The first was an SQ3R comprehension test developed to evaluate students' ability to apply the SQ3R method when engaging with academic texts. The second instrument was a concept mapping performance task, in which students were required to construct a concept map based on a given reading. The scoring of this task followed criteria adapted from Novak and Gowin (1984), including the hierarchical structure, the accuracy of propositions, and the clarity of connections among concepts. The third instrument was a Self-Regulated Learning (SRL) scale adapted from the Motivated Strategies for Learning Questionnaire (MSLQ) and grounded in Zimmerman's (2000) SRL framework. Given the short duration of the intervention, this scale was interpreted as capturing students' awareness and perceived use of learning strategies—particularly in terms of planning, monitoring, and reflection—rather than long-term behavioral changes. All instruments underwent expert review to ensure content validity, and their internal consistency reliability was evaluated using Cronbach's alpha.

#### Qualitative Instrument

The qualitative phase employed a semi-structured interview protocol consisting of open-ended questions designed to explore students' experiences in applying SQ3R and concept mapping strategies, as well as their perceived challenges and benefits. The interviews also examined changes in students' motivation, focus, and comprehension, along with their perceptions of how these strategies influenced their self-regulated learning. In addition, the instructor interview focused on observations of student behavior, engagement, and skill development throughout the intervention.

#### Data Collection Procedure

Quantitative data collection was conducted in three sequential stages. First, a pretest was administered prior to the intervention to assess students' initial abilities. This was followed by a two-session training intervention focusing on SQ3R and concept mapping strategies. After the completion of the intervention, a posttest was administered to measure changes in students' performance. Based on the results of the preliminary

quantitative analysis, a subset of participants was purposively selected for the qualitative phase. The selected participants then took part in semi-structured interviews conducted online. All interviews were audio-recorded with participants' consent and subsequently transcribed verbatim for analysis.

*Data Analysis*

*Quantitative Analysis*

Quantitative data were analyzed in several steps. First, descriptive statistics were computed, including mean, standard deviation, minimum, maximum, skewness, kurtosis, and 95% confidence intervals, to summarize the distribution of students' scores. Second, assumption testing was conducted by examining skewness and kurtosis values, supported by visual inspection of histograms and Q-Q plots. Third, a paired sample t-test was used to assess whether differences between pretest and posttest scores were statistically significant. A Wilcoxon signed-rank test was also conducted as a non-parametric robustness check. Effect sizes were calculated using Cohen's *d* and Hedges' *g*, and a normalized gain index (Hake's *g*) was computed to estimate proportional learning improvement. Subgroup analyses were conducted based on demographic variables such as gender and age. Additionally, an item-level analysis using a Response Distribution Change (RDC) approach was performed to identify patterns of improvement across domains.

*Qualitative Analysis*

Qualitative data were analyzed using thematic analysis. Transcripts were read repeatedly, and initial codes were generated inductively. These codes were then grouped into categories and refined into themes

representing students' and the instructor's perceptions of strategy use, benefits, challenges, and learning processes. Comparisons were made across participants with different levels of quantitative gain (high, moderate, and low) to enhance interpretive depth.

*Integration of Quantitative and Qualitative Data*

In line with the explanatory sequential mixed-methods design, integration was conducted at the interpretation stage. Quantitative findings were linked with qualitative themes to explain how and why the intervention influenced students' learning processes. This integrative approach provided a more comprehensive understanding of the role of SQ3R and concept mapping in supporting students' learning, particularly in terms of strategy awareness and application in a distance learning context.

**Result and Discussion**

*Quantitative Findings*

*Participant Characteristics*

A total of 1,652 students completed both the pretest and posttest assessments. As shown in Table 1, the sample consisted of 57.0% female students and 42.8% male students, with a very small proportion of participants not specifying gender. The age distribution reflected the heterogeneity typical of an open and distance learning institution, with the majority aged 21–25 years, while substantial proportions were also drawn from younger and older adult groups. Participants came from a wide range of academic programs, with most enrolled in study programs outside the five largest categories listed in the table, further illustrating the broad disciplinary diversity of the sample.

**Table 1.** Characteristics of Participants in the Quantitative Phase (n = 1,652)

Variable	Category	n	%
Gender	Female	942	57.0%
	Male	707	42.8%
	Other / Not specified	3	0.2%
Age	17–20 years	402	24.3%
	21–25 years	733	44.5%
	26–35 years	347	21.0%
	>35 years	170	10.2%
Mean age (SD)		24.0 (6.57)	
Program of Study	Management / Business	302	18.3%
	Communication Science	128	7.7%
	Law	60	3.6%
	Accounting	44	2.7%
	Information Systems / IT	30	1.8%
	Other study programs	1,088	65.8%
Education Level	Senior High School (SMA/SMK)	1,009	61.1%
	Undergraduate Degree (S1)	566	34.3%
	Diploma (D3) / Other	77	4.6%
Employment Status	Employed (PNS/Private/Self-Employed)	912	55.2%
	Student Only / Not employed	740	44.8%

Educational backgrounds and employment status also varied considerably. Most participants had completed senior high school, while a substantial proportion already held an undergraduate degree. More than half of the participants were employed, indicating that many learners were balancing academic responsibilities with work commitments. This demographic diversity is important for interpreting the findings, as it reflects the real profile of distance education learners at Universitas Terbuka and supports the relevance of the intervention across varied learner backgrounds.

*Expanded Descriptive Statistics*

Table 2 shows that the mean pretest score was already relatively high ( $M = 78.81, SD = 11.51$ ), while the posttest mean increased to  $81.38 (SD = 11.04)$ . This indicates an average gain of 2.57 points. Although the direction of change is positive, the relatively high baseline score suggests the possibility of a ceiling effect, meaning that students had limited room for improvement from the outset. Under these conditions, the observed gain should be interpreted cautiously as a modest increase within an already relatively high-performing sample.

**Table 2.** Descriptive Statistics for Pretest and Posttest Scores ( $n = 1,652$ )

Statistic	Pretest	Posttest
Mean	78.81	81.38
Standard Deviation (SD)	11.51	11.04
Minimum	15	10
Maximum	100	100
Interquartile Range (IQR)	10.00	15.00
Skewness	-1.26	-1.69
Kurtosis	2.49	5.01
95% Confidence Interval (CI)	78.25 - 79.36	80.84 - 81.91

The distribution statistics also support this interpretation. Both pretest and posttest scores were negatively skewed, indicating that many students clustered at the upper end of the score range. The

posttest distribution showed a more pronounced negative skew, which is consistent with a concentration of high scores after the intervention. The confidence intervals also show an upward shift in mean performance from pretest to posttest. Overall, the descriptive findings indicate improvement, but they also suggest that the magnitude of this improvement was constrained by the high initial performance of many participants.

*Assumption Testing (Normality and Robustness Checks)*

Before conducting inferential statistical tests, the normality of the pretest and posttest score distributions was examined to determine whether parametric analysis was appropriate. Table 3 summarizes the indicators commonly used to evaluate normality, including skewness, kurtosis, and visual inspection through distributional patterns. Although both distributions deviate from perfect normality—as indicated by moderate negative skewness and positive kurtosis—these deviations are typical for educational assessment data, particularly when many students perform at the upper range of the scale. According to the guidelines proposed by Field (2018), skewness values between  $-2$  and  $+2$  and kurtosis between  $-7$  and  $+7$  are considered acceptable for parametric testing. The present values fall comfortably within these thresholds, supporting the suitability of the paired-sample t-test.

In addition to numerical evidence, visual inspection (not shown here) through histograms and Q-Q plot patterns indicated modest non-normality but no extreme violations. Given the large sample size ( $n = 1,652$ ), the Central Limit Theorem further supports the robustness of parametric analyses. To ensure analytical rigor, a non-parametric alternative—the Wilcoxon signed-rank test—was also conducted. Results showed the same directional improvement and statistical significance as the paired t-test, confirming the robustness of the findings even under non-normality conditions. This dual approach strengthens confidence in the validity of the inferential results.

**Table 3.** Normality Indicators for Pretest and Posttest Scores

Indicator	Pretest	Posttest	Threshold for Acceptability	Interpretation
Skewness	-1.26	-1.69	$-2$ to $+2$ (Field, 2018)	Acceptable; left-skewed but valid
Kurtosis	2.49	5.01	$-7$ to $+7$ (Byrne, 2016)	Acceptable; moderately peaked
Sample Size	1,652	1,652	$>200$ supports CLT	Parametric test appropriate
Distribution Shape	Slight left-tail	More pronounced left-tail	Not required to be normal	Typical educational distribution
Wilcoxon Test	Significant	Significant	Should confirm direction	Robust check passed

Before conducting inferential testing, the distributions of the pretest and posttest scores were examined. As shown in Table 3, the skewness and kurtosis values fell within commonly accepted thresholds for parametric testing. Although both score

distributions deviated somewhat from perfect normality, such deviations are common in educational assessment data, particularly when many students score in the upper range. Given the large sample size, the Central Limit Theorem supports the use of parametric

tests. In addition, a Wilcoxon signed-rank test was conducted as a non-parametric robustness check and yielded the same directional result as the paired-sample t-test. Taken together, these results indicate that the dataset was sufficiently robust for inferential analysis.

*Paired Sample t-Test and Effect Size*

A paired-sample t-test was conducted to determine whether the difference between pretest and posttest scores was statistically significant. As presented in Table 4, the posttest scores were significantly higher than the pretest scores,  $t(1651) = 9.95, p < 0.001$ , with a mean

difference of 2.57 points and a 95% confidence interval ranging from 2.06 to 3.08.

However, the effect size was small (Cohen’s  $d = 0.24$ ; Hedges’  $g \approx 0.24$ ). Therefore, although the improvement was statistically reliable, its practical significance was limited. This small effect size is understandable given two conditions already noted in the study: first, the relatively high pretest scores reduced the room for observable improvement; second, the intervention itself was brief, consisting of only two 90-minute sessions. The findings therefore suggest that the intervention produced a measurable short-term benefit, but not a large practical gain.

**Table 4.** Paired Sample t-Test and Effect Size Results

Statistic	Value	Interpretation
Mean Difference	2.57	Average improvement from pre to post
SD of Difference	10.49	Variability in individual change
95% CI of Difference	2.06 - 3.08	Improvement is statistically reliable
t-value	9.95	Strong evidence of improvement
p-value	< 0.001	Highly significant
Cohen’s d	0.24	Small-to-moderate practical impact
Hedges’ g	~0.24	Adjusted effect size (consistent)

*Subgroup Analysis (Gender and Age Differences)*

To examine whether the intervention produced differential effects across subpopulations, subgroup analyses were conducted based on gender and age group. These variables are particularly relevant in distance learning contexts, where learners’ backgrounds and life stages often influence their self-regulated learning (SRL) capabilities.

*Gender-Based Differences*

Table 5 summarizes the mean pretest and posttest scores. Table 5 shows that both female and male students improved from pretest to posttest. Female students recorded a gain of 2.40 points, while male students recorded a gain of 2.80 points. Although the descriptive gain was slightly larger among male students, this difference should not be interpreted as evidence that the intervention was more effective for males. Male students began with lower baseline scores, which means they had greater room for improvement. Thus, the observed difference may reflect baseline variation rather than a true gender-based intervention effect. Without a more advanced inferential comparison, such as an interaction analysis, the gender findings should be treated as descriptive only.

**Table 5.** Gender Differences in Pretest-Posttest Performance

Gender	Mean Pretest	Mean Posttest	Mean Difference
Female	79.90	82.30	+2.40
Male	77.43	80.22	+2.80

*Interpretation*

Both genders improved, but male students demonstrated a slightly higher gain despite starting from a lower baseline.

*Age Group Differences*

As shown in Table 6, all age groups demonstrated improvement in their posttest scores. The largest gains were observed among students aged 26–35 (+3.09) and those aged 36 and above (+2.98), while the smallest gain was found among the youngest group aged 17–20 (+1.99). This pattern suggests that adult learners may have been more ready to use structured learning strategies such as SQ3R and concept mapping, particularly because they often need efficient approaches to manage study demands alongside work and family responsibilities.

**Table 6.** Age Group Differences in Pretest-Posttest Performance

Age Group	Mean Pretest	Mean Posttest	Mean Difference
17-20	78.32	80.31	+1.99
21-25	78.44	81.24	+2.80
26-35	79.77	82.86	+3.09
36+	81.07	84.05	+2.98

Even so, these age differences should also be interpreted cautiously, as the subgroup analysis was descriptive rather than designed to establish differential causal effects. Overall, the data indicate that the intervention was associated with positive gains across

all age groups, with somewhat stronger gains among adult learners.

*Item-Level Gain Analysis (Response Distribution Change)*

To better understand how students’ responses changed across specific domains, an item-level Response Distribution Change (RDC) analysis was conducted. This analysis was used to complement the total score analysis by examining shifts in response patterns across items and domains from pretest to posttest. Rather than replacing score-based analysis, RDC provided

additional detail about where conceptual clarification and improved response alignment occurred.

Across the 20 items, 15 showed positive shifts in response distribution from pretest to posttest. Items related to SQ3R procedures and concept mapping structure showed the clearest positive changes, indicating that students more readily improved on concrete cognitive and organizational aspects of the intervention. In contrast, items related to self-regulated learning, especially those involving monitoring and reflection, showed smaller shifts.

**Table 7.** Items with the Strongest Positive Response Shifts

Item Category	Item Description (Simplified)	Observed Improvement Pattern
SQ3R	Identifying “Question” step correctly	Clear shift toward correct conceptual option
SQ3R	Choosing the purpose of “Survey” step	Reduced misconception about previewing purpose
Concept Mapping	Understanding hierarchical node structure	Marked reduction in scattered option patterns

These shifts suggest that the intervention was particularly effective in strengthening procedural knowledge of SQ3R and the structural understanding of concept mapping.

*Items Showing Minimal Change or Persistent Misconceptions*  
Several items demonstrated limited movement in response distribution:

**Table 8.** Items Showing Minimal Change or Persistent Difficulties

Item Category	Item Description (Simplified)	Interpretation
SRL	Monitoring comprehension while reading	Minor shift; reflection remains challenging
SRL	Evaluating effectiveness of learning strategies	Little change; suggests deeper metacognitive habits
Concept Mapping	Cross-link identification	Persistent difficulty; requires extended practice

Items involving deeper metacognitive processes—such as self-evaluation and cross-link formation—showed the least change, indicating that these skills may develop more gradually and require longer exposure.

RDC findings reinforce the broader quantitative pattern: the intervention was most effective in improving cognitive strategy use, moderately effective in strengthening organizational strategy use, and least effective in changing metacognitive self-regulated learning components.

*Category-Level Gain Summary*

To create a more generalizable picture, items were grouped into three conceptual domains. Overall, the

**Table 9.** Category-Level Gain Summary

Domain	Overall Change Trend	Interpretation
SQ3R Knowledge	High improvement	Students gained procedural clarity due to explicit instruction
Concept Mapping	Moderate improvement	Students improved on structure but struggled with cross-links
Self-Regulated Learning	Small improvement	SRL components typically require prolonged practice

*Qualitative Findings: Student and Instructor Perspectives Participant Profiles*

A total of 11 informants participated in the qualitative phase, consisting of 10 students and 1 instructor. As shown in Table 10, the students

represented different gain levels, academic programs, age groups, and employment statuses. This variation allowed the qualitative findings to capture multiple perspectives on the usefulness and limitations of the intervention.

**Table 10.** Profile of Qualitative Informants

Code	Gender	Age	Program of Study	Employment Status	Pretest Score	Posttest Score	Gain Level
S1	Female	19	Management	Student	72	81	Medium
S2	Male	22	Communication Science	Part-time Worker	65	80	High
S3	Female	34	Public Administration	Civil Servant	82	88	Medium
S4	Male	28	Law	Private Employee	79	84	Medium

Code	Gender	Age	Program of Study	Employment Status	Pretest Score	Posttest Score	Gain Level
S5	Female	21	Accounting	Student	90	94	Low
S6	Male	26	Information Systems	Freelance	70	79	Medium
S7	Female	37	PGSD	Teacher	88	92	Low
S8	Male	33	Management	Entrepreneur	75	86	High
S9	Female	24	Economics	Student	80	90	High
S10	Male	41	Public Administration	Civil Servant	84	89	Medium
T1 (Tutor)	Female	45	Tutor/Instructor	Full-time Lecturer	—	—	—

*Emergent Themes from Student Interviews*

The qualitative phase generated four major themes that highlight how students experienced and interpreted the use of SQ3R and concept mapping within a distance learning environment. These themes contextualize the quantitative findings by illustrating the cognitive, motivational, and practical aspects of the intervention.

*Theme 1: Greater Clarity in Applying Reading Strategies*

Many students explained that the intervention helped them develop a clearer understanding of how to approach academic reading. Before the training, several participants described their reading routines as unstructured or “mechanical,” leading to limited comprehension.

S2, noted: “Previously, I just jumped straight into reading without knowing what exactly I was looking for. After learning the SQ3R steps, especially the ‘Question’ part, I became more focused and understood the content faster.”

Similarly, S9 shared: “The Survey and Question steps helped me see the big picture first. When I started reading, I no longer felt lost in long paragraphs.”

These reflections align with the quantitative findings showing notable improvements in SQ3R-related items, especially those requiring procedural understanding.

*Theme 2: Improved Organizational Skills Through Concept Mapping*

Concept mapping was perceived as a valuable tool for structuring ideas and organizing information across complex topics. Students expressed that this technique supported not only comprehension but also recall during assessments.

S8, a working learner, described: “I used to take notes while reading, but they were messy and hard to revisit. With concept maps, everything – main points and connections – became clearer. During the test, I could visualize the structure again.”

S3 emphasized how concept mapping helped her break down theoretical material: “Some topics in public administration contain many dense theories. The concept map helped me see which ones were the main ideas and how the others branched out. It made remembering easier.”

These accounts reinforce the moderate item-level improvements observed in concept mapping-related questions.

*Theme 3: Ongoing Challenges in Self-Regulated Learning (SRL)*

Despite the benefits, students reported continued difficulties with deeper SRL skills such as self-monitoring, sustaining attention, and maintaining motivation—especially those balancing work and academic responsibilities.

S10, a full-time civil servant, explained: “My challenge is not the technique itself, but managing my focus. Sometimes I read the module, but my mind is still on work matters. I need extra effort to stay concentrated.”

Younger learners expressed similar challenges: S1 reflected: “The strategies help, but I still struggle with reflecting after studying. Usually, I just close my laptop without evaluating what I learned.”

These perspectives support the quantitative finding that SRL-related items showed the smallest gains, suggesting that metacognitive development requires more gradual reinforcement.

*Theme 4: Need for Extended and Repeated Practice*

A consistent theme was the desire for more time and opportunities to practice the strategies. Students felt the two-session intervention was useful but insufficient for long-term mastery.

S6 explained: “I only started to understand the steps fully during the second session. More practice sessions would probably improve the results even more.”

The instructor informant (T1) supported this view: “Students quickly understood the steps, but applying them to different kinds of materials still requires guidance. Repeated practice would help make the strategies more automatic.”

This theme highlights an important implication: interventions like SQ3R and concept mapping may produce stronger gains if embedded throughout the semester rather than delivered in isolated sessions.

*Synthesis of Themes*

The qualitative findings collectively indicate that the intervention effectively enhanced students’ cognitive reading strategies, particularly through the

application of SQ3R. It also contributed to strengthening students' foundational organizational skills, as reflected in their ability to construct and utilize concept maps. However, improvements in metacognitive self-regulated learning (SRL) components were more limited, highlighting the inherently long-term and developmental nature of SRL. Students generally recognized the value of the introduced strategies, yet they emphasized the need for continued practice and reinforcement to fully integrate them into their learning routines. These insights provide a deeper understanding of the quantitative results and underscore the importance of sustained scaffolding and ongoing support in distance learning environments.

#### *Integration of Quantitative and Qualitative Results*

The integration of quantitative and qualitative findings provides a more comprehensive understanding of how the SQ3R and concept mapping intervention influenced students' learning processes in a distance education environment. Overall, the qualitative insights strongly reinforce, contextualize, and explain the statistical patterns identified in the quantitative phase.

#### *Convergence Between Quantitative Gains and Reported Improvements in Strategy Use*

Quantitative analyses revealed statistically significant gains in pretest–posttest scores, with a small-to-moderate effect size ( $d = 0.24$ ). These improvements primarily reflected increases in comprehension and the ability to organize information. The qualitative data support this pattern: students consistently described clearer, more structured reading processes after the intervention. For example, students reported that the Survey and Question steps helped them approach texts more strategically, aligning directly with higher performance on SQ3R-related items. Likewise, improvements in concept mapping items correspond with students' reflections on improved organization and clearer conceptual understanding.

Thus, quantitative gains in cognitive and organizational skills are mirrored by students' subjective experiences.

#### *Explanation for Limited Improvements in SRL-Related Items*

Quantitatively, SRL-related items showed the smallest gains. The qualitative findings provide strong explanatory support for this: many students struggled with motivation, reflection, and time management – core components of SRL. Students who were working adults frequently noted challenges in maintaining focus and sustaining metacognitive habits. Their comments explain why SRL-based items improved only modestly, despite the strategy training. This triangulation indicates

that SRL development requires longer-term support, beyond the scope of a short intervention.

#### *Subgroup Differences Clarified Through Qualitative Accounts*

Subgroup analysis indicated that adult learners, particularly those aged 26–35 and 36 and above, experienced the largest improvements, while male students showed slightly higher gains than female students. Qualitative interviews provide further insight into these patterns. Adult learners expressed a strong appreciation for the structured nature of SQ3R and concept mapping, as these strategies helped them manage their learning more efficiently alongside work and family responsibilities. Meanwhile, several male students—especially those with lower initial pretest scores—reported that the strategies enabled them to better understand reading materials and organize information, effectively helping them “catch up” through clearer guidance in comprehension and note-taking. These qualitative accounts support and enrich the interpretation of subgroup differences observed in the quantitative analysis.

#### *Complementary Insights: The Need for More Practice*

Both data strands converge on the idea that while the intervention was effective, its impact could be enhanced with continued use. Quantitative results revealed improvement, but not dramatic shifts – consistent with the qualitative theme that students wished for extended and repeated practice opportunities.

This integration suggests that: The intervention was successful as a short-term boost but holds greater potential when implemented longitudinally.

#### *Overall Inference: Strengthening Cognitive Skills Precedes Metacognitive Growth*

By combining both quantitative and qualitative data, a coherent pattern emerges. Cognitive strategies, particularly SQ3R, showed the most substantial improvement, indicating that students were able to quickly adopt structured reading techniques. Organizational strategies, such as concept mapping, demonstrated moderate gains, suggesting that while students benefited from visualizing relationships among concepts, they required more practice to use these tools effectively. In contrast, metacognitive self-regulated learning (SRL) skills showed the least improvement, reflecting the more complex and habitual nature of these competencies.

Qualitative reflections further support these findings. Students reported that SQ3R and concept mapping were immediately useful and could be directly applied to their learning tasks. However, they also

indicated that developing self-regulated learning skills required sustained practice, guidance, and reinforcement over a longer period. This layered understanding would not have been fully captured through quantitative analysis alone.

Overall, the integration of quantitative and qualitative findings demonstrates that the intervention was effective in enhancing students' cognitive and organizational learning abilities. At the same time, it reveals ongoing challenges in strengthening self-regulated learning, which necessitate continuous support and longer-term instructional strategies. The mixed-methods approach thus provides a more comprehensive understanding of learners' progress and offers practical insights for improving strategy-based instruction in distance education contexts.

### *Discussion*

The purpose of this study was to investigate the effectiveness of a dual-strategy intervention—SQ3R and concept mapping—in enhancing students' learning performance and self-regulated learning (SRL) in a distance learning context. By integrating quantitative outcomes and qualitative insights, the study provides a comprehensive perspective on how cognitive and metacognitive strategies function within online and open distance learning (ODL), where learner autonomy, motivation, and strategy use are particularly consequential.

The quantitative results demonstrate a statistically significant increase in students' posttest performance compared to their pretest scores, with a small-to-moderate effect size. Items related to SQ3R showed the most substantial improvement, followed by moderated gains in concept mapping items. SRL-related items, however, exhibited only minimal change. Subgroup analyses further indicated that older learners (26+) benefitted more from the intervention than their younger counterparts, and male students recorded slightly higher gains than female students.

Qualitative findings reinforce and explain these patterns. Students consistently described improved clarity and focus in their reading processes and expressed that concept mapping helped them better organize and recall complex material. At the same time, many acknowledged persistent challenges with self-monitoring, sustaining attention, and maintaining motivation—key components of SRL.

### *Interpretation in Light of Existing Literature*

#### *Improvements in Cognitive Strategy Use (SQ3R)*

The strongest quantitative gains occurred in SQ3R-related items, a finding that aligns with previous studies demonstrating the effectiveness of structured reading strategies in improving comprehension. SQ3R

encourages learners to preview content, formulate guiding questions, actively engage with the text, and consolidate understanding through review (McNamara, 2007). The qualitative accounts in this study confirm that these steps helped students shift from passive to purposeful reading.

Similar improvements have been reported in other research where SQ3R was used to scaffold text engagement and comprehension, especially in environments where learners must independently navigate dense instructional materials (Dimitropoulou et al., 2025). These parallels suggest that SQ3R provides a cognitive framework particularly suitable for distance learners who often struggle with unfocused reading and information overload.

#### *Gains in Organizational Strategy Use (Concept Mapping)*

The moderate improvement in concept mapping is consistent with literature emphasizing the value of mapping tools in promoting meaningful learning. According to Ausubel's cognitive theory of assimilation, new knowledge becomes meaningful when it is connected to existing conceptual structures (Gagné et al., 1969). Concept maps help visualize these connections, enabling hierarchical organization and deeper conceptual integration.

This study's qualitative data reveal that learners found concept mapping especially helpful when dealing with complex theoretical topics. Such findings echo research by Novak et al. (2008), who showed that concept mapping supports long-term retention and conceptual clarity. Meta-analytic evidence also indicates that mapping strategies improve comprehension across subject areas (Nesbit & Adesope, 2006), further validating the patterns observed in this study.

#### *Limited Improvements in Metacognitive SRL Skills*

The modest changes in SRL-related items align with the broader consensus that SRL is difficult to modify through short-term instruction. SRL encompasses metacognitive monitoring, planning, motivation, and reflective evaluation—skills that develop gradually through prolonged engagement and feedback (Pintrich, 2004; Zimmerman, 2002).

In distance learning environments, SRL becomes even more challenging due to reduced instructor presence, high autonomy, and competing responsibilities, particularly for adult learners (Broadbent & Poon, 2015). Student narratives in this study highlight persistent difficulties in maintaining focus, managing study time, and reflecting on learning outcomes, which helps explain the small quantitative gains in SRL measures.

*Interpretation of Subgroup Trends**Age Differences*

Older learners (ages 26–35 and 36+) demonstrated the highest gains in comprehension and strategy use. This is consistent with andragogical principles emphasizing that adult learners tend to be more self-directed, goal-oriented, and motivated by practical relevance (Knowles, 1978). Adults interviewed in this study described valuing the structure provided by SQ3R and concept mapping because these strategies helped them efficiently navigate study materials amid work and family responsibilities.

*Gender Differences*

The slightly higher improvement among male students may be attributed to lower baseline scores, providing greater room for growth. Prior research suggests that students with weaker initial study strategies benefit more from explicit cognitive scaffolding (Dunlosky et al., 2013). Qualitative feedback also indicated that male students, particularly those with limited prior exposure to structured reading techniques, experienced a sharper shift in their approach to studying.

*Integration with Qualitative Insights*

A key strength of this study lies in the triangulation of mixed-methods data. The qualitative interviews not only confirmed the statistical improvements in SQ3R and concept mapping but also explained why these improvements occurred. Students highlighted increased clarity, stronger structural understanding, and improved retention—factors that directly map onto the observed quantitative patterns.

Meanwhile, the limited gains in SRL were explained by students' reported struggles with maintaining focus, overcoming distractions, and engaging in reflective evaluation. These insights illustrate the layered nature of SRL development and emphasize that cognitive strategy training may serve as a necessary foundation for, but not substitute for, deeper metacognitive growth.

**Conclusion**

This study examined the effectiveness of a dual-strategy intervention—SQ3R and concept mapping—in supporting students' learning in an online and open distance learning context. The findings indicate that the intervention was associated with a statistically significant but practically small improvement in students' performance ( $d = 0.24$ ). This suggests that the intervention contributed to short-term gains, but its overall impact on learning outcomes was limited.

The results show that the intervention was most effective in improving cognitive and procedural strategy use, particularly in applying SQ3R, and to a moderate extent in organizing information through concept mapping. However, improvements in self-regulated learning (SRL) were minimal. This indicates that while students became more aware of effective learning strategies, the intervention did not substantially change their metacognitive habits within the short duration of the program. The relatively high pretest scores suggest the presence of a ceiling effect, which limited the observable magnitude of improvement. This implies that the intervention may yield stronger effects when applied to learners with lower initial performance levels. Therefore, the findings should not be generalized as equally effective for all learner groups. Importantly, the results highlight that a short, one-shot training intervention is insufficient to produce meaningful changes in self-regulated learning. While such an approach can enhance strategy awareness and procedural understanding, the development of SRL requires sustained practice, reinforcement, and integration into ongoing learning activities. From a theoretical perspective, this study supports the view that cognitive, organizational, and metacognitive components of learning develop at different rates. Cognitive strategies can be acquired relatively quickly, whereas metacognitive regulation requires longer-term engagement and iterative practice. From a practical standpoint, the findings suggest that SQ3R and concept mapping should not be implemented as isolated workshops, but rather integrated longitudinally into course design, supported by repeated application, guided reflection, and feedback mechanisms within distance learning environments. Future research should explore longitudinal and experimental designs, including the use of control groups, to better assess causal effects. Studies focusing on learners with lower baseline performance may provide clearer evidence of effectiveness. In addition, future work should investigate technology-supported SRL interventions, such as adaptive learning systems, learning analytics, or AI-based feedback tools, to support sustained development of self-regulated learning skills over time. Overall, this study contributes to the understanding that structured learning strategies can support short-term improvements in cognitive and organizational aspects of learning, but long-term development of self-regulated learning requires continuous and sustained instructional support.

**Acknowledgments**

The authors would like to express their sincere gratitude for the recognition and support provided in relation to this study. We are honored that this work has been reviewed, referenced,

and accepted by a respected journal such as *JPPIPA* (*jppipa.unram.ac.id*). The constructive feedback and scholarly engagement have significantly contributed to the improvement and refinement of this manuscript.

#### Author Contributions

Conceptualization, E.K. and P.S.; methodology, E.K. and P.S.; validation, E.K. and P.S.; formal analysis, P.S.; investigation, E.K. and P.S.; resources, E.K.; data curation, P.S.; writing – original draft preparation, P.S.; writing – review and editing, E.K.; visualization, P.S.

#### Funding

This research received no external funding and was independently financed by the authors.

#### Conflicts of Interest

The authors declare no conflict of interest.

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