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# The Effect of Metacognitive Strategy Instruction on Self-Regulated Learning in Students with Special Educational Needs

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## Abstract

Self-regulated learning (SRL) is a critical competency for academic success, particularly for students with special educational needs (SEN) who often face challenges in managing their learning independently. Although metacognitive strategy instruction has been shown to enhance SRL, empirical research remains scarce examining its effectiveness among SEN learners in non-Western and Arabic-speaking contexts. This study investigated the impact of explicit metacognitive strategy instruction—focused on planning, monitoring, and evaluation—on the self-regulated learning success of students with SEN in Palestine. The aim was to determine the effectiveness and inclusivity of this intervention across disability types and genders. A quasi-experimental, pre-/post-test control group design was implemented at Al-Bakriya Special Education School. The sample comprised 40 students (ages 11–15) with LD, ADHD, or MID, randomly assigned to either an experimental or control group. The intervention spanned 18 sessions over six weeks. Data were collected using an adapted SRL inventory, observation checklists, and student journals. Statistical analyses included paired-sample and independent-sample t-tests, two-way ANOVAs, and effect size calculations. The experimental group demonstrated statistically significant improvements

in overall SRL and each subcomponent—planning, monitoring, and evaluation—with large effect sizes (d > 1.5). No significant changes were observed in the control group. Two-way ANOVA results showed no moderation effects by gender or disability type. Qualitative data confirmed increased metacognitive awareness and engagement. Findings underscore the potential of metacognitive instruction as a scalable and equitable approach to supporting SRL in special education. The study offers a model for localized, evidence-based pedagogical practice that can inform policy and teacher training in inclusive education systems.

**Keywords:** Metacognitive Strategy Instruction, Self-Regulated Learning (SRL), Special Educational Needs (SEN), Inclusive Education, Educational Psychology.

## * Introduction

Self-regulated learning (SRL) is a key idea in educational psychology, describing learners' ability to take charge of their learning. This includes setting goals, making plans, keeping track of their progress, and reviewing their performance (Zimmerman, 2000; Efklides & Schwartz, 2024). Rather than just being a thinking skill, SRL is now seen as a combination of how learners think, feel, stay motivated, and control their actions (Zheng, Lajoie, & Li, 2023; Winne, 2022). Research consistently shows that strong self-regulation is linked to better academic outcomes, perseverance, and flexible problem-solving across various learning settings (Theobald, 2021; Callan et al., 2022).

A central part of SRL is using metacognitive strategies—intentional actions that help students plan, observe, and assess their learning. These strategies allow learners to manage their thinking, adjust their study, and reflect on their progress to improve over time (Flavell, 1979; Ozturk, 2024). Planning involves setting goals and choosing methods to reach them; monitoring refers to checking understanding and tracking how tasks are going; and evaluation means reviewing learning after the task is completed (Safari, Ghaemi, & Siyyari, 2024).

This study draws on two main theories: Zimmerman's (2000) model of SRL and Flavell's (1979) metacognitive theory. Zimmerman outlines three phases in self-regulated learning—preparation, action, and reflection—each supported by thinking skills and motivation. Flavell adds to this view by separating what learners know about

thinking (such as knowing strategies and understanding tasks) from how they control and adjust their thinking in real time (Efklides & Schwartz, 2024; Ozturk, 2024). Together, these theories provide a strong foundation for exploring how direct instruction in metacognitive strategies can improve SRL.

For students with special educational needs (SEN), including those with learning difficulties, ADHD, or mild intellectual disabilities, learning to regulate their learning is especially hard (Butler, 1995; Rehan, John, & Nazli, 2025). These students often struggle with memory, attention, and organizing their actions, making it difficult to plan, track, and reflect on their learning effectively (Montague, 2007; Budin, Patti, & Rafferty, 2022). As a result, they are at greater risk of falling behind in school, losing interest, and developing a sense of helplessness (Vosniadou et al., 2021; Elbaum et al., 2018).

Even though the value of SRL is well known, there is still a significant gap in understanding how to teach these skills to students with SEN. Without direct teaching and step-by-step guidance, many students struggle to apply SRL strategies independently and rely heavily on teacher support (Berger, 2023; Braad et al., 2022). While some general education classrooms have begun to adopt methods that encourage SRL, such approaches are not common or are poorly adapted in special education, especially where resources are limited.

One effective teaching method is explicit instruction in metacognitive strategies. This involves clearly showing students how to use thinking strategies, giving them guided practice, offering feedback, and encouraging them to reflect on their learning. This approach is especially helpful for students with learning challenges, as it helps them approach academic work more thoughtfully and independently (Butler, 1995; Rehan et al., 2025). Growing evidence supports this method's ability to boost performance, motivation, and self-awareness in typical and special needs learners (Montague, 2007; Celik, 2022; Stebner et al., 2022). In addition to personal benefits, metacognitive instruction supports the goals of inclusive education. It helps students become more independent, flexible, and resilient—crucial skills for equal access to learning opportunities (Courtade, Test, & Cook, 2014; Brünner et al., 2024). This is especially important in places where financial and social

challenges limit the availability of tailored educational programs.

In Palestine, these difficulties are even more pronounced. Although policies support inclusive education, schools in the West Bank and Gaza often struggle with large class sizes, undertrained teachers, outdated technology, and a lack of services for SEN students (Samara, 2024; Aburub & Assaf, 2022). As a result, the potential benefits of teaching metacognitive strategies have not been fully explored, particularly in special education schools where custom teaching methods are rarely used on a broad scale. Still, recent local studies have shown that SRL-focused teaching methods may have promise in Palestinian classrooms. For example, Shatroubi and Ramirez-Garcia (2023) found that coaching improved SRL and student engagement among disadvantaged learners, and Marawa'a (2024) discovered that supportive metacognitive strategies helped reduce anxiety and improve confidence at the university level. However, these efforts are still in early stages and have not fully examined students with special needs or used strong research methods.

This study aims to fill this gap by testing a structured program that teaches metacognitive strategies at Al-Bakriya Special Education School in the northern West Bank. The school was chosen because of its commitment to inclusive teaching, small class sizes, and experienced staff. Despite these advantages, Al-Bakriya still faces challenges common to many Palestinian schools, such as limited facilities and materials, making it a valuable site for testing practical and scalable teaching strategies (Saada, 2021). Much of the existing research on SRL and metacognition comes from Western or wealthy countries, leaving a gap in understanding how these concepts apply in Arabic-speaking or conflict-affected regions. Studies usually focus on older students or general education settings, with little attention paid to younger learners with special needs (Xu et al., 2023; Werdiningsih, Al-Rashidi, & Azami, 2022). Furthermore, few studies in these contexts use strong research designs like quasi-experimental or mixed-method approaches (Taghani & Razavi, 2022; Sethares & Asselin, 2022).

To address this, the current study examines how teaching metacognitive strategies affects the self-regulation skills of SEN students in Palestine. The program focuses on three key areas: planning,

monitoring, and evaluating, all delivered through structured lessons and reflection activities. This research has two main goals. First, it seeks to understand better how SRL and thinking skills develop in students with learning difficulties. Second, it aims to create and test a teaching model that fits the cultural and practical needs of special education in Palestine.

By carrying out the program in a real school and using numbers and stories to measure outcomes, the study helps bridge the gap between theory and classroom practice. It builds on Zimmerman's and Flavell's models, extending their use to often overlooked students and schools. At the same time, it offers a flexible, evidence-based way to improve SRL in special education. Lastly, this study has a broader meaning for inclusive education. It shows that SRL skills can be taught to all students, regardless of their abilities or backgrounds, and that doing so supports fair and equal access to quality education. In this way, the research adds to a more diverse and practical understanding of self-regulated learning around the world.

*** Literature Review**

**1- Theoretical Foundations of Self-Regulated Learning**

Self-regulated learning (SRL) has become a major focus in educational psychology, reflecting a shift toward teaching methods that give students more control over their learning. This approach emphasizes independent thinking, goal setting, and maintaining motivation (Theobald, 2021; Li & Lajoie, 2022). SRL is not a fixed set of techniques but an active and flexible process involving thinking skills, emotional responses, and behaviors that help learners adjust to various academic challenges (Efklides & Schwartz, 2024). A key feature of SRL is the learner's ability to set goals, track their progress, choose helpful strategies, and evaluate results in a cycle aimed at continuous improvement (Zheng, Lajoie, & Li, 2023).

Over time, scholars have refined SRL theories to explain better how students manage their learning. Many of these theories highlight the importance of metacognition (thinking about one's thinking) and motivation as core elements of effective self-regulation (Saint et al., 2022; Molenaar, 2022). One of the most influential models is Zimmerman's cyclical framework,

which breaks the learning process into three stages—planning, doing, and reflecting. These stages help students fine-tune their learning strategies (Callan et al., 2022; Parra-Gavilánez & Totoy, 2023). This model is especially useful in designing classroom activities, including digital tools to support students' reflective thinking (Brünner et al., 2024; Steinert et al., 2023).

**1- Zimmerman's Cyclical Model of Self-Regulated Learning**

Zimmerman's model explains SRL as a repeating cycle of three connected phases: planning (forethought), action (performance), and reflection (Zimmerman, 2000; Parra-Gavilánez & Totoy, 2023). In the planning phase, students decide how to approach a task and build confidence by focusing on why the task matters (Safari, Ghaemi, & Siyyari, 2022). During the performance phase, they apply learning strategies, manage their attention, and monitor their progress (Callan et al., 2021). Finally, in the reflection phase, students assess their outcomes and consider why they succeeded or struggled, which shapes how they approach future tasks (Callan et al., 2022; Efklides & Schwartz, 2024).

This model is particularly useful because it focuses on feedback loops—each phase builds on the last and helps learners adjust their approach over time (Zheng, Lajoie, & Li, 2023). Research shows that students who use all three stages tend to be more motivated, independent, and successful in various learning settings (Theobald, 2021; Safari, Ghaemi, & Siyyari, 2024). In settings like special education or language learning, where students often need extra support, the model has been found to help with both language skills and managing emotions (Safari et al., 2022, 2024).

New developments in digital education have further expanded the reach of Zimmerman's model. For example, tools that give immediate feedback now guide students through the stages of SRL, helping them stay focused and reflect on their learning in real time (Steinert et al., 2023; Brünner et al., 2024). Data analysis techniques also confirm the step-by-step nature of SRL, showing how students move between the phases and how emotional control influences reflection (Saint et al., 2022; Zheng et al., 2023).

Zimmerman's model has also been applied to specific areas like academic writing. When writing tasks are aligned with the three SRL stages—such as planning, drafting, and revising—students become more

aware of how they learn and improve their writing skills (Parra-Gavilánez & Totoy, 2023). Blending SRL with theories of cognitive involvement has also led to a deeper understanding of how students make choices and take charge of their learning (Li & Lajoie, 2022; Tran & Hasegawa, 2021).

In summary, Zimmerman's framework provides a strong, research-backed way to understand and improve self-regulated learning. Its cyclical nature reflects how effective learning happens in stages, with metacognition playing a vital role in helping students adjust and succeed (Efklides & Schwartz, 2024; Theobald, 2021).

**2- Flavell's Theory of Metacognition**

In addition to Zimmerman's model, Flavell's theory of metacognition offers insight into how students control their thinking. He separates this into two parts: knowing about thinking, such as understanding which strategies to use and being aware of one's learning style, and managing thinking, such as planning, tracking progress, and checking results (Xie, Lei, & Xie, 2022; Zhang, 2023).

These two elements work together to help students choose the right strategies and change their behavior based on feedback or task demands (Stebner et al., 2022). Research shows that controlling these thinking processes is especially helpful when students face complex or unfamiliar tasks, as it helps them stay focused and keep trying even when challenges arise (Rehan, John, & Nazli, 2025). Teaching tools like reflection questions and detailed feedback can help students improve these skills by prompting them to think more deeply about their learning (Ozturk, 2024; Berger, 2023).

Flavell's ideas also apply well in online learning. For instance, digital portfolios and interactive apps allow students to make their thinking visible, helping them better understand and manage how they learn (Segaran & Hasim, 2021; Winne, 2022). More and more, instructional methods based on this theory include technology that encourages reflection and smart decision-making (Braad et al., 2022).

Studies in different fields, including language learning and medical training, have shown that using metacognitive strategies based on Flavell's theory leads to better results and greater independence in learners (Chen et al., 2024; Versteeg et al., 2021). These findings suggest that the ability to manage thinking is valuable across many subjects and

helps promote meaningful, self-guided learning (Říčan, Chytrý, & Medová, 2022).

Overall, Flavell's theory clearly explains how learners regulate their thinking. Its focus on conscious control over learning makes it a valuable framework for building educational environments that support thoughtful learning and reflective habits (Ozturk, 2024; Berger, 2023).

**2- Metacognitive Strategies and Their Instructional Value**

Metacognitive strategies are central to self-regulated learning by helping students manage their thinking during learning activities. These strategies include planning (such as setting goals and analyzing tasks), monitoring (like checking understanding while working), and evaluating (reflecting on how effective the strategies were after completing a task) (Kuhn, 2022; Vosniadou et al., 2021; Zhang et al., 2021).

Unlike cognitive strategies, which focus on understanding and remembering information, metacognitive strategies guide when and how those learning techniques are used. In other words, they help students decide the best time and way to use what they know (Budin, Patti, & Rafferty, 2022; Cromley, 2023). Learners aware of these processes often feel more confident, are more adaptable, and can use what they learn in different settings (Cheng & Chan, 2021; Yokuş, 2021).

Teaching these strategies effectively usually involves clear, direct instruction, teacher demonstrations, and step-by-step practice. Explicit teaching helps students understand how the strategies work, while modeling shows how experienced learners apply them in real situations (Celik, 2022; Kuhn, 2022). Guided practice, where students try strategies with support and feedback, helps them become more comfortable and independent in using them over time (Anthonysamy, 2023; Alfaifi, 2022).

Well-known teaching models, such as those developed by Butler (1995) and Montague (2007), have shown that structured training in metacognitive strategies can lead to better academic outcomes and greater student independence. These benefits are often more noticeable in digital learning environments, where support tools can be adapted to match each learner's background knowledge and motivation (Ali et al., 2024; Zhang et al., 2022).

In English as a Foreign Language (EFL), strategy instruction based on metacognitive principles

has improved language skills and learners' ability to think strategically about how they learn (Robillos & Bustos, 2022; Cheng & Chan, 2021). Across different educational settings, teaching practices that include reflection, feedback, and student-centered learning tend to boost motivation, persistence, and flexibility in using learning strategies (Cai, King, & McInerney, 2022).

To summarize, teaching metacognitive strategies is essential for helping students become reflective and self-sufficient learners. This kind of instruction supports long-term learning habits and helps learners adapt to new challenges (Zhang et al., 2021; Cromley, 2023).

**3- Self-Regulated Learning (SRL): Concepts and Constructs**

Self-regulated learning (SRL) is a process where learners take control of their academic growth by planning, monitoring, and evaluating how they think and behave during learning. This approach aims to improve school performance and personal development (Efklides & Schwartz, 2024; Theobald, 2021). The key elements—setting goals, tracking progress, and assessing outcomes—help students align their efforts with the task's requirements. This coordination helps them make adjustments based on their reflections and the feedback they receive (Zheng, Lajoie, & Li, 2023; Callan et al., 2022). Setting goals gives direction and purpose, monitoring ensures learners stay on track, and evaluation helps them identify what worked and needs improvement (Tran & Hasegawa, 2022; Saint et al., 2022).

These parts function in a cycle, where each experience informs the next. As a result, learners become more independent and build confidence in their ability to succeed (Safari, Ghaemi, & Siyyari, 2024; Callan et al., 2021). Research has also shown that SRL is strongly linked to academic motivation. Internally motivated students tend to stick with difficult tasks and learn from failure (Berger, 2023; Celik, 2022). Being in control of their learning supports SRL and grows out of it, allowing learners to take responsibility for shaping their educational paths (Li & Lajoie, 2022; Rehan, John, & Nazli, 2025). SRL combines several skills, including managing thoughts, emotions, and the learning environment (Brünner et al., 2024; Xie, Lei, & Xie, 2022).

Teaching SRL involves strategies that help students think about their thinking, reflect on their progress, and learn through meaningful feedback. These methods

encourage students to make thoughtful learning choices and respond flexibly to academic challenges (Stebner et al., 2022; Winne, 2022). In recent years, digital tools—like learning dashboards and reflection apps—have helped students manage their learning by offering immediate insights into their progress and emotional state (Molenaar, 2022; Braad et al., 2022).

However, teaching SRL in special education settings comes with specific challenges. Students with learning disabilities (LD), ADHD, or mild intellectual disabilities (MID) often struggle with planning, monitoring, and adjusting their learning strategies. They may also have trouble with attention and memory, making working independently harder (Efklides & Schwartz, 2024; Zhang, 2023; Callan et al., 2022; Saint et al., 2022).

Despite these obstacles, research shows that customized teaching methods can help. Combining personal guidance with smart feedback tools has proven useful in helping these students follow the SRL process and improve their ability to manage their learning (Brünner et al., 2024; Steinert et al., 2023). For example, real-time tools that offer prompts and visual aids can help students stay focused and manage their feelings while learning (Ozturk, 2024; Zheng et al., 2023).

Equally important are teaching strategies that directly support students with special needs, such as modeling, practicing with guidance, and structured self-checks. These approaches strengthen metacognitive thinking and improve students' motivation, confidence, and ability to manage emotions (Budin, Patti, & Rafferty, 2022; Chen et al., 2024; Versteeg et al., 2021). When used in inclusive classrooms, SRL programs help students apply what they learn in new situations and become more resilient, turning SRL into a powerful tool for long-term learning success (Říčan, Chytrý, & Medová, 2022; Anthonysamy, 2023).

**4- Empirical Studies on Metacognitive Strategy Instruction**

A large number of studies have confirmed that teaching metacognitive strategies has a positive effect on students' academic performance and their ability to manage their learning. These benefits have been seen across different subjects and education levels (Celik, 2022; Pradhan & Das, 2021). The research shows that metacognitive instruction helps students feel more confident, become more aware of their learning strategies, and stay committed to their academic goals.

This is especially important at the university level, where students are expected to take more responsibility for their learning (Taghani & Razavi, 2022; Rao, Jeevan, & Ahmad, 2023).

Studies focusing on specific subjects like reading, science, math, and writing further highlight the usefulness of metacognitive strategies. In areas such as STEM, students who receive this type of training are better at solving problems and can switch strategies more easily when needed (Özçakmak et al., 2021; Sethares & Asselin, 2022). This aligns with findings that metacognitive support encourages deeper understanding by helping learners monitor and assess their thinking during complex tasks (Higgins, Rathner, & Frankland, 2023).

More recently, research has expanded into digital and blended learning environments. In these contexts, tools that support metacognitive thinking have led to better performance and greater student persistence—even during disruptions like those caused by the COVID-19 pandemic (Xu et al., 2022; Dai et al., 2021). Notably, primary and secondary students who develop metacognitive awareness tend to perform better on standardized tests, suggesting these strategies are useful for younger learners as well (Nieto-Márquez, García-Sinausía, & Nieto, 2021; Estévez et al., 2021).

Reviews of multiple studies also confirm that SRL and metacognitive instruction are generally effective. They point out that students' beliefs and emotions, such as how they see themselves as learners or manage stress, can influence how well they use these strategies (Xu et al., 2023; Feraco et al., 2023). This connection between thinking skills and emotions shows that developing metacognitive abilities can improve academic skills and personal growth (Vosniadou et al., 2021).

Structured teaching methods help students learn how to choose strategies, track their progress, and reflect on what works best. These practices support the long-term use of learning strategies in different situations, showing that the skills are becoming part of the learner's regular behavior (Sutarni et al., 2021; Higgins et al., 2023). Studies over longer periods have shown that metacognitive training can build independence and resilience, helping students deal with future academic challenges (Hsu, Chen, & Shin, 2022; Xu et al., 2022).

Importantly, the benefits of these strategies go beyond academics. Learners have improved their abilities to manage their emotions, organize their time, and think creatively. These broader skills are often encouraged through activities like peer discussion, guided reflection, and regular feedback, which help students apply what they learn in real-life situations (Feraco et al., 2023; Celik, 2022; Discipulo & Bautista, 2022; Sethares & Asselin, 2022).

**6- Gaps in the Literature and Rationale for the Present Study**

Even though research supports the benefits of metacognitive strategy instruction, important gaps remain, particularly in regions and populations that have not been widely studied. Most of the current research comes from Western and East Asian countries, which makes it difficult to apply those findings directly to Arabic-speaking or resource-limited settings like Palestine (Xu et al., 2023; Vosniadou et al., 2021). There is especially limited knowledge about how to adapt metacognitive instruction to meet the learning, language, and emotional needs of students with special educational needs (SEN) in Arabic-speaking classrooms (Taghani & Razavi, 2022; Werdiningsih, Al-Rashidi, & Azami, 2022).

In addition, many existing studies do not clearly distinguish between general education students and those with learning challenges such as disabilities, ADHD, or mild intellectual impairments. This lack of detail prevents a full understanding of how SRL works for different types of learners (Sotardi, 2022; Estévez et al., 2021). As a result, it becomes difficult to create inclusive teaching methods that meet the specific challenges faced by SEN students—challenges that often involve difficulties with attention, memory, and motivation (Pradhan & Das, 2021; Rao et al., 2023).

Another key issue is that we still don't know enough about how metacognitive instruction affects the different parts of SRL—planning, monitoring, and evaluation—especially in special education contexts (Karlen et al., 2021; Ha, Roehrig, & Zhang, 2023). While some studies have shown a link between metacognition and better learning outcomes, few have used detailed research methods to track how instruction changes students' learning behavior over time (Sethares & Asselin, 2022; Xu et al., 2022).

To help close these gaps, this study explores how teaching

metacognitive strategies influences SRL among students with SEN at Al-Bakriya Special Education School in Palestine. It focuses on how learners' planning, monitoring, and evaluation behaviors change after receiving structured instruction, while also examining how individual factors like disability type, age, and gender affect the results.

The study uses a quasi-experimental, mixed-methods approach, combining numerical data with student and teacher feedback to better understand how SRL develops in real classrooms (Hsu, Chen, & Shin, 2022; Xu et al., 2022). This approach provides a more complete and balanced view, offering practical teaching insights relevant to the Palestinian context. The goal is to add to existing theories while creating practical strategies that support more effective, inclusive, and culturally sensitive teaching of SRL and metacognitive skills.

*** Methodology**

**1- Research Design**

This research used a quantitative, quasi-experimental design to explore how teaching metacognitive strategies might impact the ability of students with special educational needs (SEN) to manage their learning. The study was carried out at Al-Bakriya Special Education School in Palestine. A quasi-experimental approach was chosen because fully randomizing students into different groups in real-world school environments is often not practical or ethical (Shadish, Cook, & Campbell, 2002). In special education settings, it's particularly important to maintain classroom stability and protect students' well-being while still applying strong research methods (Mertens, 2020).

The study's main goal was to determine whether directly teaching metacognitive strategies, like planning, monitoring, and evaluating one's learning, could help SEN students become more self-directed. Previous studies have shown that this kind of teaching helps students better manage their thinking and improves their academic performance (Dignath & Büttner, 2008; Donker et al., 2014). Such strategies could be especially useful for students with SEN, who often benefit from added guidance (Scruggs & Mastropieri, 2002). To measure this, a pre-test/post-test control group setup was used. One group of students received lessons on metacognitive strategies, while the other group continued with their usual classes. Both groups completed the same tests before and after the intervention to compare their development in self-regulated

learning. This design allowed the researcher to assess changes within each group and compare the two groups after the teaching period ended, following established practices in education research (Creswell & Creswell, 2018).

The design was based on Zimmerman's (2000) model of self-regulated learning, which describes a cycle of planning, monitoring, and evaluating learning, and Flavell's (1979) ideas about metacognition, which distinguish between knowing about one's thinking and managing it. Zimmerman's model helped shape the lessons provided to students, while Flavell's theory offered a framework for helping them become more aware of how they think and learn. These theories are widely used in education to promote independent learning, motivation, and effective study habits (Schunk & Greene, 2018). To make the study more relevant to the specific group of students, the researcher also considered how characteristics such as age, gender, and type of disability might affect how students respond to the lessons (Veenman, Van Hout-Wolters, & Afflerbach, 2006). By combining strong theoretical foundations with sensitivity to students' backgrounds, the research design connected the main questions, teaching methods, and measurement tools consistently and thoughtfully.

**2- Research Setting**

This study occurred at Al-Bakriya Special Education School, a government-run institution in northern West Bank, Palestine. The school supports a varied group of students with SEN, including those with learning disabilities, ADHD, mild intellectual challenges, and communication disorders. It offers programs that blend academic subjects with life skills, adapting lessons to meet individual needs. The school focuses on helping students develop socially and mentally, with small classes of 5 to 10 students that allow for tailored teaching methods. The teaching staff includes certified special education instructors, with help from counselors and support workers.

Palestine's educational system provides both opportunities and difficulties when it comes to applying research-based teaching methods. While the country has recently supported inclusive and customized education (Abu-Hamour & Al-Hmouz, 2013), there are still challenges like limited resources, outdated facilities, and inconsistent teacher training (Amr, 2011; UNICEF, 2020). Within this landscape, Al-Bakriya stands out as a

suitable site for testing new teaching strategies informed by educational theory.

Choosing this school made sense both practically and educationally. The school's emphasis on personalized instruction and student engagement matched the study's goals. It also allowed the research to take place in real classrooms, adding to the findings' reliability and relevance (Creswell & Creswell, 2018). Importantly, by focusing on a Palestinian school, this study helps fill a gap in educational research, which has often centered on Western settings (Dignath & Veenman, 2021). This makes the findings more applicable to other underrepresented educational systems, providing a better understanding of how metacognitive strategies can help students manage their learning in different cultural contexts.

**3- Population and Sampling**

The study focused on students with SEN who were enrolled at Al-Bakriya School. Participants were those who had been formally diagnosed with conditions like learning disabilities, ADHD, or similar developmental issues. These students often struggle with managing their learning, making them a key group for testing strategies to improve metacognitive skills (Butler, 1995; Montague, 2007). A purposive sampling method was used, meaning students were chosen based on specific criteria that matched the study's goals (Palinkas et al., 2015). The selected participants were from grades 5 to 9, an age group developmentally ready to understand and apply metacognitive lessons. This made it easier to focus on those most likely to benefit from the teaching and contribute meaningfully to the study. To qualify, students needed to meet three main conditions: they had to have a formal diagnosis, be in the target grade levels, and be able to understand Arabic well enough to participate in lessons. Students with severe intellectual disabilities, major behavioral issues, or sensory impairments were excluded to ensure that everyone in the study could engage with the teaching meaningfully (Courtade, Test, & Cook, 2014).

In total, 40 students were chosen, with 20 placed in the experimental group and 20 in the control group. This number met guidelines for detecting meaningful differences in studies like this, based on common statistical standards (Cohen, 2013). While the sample size was small, it was similar to those used

in other successful intervention studies in special education (Elbaum et al., 2018). The group was almost evenly split by gender (22 boys and 18 girls), and the students ranged from 11 to 15. Diagnoses included specific learning disabilities (60%), ADHD (25%), and mild intellectual disabilities (15%). All participants had been enrolled at the school for at least a full academic year, were comfortable in the school environment, and received instruction mainly in Arabic.

**4- Variables of the Study**

The study aimed to understand the connection between metacognitive strategy instruction (the independent variable) and how well students could manage their learning (the dependent variable). Each variable was carefully defined and broken down to match the study's theoretical background.

The independent variable referred to a teaching program focused on three main skills: planning, monitoring, and evaluating. These were taught using direct lessons, guided exercises, and reflection activities. The structure of this program was based on Flavell's (1979) ideas about metacognition and Zimmerman's (2000) model of self-regulated learning. The dependent variable—self-regulated learning success—measured how well students could take charge of their learning. This included setting goals, tracking progress, and thinking about their learning. Assessments were adapted for SEN students, using easy-to-understand self-reports and teacher observations that had been proven effective in earlier research (Butler, 1995).

To improve accuracy, the independent and dependent variables were divided into three categories: planning, monitoring, and evaluation. This mirrored the core ideas in the teaching program and the way learning success was measured. Details about how each part was defined and assessed are provided in Table 1.

**Table 1: Study Variables, Sub-Variables, and Operational Definitions**

| Variable Type | Sub-Variable | Operational Definition | Measurement Tool |
|---|---|---|---|
| Independent Variable | Planning Instruction | Structured teaching of goal-setting, time management, and task preparation strategies. | Teacher lesson plans; implementation checklist |
| | Monitoring Instruction | Instructional activities focused on self-checking, progress tracking, and task adjustment. | Observation logs, feedback forms |
| | Evaluation Instruction | Guided reflection on task outcomes and identification of strategy effectiveness. | Student reflection worksheets; teacher rubrics |
| Dependent Variable | Planning | Student's ability to plan for learning, set goals, and organize resources. | SRL self-report scale; student learning logs |
| | Monitoring | Student's ability to monitor comprehension and task execution in real time. | Task tracking checklists, teacher observations |
| | Evaluation | Student's ability to reflect on outcomes and revise strategies accordingly. | Post-task reflections, performance review forms |

To reduce the impact of other factors that might affect the results, the study also accounted for variables like the students' grade level, the language used in instruction, and how long they had been enrolled at the school. By keeping these elements consistent across groups, the

researchers could better link any changes in students' self-regulated learning to the metacognitive strategy instruction rather than to unrelated differences (Cohen, 2013; Elbaum et al., 2018).

**5- Instrumentation**

To evaluate how teaching metacognitive strategies influenced students' ability to regulate their learning, the study used a mix of standardized tools, adjusted assessments, and materials created specifically for this research. The tools were chosen for how well they matched key ideas about metacognition and self-regulated learning (SRL), and for their suitability for students in special education. The instruments were carefully reviewed to ensure they were easy to understand, culturally relevant, and appropriate for the students' cognitive levels.

The main tool was a modified version of the Self-Regulated Learning Strategy Inventory (SRLSI), originally based on Zimmerman's (2000) model, which includes three stages: planning, performance, and self-reflection. The adapted version measured how often students used strategies related to planning, monitoring, and evaluating their learning. It consisted of 15 questions (five per category), using a 5-point scale where students rated how true each statement was for them, from "never true" to "always true." This tool was aimed at capturing students' self-regulation habits in the classroom. The researcher also created a Metacognitive Instruction Observation Checklist to help verify results and track how well the lessons were being implemented. Based on Butler's (1995) teaching model, this checklist included signs of good teaching practice, such as how well teachers modeled strategies, how involved students were, and whether the lessons stayed focused on metacognitive goals. Additional materials included teacher scoring rubrics and student learning journals. These provided more in-depth insights into how students were thinking about and reflecting on their learning, especially during the evaluation phase of the program.

All instruments were translated into Modern Standard Arabic using a forward–backward translation method to ensure they kept their meaning and were understandable (Beaton et al., 2000). Three bilingual experts in educational psychology and special education reviewed the translations. Based on their feedback, changes were made to keep the questions clear and appropriate for

students' developmental levels while staying true to the original ideas.

A small-scale trial was held with 10 students from a similar school who were not part of the main study. This pilot test helped check the clarity and suitability of the materials. After reviewing feedback, some items were simplified for better understanding, which helped improve how well the instruments matched Palestinian SEN students' cultural and educational context (Elbaum et al., 2018). The SRLSI showed high reliability in the pilot test. Cronbach's alpha for the full scale was .84, with subcategories ranging from .78 for planning to .86 for evaluation, which are well above the minimum standards for educational research tools (Nunnally & Bernstein, 1994).

Experts in metacognitive instruction and special education also reviewed the tools to confirm content validity. They judged whether each item was relevant, clear, and aligned with key theories. The SRLSI's structure was tied to well-known theories of metacognition (Flavell, 1979; Zimmerman, 2000), supporting its construct validity. The observation checklist also showed strong reliability. Agreement between two independent raters was high, with Cohen's kappa at $\kappa = .87$, indicating consistent evaluations across observers. Scores from the SRLSI ranged from 15 to 75, with higher totals reflecting stronger SRL abilities. Separate scores were calculated for the three areas—planning, monitoring, and evaluation. For the observation checklist, each behavior was marked as either observed (1) or not observed (0), and scores were tallied per session. An 80% benchmark was used to indicate strong implementation, as recommended by prior studies (Courtade, Test, & Cook, 2014).

Qualitative data from journals and rubrics were examined using thematic analysis. This helped identify trends in how students reflected on and managed their learning. These findings added further support to the quantitative results and helped strengthen the study's overall conclusions (Lincoln & Guba, 1985).

**6- Intervention Procedures**

The intervention involved a structured program delivered in classrooms, focusing on teaching students how to plan, monitor, and evaluate their learning. Based on well-established models by Butler (1995) and Zimmerman (2000), the program was carefully adapted to match the abilities and language needs of students with special

educational needs. A direct teaching method was used, where strategies were taught step-by-step. Each session included teacher demonstrations, guided student practice, individual work, and group discussions. Lessons were tied to core subjects like Arabic and math to help students apply what they learned in their regular classes.

The program lasted six weeks, with three 40-minute sessions per week, totaling 18 sessions. This schedule balanced frequency and duration in a way that research suggests is effective for students with learning challenges (Courtade et al., 2014).

**The program was divided into three parts: -**

1- Planning Module (Sessions 1–6): Focused on setting goals, organizing materials, and preparing for tasks. Activities included worksheets for setting goals, planning exercises, and time management tasks.

2- Monitoring Module (Sessions 7–12): Helped students track their progress and adjust while working. Techniques included asking themselves questions, using checklists, and watching teacher demonstrations.

3- Evaluation Module (Sessions 13–18): Encouraged students to reflect after tasks and adjust their strategies. Tools included journals, self-assessment forms, and peer discussions.

All lesson materials were simplified and written in clear Arabic, with visual aids and templates to help with understanding and engagement.

The researcher helped lead the program and provided ongoing support. Before starting, a two-day training was held for teachers to explain the theory behind the program, how to teach the strategies, and how to use the observation tools. During the six weeks, classroom teachers led the lessons using a detailed guide, while the researcher observed sessions and provided coaching. Weekly meetings were held to solve problems and keep the teaching consistent.

To check whether the program was being delivered properly, a special checklist was used, adapted from proven tools (Courtade et al., 2014). It looked at four areas: whether teachers followed the plan, how accurate the lessons were, how engaged students were, and how well strategies were modeled. Two observers evaluated six randomly selected sessions, or about a third of the total. They agreed on their evaluations at a high rate ($\kappa = .89$), showing the checklist worked well. If

a session fell below the 80% quality standard, feedback was provided to help improve teaching (Odom et al., 2005).

**7- Data Collection Procedures**

The way data were gathered was closely aligned with the intervention schedule and designed to follow ethical guidelines, especially for working with students who have special needs. Both the experimental and control groups were given the same tests before and after the program to check for changes in how they managed their learning.

The entire data collection process took eight weeks. In the first week, students were introduced to the study, learned how to use the tools, and completed the initial assessments. The intervention ran from Weeks 2 to 7, and final tests were given in Week 8. Throughout the six-week period, the researcher also collected observation data and monitored how the program was being delivered.

The SRLSI was used before and after the program to measure progress in planning, monitoring, and evaluating. Tests were done in small groups of 5 to 6 students, supervised by the researcher and trained school staff. Since students had different reading abilities, the instructions were read aloud, and testing conditions were the same each time.

All parts of the process followed ethical research practices. Parents or guardians gave written permission, and students gave verbal agreement to take part. The research was approved by the ethics committee at An-Najah National University and the Palestinian Ministry of Education.

To keep information private, students were assigned codes, and all records were stored securely. Participation was optional, and students could leave the study at any time without any negative consequences, following ethical standards for working with vulnerable populations (Cohen, Manion, & Morrison, 2018).

**8- Data Analysis**

Quantitative data from the SRLSI were analyzed using SPSS (version 26) to measure the impact of the metacognitive instruction on students' ability to manage their learning. The level of significance for testing the results was set at .05.

**To answer the research questions, several statistical tests were performed: -**

1- Paired-sample t-tests checked for changes in each group before and after the program.

2- Independent-sample t-tests compared the final results between the experimental and control groups.
3- A two-way ANOVA was used to see if different factors, like gender or disability, influenced how well the program worked.

Before analyzing, the data were checked for errors, missing responses, and unusual values. Any student with more than 10% missing answers was excluded. For smaller gaps, average scores were used to fill in missing values. Descriptive statistics, including averages, standard deviations, and checks for normal data distribution, were also calculated.

Assumptions for parametric testing were checked to ensure the tests were valid. These included testing for normality using the Shapiro–Wilk test and Q–Q plots, and testing for equal group variances with Levene's test. All assumptions were met, which supported the use of t-tests and ANOVA (Cohen, 2013).

The size of the effects was also measured using Cohen's d and partial eta squared ($\eta^2$). These helped determine how meaningful the results were. Medium to large effects were considered important, using common guidelines (Cohen, 2013): $d \geq 0.50$ and $\eta^2 \geq 0.06$.

*** Results**

**1- Participant Demographics**

The final group of participants in the study consisted of 40 students from Al-Bakriya Special Education School. These students were split equally into two groups: one was the experimental group (n = 20), which received instruction focused on improving thinking and learning strategies, while the other served as the control group (n = 20), continuing with the regular curriculum. The students' ages ranged from 11 to 15 years, with an average age of 13.02 years and a standard deviation of 1.12. The gender ratio was relatively even, with 22 boys (55%) and 18 girls (45%).

All students involved in the study had been officially identified as having special educational needs, following the Palestinian Ministry of Education guidelines. When looking at the specific types of needs, 60% (24 students) were found to have specific learning disabilities, 25% (10 students) were diagnosed with attention-deficit/hyperactivity disorder, and 15% (6 students) had mild intellectual disabilities. These students were in grades 5 through 9, with the highest number of participants coming from grades 6 and 7. These middle grade levels are generally considered ideal for

introducing strategy-based learning approaches, as supported by Zimmerman (2000) and Montague (2007).

Each student had been attending the school for at least one full academic year and was taught mainly in Arabic. This consistent exposure helped ensure that students were familiar with the school environment and classroom routines, which also supported the cultural relevance and appropriateness of both the teaching methods and the tools used for evaluation (Elbaum, Arguelles, Campbell, & Saleh, 2018).

A more detailed summary of the students' background information, including gender, age, grade level, and type of disability, is shown in Table 2. The variety in the sample mirrors the diverse nature of special education settings, which adds strength to how broadly the study's results can be applied. Additionally, the even distribution across important demographic categories helps support fair comparisons between the experimental and control groups during data analysis.

**Table 2. Demographic Profile of Participants (N = 40)**

| Characteristic | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Gender | Male | 22 | 55.0 |
| | Female | 18 | 45.0 |
| Age Group (years) | 11–12 | 14 | 35.0 |
| | 13–14 | 18 | 45.0 |
| | 15 | 8 | 20.0 |
| Grade Level | Grade 5 | 6 | 15.0 |
| | Grade 6 | 12 | 30.0 |
| | Grade 7 | 10 | 25.0 |
| | Grade 8 | 7 | 17.5 |
| | Grade 9 | 5 | 12.5 |
| Type of Disability | Specific Learning Disability | 24 | 60.0 |
| | ADHD | 10 | 25.0 |
| | Mild Intellectual Disability | 6 | 15.0 |

## 2- Descriptive Statistics of SRL Scores

Descriptive statistics were calculated for the Self-Regulated Learning Strategy Inventory (SRLSI) to explore how students in both the experimental and control groups performed before and after the intervention. This inventory measures students' ability to manage their learning and includes three main components—planning, monitoring, and evaluation—along with an overall score that reflects total self-regulated learning ability.

According to the data in Table 3, both groups started with similar performance levels. The average total SRL score before the intervention was 38.15 (SD = 5.42) for the experimental group and 38.95 (SD = 5.87) for the control group. These closely matched pre-test scores indicate that the groups were fairly equal at the beginning of the study.

Following the intervention, students in the experimental group demonstrated a clear improvement in their SRL scores, with their post-test

average rising to 52.60 (SD = 6.10). The greatest gains were observed in planning and evaluation, which align with the instruction content they received. On the other hand, the control group showed only slight changes, with a post-test mean of 40.05 (SD = 5.98), suggesting limited natural improvement without targeted support.

These early findings, as illustrated in Table 3, point to the potential benefit of teaching students learning strategies that help them think about and manage their learning. The results lay a strong foundation for more detailed statistical testing, which is discussed in the following sections.

**Table 3. Descriptive Statistics of Pre and Post-Test SRL Scores (N = 40)**

| Group | SRL Dimension | Pre-Test Mean (SD) | Post-Test Mean (SD) |
|---|---|---|---|
| Experimental | Planning | 12.30 (2.10) | 17.45 (2.35) |
| | Monitoring | 12.10 (2.42) | 17.15 (2.65) |
| | Evaluation | 13.75 (1.92) | 18.00 (2.10) |
| | **Total SRL** | **38.15 (5.42)** | **52.60 (6.10)** |
| Control | Planning | 12.50 (2.05) | 13.10 (2.20) |
| | Monitoring | 12.10 (2.55) | 12.85 (2.63) |
| | Evaluation | 14.35 (2.00) | 14.10 (1.98) |
| | **Total SRL** | **38.95 (5.87)** | **40.05 (5.98)** |

## 2- Pre-Test Equivalence of Groups

To ensure that both groups were comparable before the intervention began, independent samples t-tests were conducted to check for any significant differences in their pre-test scores on the Self-Regulated Learning Strategy Inventory (SRLSI). This step was important to ensure that any changes observed after the intervention could be confidently linked to the instructional program rather than existing differences between the two groups. As shown in Table 4, the results revealed no meaningful differences in the total SRL scores or individual subscales. For instance, the average score for planning was 12.30 (SD = 2.10) in the experimental group and 12.50 (SD = 2.05) in the control group. The difference between these means was insignificant, $t(38) = -0.32$, $p = .752$. Similarly, the monitoring and evaluation scores did not differ significantly between the groups, with all p-values exceeding the typical cutoff for significance.

These results support the conclusion that the groups were statistically equivalent at the beginning of the study. As a result, any differences observed in the post-test can be more confidently attributed to the intervention itself, thus strengthening the internal validity of the research and supporting fair comparisons between the two groups in later analyses.

**Table 4. Independent Samples t-Test for Pre-Test SRL Scores Between Experimental and Control Groups (N = 40)**

| SRL Measure | Group | M | SD | t(38) | p |
|---|---|---|---|---|---|
| Planning | Experimental | 12.30 | 2.10 | -0.32 | .752 |
| | Control | 12.50 | 2.05 | | |
| Monitoring | Experimental | 12.10 | 2.42 | 0.00 | 1.000 |
| | Control | 12.10 | 2.55 | | |
| Evaluation | Experimental | 13.75 | 1.92 | -0.95 | .347 |
| | Control | 14.35 | 2.00 | | |
| **Total SRL** | Experimental | 38.15 | 5.42 | -0.45 | .656 |
| | Control | 38.95 | 5.87 | | |

## 3- Within-Group Comparisons: Pre vs. Post-Test

### 1- Experimental Group – Paired Samples t-Test

To assess the impact of the intervention within the experimental group, paired samples t-tests were conducted comparing pre- and post-test scores across all SRL domains. As shown in Table 5, statistically significant improvements were found across all measures. The total SRL score increased from 38.15 (SD = 5.42) to 52.60 (SD = 6.10), with $t(19) = -12.14$, $p < .001$, and a large effect size (Cohen's $d = 1.96$), indicating a substantial intervention effect. Each subscale also reflected significant gains. Planning improved from 12.30 to 17.45 ($t(19) = -8.75$, $p < .001$, $d = 1.71$), monitoring increased from 12.10 to 17.15 ($t(19) = -7.84$, $p < .001$, $d = 1.53$), and evaluation rose from 13.75 to 18.00 ($t(19) = -9.01$, $p < .001$, $d = 1.67$).

These results prove the intervention's efficacy in enhancing students' self-regulated learning capacities, supporting prior research highlighting the benefits of metacognitive instruction in special education (Butler, 1995; Zimmerman, 2000).

**Table 5. Paired Samples t-Test for Experimental Group SRL Scores (n = 20)**

| SRL Domain | Pre-Test Mean (SD) | Post-Test Mean (SD) | t(19) | p | Cohen's *d* |
|---|---|---|---|---|---|
| Planning | 12.30 (2.10) | 17.45 (2.35) | -8.75 | < .001 | 1.71 |
| Monitoring | 12.10 (2.42) | 17.15 (2.65) | -7.84 | < .001 | 1.53 |
| Evaluation | 13.75 (1.92) | 18.00 (2.10) | -9.01 | < .001 | 1.67 |
| **Total SRL** | **38.15 (5.42)** | **52.60 (6.10)** | -12.14 | < .001 | 1.96 |

### 2- Control Group – Paired Samples t-Test

To determine whether any natural progression occurred without intervention, paired samples t-tests were also conducted within the control group. The findings in Table 6 indicated no statistically significant differences between pre- and post-test scores in any SRL domain. The total SRL score increased slightly from 38.95 (SD = 5.87) to 40.05 (SD = 5.98), but the difference was not statistically significant ($t(19) = -1.34$, $p = .196$, $d = 0.30$). Subscale analyses echoed this trend. Planning rose modestly from 12.50 to 13.10 ($t(19) = -1.25$, $p = .225$), monitoring increased from 12.10 to 12.85 ($t(19) = -1.12$, $p = .275$), and evaluation slightly decreased from 14.35 to 14.10 ($t(19) = 0.57$, $p = .576$).

These non-significant changes suggest that the standard curriculum alone was insufficient in fostering SRL growth, thus reinforcing the effectiveness of the metacognitive strategy instruction implemented in the experimental group.

**Table 6. Paired Samples t-Test for Control Group SRL Scores (n = 20)**

| SRL Domain | Pre-Test Mean (SD) | Post-Test Mean (SD) | t(19) | p | Cohen's *d* |
|---|---|---|---|---|---|
| Planning | 12.50 (2.05) | 13.10 (2.20) | -1.25 | .225 | 0.28 |
| Monitoring | 12.10 (2.55) | 12.85 (2.63) | -1.12 | .275 | 0.25 |
| Evaluation | 14.35 (2.00) | 14.10 (1.98) | 0.57 | .576 | 0.13 |
| **Total SRL** | **38.95 (5.87)** | **40.05 (5.98)** | -1.34 | .196 | 0.30 |

## 4- Between-Group Comparison at Post-Test

To further assess the effectiveness of the metacognitive strategy instruction, independent samples t-tests were performed to compare post-test scores between the experimental and control groups. These comparisons were made for the overall Self-Regulated Learning (SRL) score and its three specific areas: planning, monitoring, and evaluation. This step aimed to determine whether the improvement in the experimental group reflected a meaningful difference when directly compared to the control group.

The findings in Table 7 revealed significant differences across all parts of the SRL scale. Students in the experimental group scored notably higher overall, with an average SRL score of 52.60 (SD = 6.10), compared to 40.05 (SD = 5.98) in the control group. This difference was statistically significant, $t(38) = 6.80$, $p < .001$, and was paired with a very large effect size (Cohen's $d = 2.11$), suggesting that the results were not only statistically meaningful but also relevant in real educational settings.

Looking more closely at the specific areas of SRL, a similar trend was observed. In planning, the experimental group scored 17.45 (SD = 2.35), while the control group averaged 13.10 (SD = 2.20). This difference was statistically significant, $t(38) = 6.14$, $p < .001$, with a large effect size of $d = 1.94$. Monitoring skills followed the same pattern, with experimental students scoring 17.15 (SD = 2.65) versus 12.85 (SD = 2.63) for the control group, $t(38) = 5.28$, $p < .001$, $d = 1.67$. Finally, in the evaluation category, the experimental group averaged 18.00 (SD = 2.10), compared to 14.10 (SD = 1.98) in the control group, resulting in another significant difference, $t(38) = 6.15$, $p < .001$, with an effect size of $d = 1.94$.

Overall, these results offer strong and clear evidence that the metacognitive strategy instruction significantly impacted students' ability to manage and reflect on their learning. The considerable differences between groups at the post-test stage indicate that the improvements seen in the experimental group were likely due to the targeted instruction rather than other factors such as natural development or general classroom exposure.

**Table 7. Independent Samples t-Test for Post-Test SRL Scores Between Experimental and Control Groups (N = 40)**

| SRL Domain | Group | Mean (SD) | t(38) | p | Cohen's *d* |
|---|---|---|---|---|---|
| Planning | Experimental | 17.45 (2.35) | 6.14 | < .001 | 1.94 |
| | Control | 13.10 (2.20) | | | |
| Monitoring | Experimental | 17.15 (2.65) | 5.28 | < .001 | 1.67 |
| | Control | 12.85 (2.63) | | | |
| Evaluation | Experimental | 18.00 (2.10) | 6.15 | < .001 | 1.94 |
| | Control | 14.10 (1.98) | | | |
| **Total SRL** | Experimental | **52.60 (6.10)** | 6.80 | < .001 | **2.11** |
| | Control | **40.05 (5.98)** | | | |

To explore whether the impact of the metacognitive strategy instruction varied based on students' specific learning needs, a two-way analysis of variance (ANOVA) was conducted. The two factors in the analysis were the group assignment (experimental versus control) and the type of diagnosed disability—specific learning disabilities (SLD), attention-deficit/hyperactivity disorder (ADHD), or mild intellectual disability (MID). The outcome was the students' post-test scores on the Self-Regulated Learning (SRL) scale.

As shown in Table 8, the results revealed a significant main effect for group, $F(1, 34) = 47.02$, $p < .001$, with a partial eta squared value of .58. This indicates that, overall, students in the experimental group performed significantly better on the SRL post-test than those in the control group, regardless of their type of disability. These findings are consistent with the earlier t-test results and offer additional evidence supporting the overall effectiveness of the intervention.

On the other hand, the type of disability did not significantly affect SRL outcomes, $F(2, 34) = 1.82$, $p = .177$. This suggests that students with different diagnoses—SLD, ADHD, or MID—did not show meaningful differences in post-test scores when the influence of the intervention was not taken into account. Moreover, the interaction between group and disability type was not statistically significant either, $F(2, 34) = 0.71$, $p = .499$, indicating that the benefit of the intervention was consistent across all diagnostic categories.

These results show that the metacognitive strategy instruction was equally effective for students with special educational needs. This consistency highlights the inclusive nature of the intervention, making it a promising approach for supporting a wide range of learners in special education settings (Montague, 2007; Courtade, Test, & Cook, 2014).

**Table 8. Two-Way ANOVA: Group × Disability Type on Post-Test SRL Scores (N = 40)**

| Source | SS | df | MS | F | p | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Group | 1234.50 | 1 | 1234.50 | 47.02 | < .001 | .58 |
| Disability Type | 95.27 | 2 | 47.64 | 1.82 | .177 | .10 |
| Group × Disability Type | 37.35 | 2 | 18.68 | 0.71 | .499 | .04 |
| Error | 892.40 | 34 | 26.25 | | | |

## 2- Two-Way ANOVA: Group × Gender

To determine whether the effect of the metacognitive

instruction differed by gender, a second two-way ANOVA was conducted using group (experimental vs. control) and gender (male vs. female) as independent variables and post-test SRL scores as the dependent variable.

As shown in Table 9, there was a significant main effect of group, $F(1, 36) = 48.11$, $p < .001$, partial $\eta^2 = .57$, once again confirming the superior SRL outcomes achieved by students in the experimental group. In contrast, the main effect of gender was insignificant, $F(1, 36) = 0.64$, $p = .429$, indicating that male and female students performed similarly on the post-test. Additionally, the interaction between group and gender was non-significant, $F(1, 36) = 0.12$, $p = .732$. This implies that the positive effect of the intervention was consistent across genders and that neither male nor female students derived a differential benefit from the metacognitive instruction.

These results align with previous research emphasizing the gender-neutral efficacy of metacognitive strategies when applied within a structured and inclusive pedagogical framework (Dignath & Büttner, 2008; Elbaum et al., 2018).

**Table 9. Two-Way ANOVA: Group × Gender on Post-Test SRL Scores (N = 40)**

| Source | SS | df | MS | F | p | Partial $\eta^2$ |
|---|---|---|---|---|---|---|
| Group | 1274.40 | 1 | 1274.40 | 48.11 | < .001 | .57 |
| Gender | 16.95 | 1 | 16.95 | 0.64 | .429 | .02 |
| Group × Gender | 3.09 | 1 | 3.09 | 0.12 | .732 | .003 |
| Error | 952.35 | 36 | 26.45 | | | |

## 6- Effect Size Reporting

In addition to statistical significance testing, effect sizes were calculated to evaluate the magnitude and educational relevance of observed differences. For all t-test analyses, Cohen's d was used, while for ANOVA models, partial eta squared ($\eta^2$) was applied. These measures provide additional insights into the strength and practical importance of the intervention outcomes.

According to Cohen (2013), a d value of 0.2 indicates a small effect, 0.5 a medium effect, and 0.8 or higher a large effect. In this study, all Cohen's d values for the experimental group ranged from 1.53 to 2.11, indicating large effects favoring the metacognitive intervention. Similarly, the partial $\eta^2$ values from the ANOVA analyses exceeded .50 for the main effect of group, which represents a large effect by conventional benchmarks ($\eta^2 > .14$). As shown in Table 10, these consistently large effect sizes highlight the practical significance of the intervention, reinforcing the value of implementing metacognitive

strategy instruction to enhance SRL among students with special educational needs. The intervention was statistically effective and substantively meaningful in terms of educational impact.

**Table 10. Summary of Effect Sizes for Significant Comparisons**

| Test Type | Comparison | Effect Size | Metric | Interpretation |
|---|---|---|---|---|
| Paired t-test (Exp. Group) | Pre vs. Post (Total SRL) | 1.96 | Cohen's *d* | Very large |
| | Pre vs. Post (Planning) | 1.71 | Cohen's *d* | Very large |
| | Pre vs. Post (Monitoring) | 1.53 | Cohen's *d* | Very large |
| | Pre vs. Post (Evaluation) | 1.67 | Cohen's *d* | Very large |
| Independent t-test | Exp. vs. Control (Total SRL) | 2.11 | Cohen's *d* | Very large |
| | Planning | 1.94 | Cohen's *d* | Very large |
| | Monitoring | 1.67 | Cohen's *d* | Very large |
| | Evaluation | 1.94 | Cohen's *d* | Very large |
| Two-Way ANOVA | Main Effect of Group (Disability Type) | .58 | Partial $\eta^2$ | Large |
| Two-Way ANOVA | Main Effect of Group (Gender) | .57 | Partial $\eta^2$ | Large |

## 7- Triangulated Observational and Qualitative Findings

To better understand the results of the quantitative data and offer a fuller picture of how students responded to the intervention, researchers also collected qualitative information from teacher observation checklists and student learning journals. By combining these different data types, the study aimed to capture what was happening in the classroom and what students were experiencing internally. This combination of outside observations and personal reflections is considered a strong method in special education research, as it helps connect what is taught with how students engage and learn (Lincoln & Guba, 1985; Palinkas et al., 2015).

### 1- Teacher Observation Checklists: Fidelity and Engagement

According to the teacher observation checklists, the intervention was delivered consistently throughout its duration. Observers used a structured checklist called the Metacognitive Instruction Fidelity Checklist, showing that teachers followed the steps closely. These steps included showing students how to use strategies, guiding them through practice, and giving them chances to reflect. Nearly all the lessons observed followed this sequence, showing that the teaching was reliably carried out as planned.

Besides confirming consistent instruction, the checklists also revealed that students became more involved in lessons. This was especially true during sessions focused on students thinking about and reviewing their learning. By the third week, students began to speak up independently, using reflective language without being prompted. For instance, some said things like "I think I need to check my answer again" or "I didn't plan my time well." These kinds of comments were rare in the early sessions but became more common later, showing that

students were beginning to understand and use metacognitive thinking (Zimmerman, 2000; Butler, 1995).

Teachers also offered insights into how different students responded. For example, students with ADHD initially found it hard to stay focused during planning tasks. However, they showed improvement in paying attention and talking through their thinking as the program continued. Students with mild intellectual disabilities needed more support to join the metacognitive activities. But these students became more involved when teachers included visual tools and group tasks. These changes seemed to make the lessons more accessible and encouraged a wider range of students to take part in reflective learning.

**2- Student Journals: Metacognitive Awareness and Self-Reflection**

Student journals provided valuable evidence of how students started thinking more about their learning. Using a method based on Lincoln and Guba's (1985) approach to naturalistic research, four main themes were identified: Planning with Purpose, Monitoring with Mindfulness, Reflective Evaluation, and Increased Self-Efficacy.

In the Planning with Purpose theme, students described how they were beginning to set clear goals and think ahead before starting assignments. For example, some wrote things like "I want to finish my reading on time" or "I will read the questions first," showing they were starting to plan their approach. The Monitoring with Mindfulness theme captured moments when students noticed they were confused and took action to address it. One student, for instance, wrote, "I was confused, so I reread the paragraph," which matches the kind of thoughtful self-checking described in Zimmerman's (2000) model of self-regulated learning.

The Reflective Evaluation theme included students' thoughts on their performance and what they could do better next time. Some reflections included remarks like "I did better because I stayed focused today" or "Next time I will ask the teacher when I get stuck," showing they were learning to assess their progress and make changes. Lastly, the Increased Self-Efficacy theme reflected growing confidence and independence. Many students wrote statements like "I think I am better now at solving problems alone," which points to a stronger sense of ability and motivation to take charge of their learning (Montague, 2007).

Altogether, these qualitative insights, also outlined in Table 11,

strongly support the idea that the intervention had a meaningful impact. Not only were students practicing metacognitive strategies, but they were also starting to use them naturally. This growth was seen in their ability to plan, monitor, and evaluate their learning and their rising confidence and emotional connection to the learning process.

**Table 11. Summary of Emerging Themes from Student Reflection Journals**

| Theme | Description | Illustrative Student Quote |
|---|---|---|
| Planning with Purpose | Goal setting and strategy selection at the beginning of tasks | "I decided to read the story before answering questions." |
| Monitoring with Mindfulness | Awareness of confusion or progress during learning | "When I didn't understand, I looked at the example again." |
| Reflective Evaluation | Post-task self-assessment and forward planning | "Next time, I will ask the teacher when I get stuck." |
| Increased Self-Efficacy | Expressions of confidence and autonomy in learning | "I think I'm getting better at doing things by myself." |

The combined insights from classroom observations and student reflections show that the metacognitive strategy instruction was carried out as intended, reached a wide range of learners, and supported noticeable improvements in thinking skills and motivation. The close connection between the themes found in the qualitative data and the positive results from the quantitative analysis strongly supports the intervention's effectiveness. This consistency reinforces the idea that teaching metacognitive strategies works and fits well within special education classrooms (Courtade, Test, & Cook, 2014; Elbaum et al., 2018).

## * Discussion

This study explored how direct teaching metacognitive strategies affects self-regulated learning (SRL) among students with special educational needs (SEN) in Palestine. Drawing on Zimmerman's (2000) cyclical model of SRL and Flavell's (1979) metacognition theory, the research followed a quasi-experimental design to examine changes before and after the intervention. These changes were observed in three key areas of SRL: planning, monitoring, and evaluation. Participants included students diagnosed with learning disabilities (LD), ADHD, or mild intellectual disabilities (MID).

The results showed clear and significant improvements in overall SRL and its specific areas among students who received the intervention. The qualitative data collected through student journals and teacher observations also revealed these positive changes. Importantly, the intervention proved effective regardless of students' gender or type of disability, pointing to its broad usefulness and inclusive nature.

These outcomes strongly support Zimmerman's (2000) model, which views SRL as a continuous cycle of preparing, performing, and

reflecting. Students who received metacognitive instruction demonstrated better control over their thinking, motivation, and behavior, a finding supported by other recent studies (Parra-Gavilánez & Totoy, 2023; Safari, Ghaemi, & Siyyari, 2022). The results also align with Flavell's (1979) distinction between understanding strategies and knowing when to use them. Students learned about SRL and applied these skills effectively in real learning situations. This pattern is consistent with research highlighting the need for knowledge and adaptability in SRL development (Efklides & Schwartz, 2024; Ozturk, 2024).

The findings align with previous research reviews confirming SRL-focused teaching strategies' success in various educational settings. For example, Theobald (2021) reported that structured SRL instruction boosts strategic thinking, motivation, and academic results, while Celik (2022) observed similar benefits in college-level students. The current study builds on these findings by showing that SRL instruction works well with younger students with special educational needs.

Each SRL component—planning, monitoring, and evaluation—showed clear improvement, highlighting the intervention's internal consistency and theoretical strength. This mirrors the results of Stebner et al. (2022), who found that SRL training improved both academic content mastery and the ability to adjust learning strategies. In planning, students became better at setting goals and preparing for tasks, skills often underdeveloped in students with SEN (Montague, 2007; Budin et al., 2022). In monitoring, students became more aware of their understanding and more skilled at spotting and correcting mistakes, similar to the findings of Versteeg et al. (2021) among medical students. Evaluation improvements pointed to stronger self-reflection and better judgment about performance, supporting Zhang et al.'s (2021) work on post-task reflection.

The instructional design of the intervention—featuring direct demonstrations, supported practice, and reflective writing—seems to have played a key role in student progress. Reflective journals, in particular, helped students express and fine-tune their thought processes. This method is recommended by Winne (2022) and Efklides & Schwartz (2024) to help learners develop metacognitive self-awareness.

When comparing students who received the intervention to those who did not, the experimental group showed large improvements across all areas of SRL, highlighting the approach's effectiveness. These results match findings by Callan et al. (2021) and Cai et al. (2022), who showed that even short SRL interventions can lead to meaningful gains in student independence and academic success.

One of the most notable effects of the intervention was the shift in student behavior, from being passive learners to actively engaging in their learning. This transformation is central to inclusive and student-centered teaching (Aleghfeli, 2024; Budin et al., 2022). While the control group showed little progress, students in the experimental group became more self-directed and reflective, highlighting SRL's powerful role in special education.

Furthermore, the fact that results did not vary by gender or type of disability suggests the intervention worked equally well for all students. This uniform effectiveness supports the principles of Universal Design for Learning (UDL), which aims for flexible and inclusive teaching methods (Brünner et al., 2024). These results echo previous studies by Vosniadou et al. (2021) and Steinert et al. (2023), which found that SRL strategies can benefit many students.

This broad applicability is especially important in regions like Palestine, where limited resources and unclear diagnostic criteria can create additional educational challenges (Shatroubi & Ramirez-Garcia, 2023). That the intervention worked regardless of specific disability diagnoses suggests it could be adapted and scaled in similar settings with minimal barriers.

Equally important is the alignment between the quantitative findings and the qualitative insights from journals and teacher notes. Students described adjusting their strategies based on task difficulty, showing they were learning how to manage their learning. Observers also noticed more students verbalizing their thought processes and engaging more actively—patterns that match findings from Berger (2023) and Zheng, Lajoie, & Li (2023), who emphasized the role of motivation in SRL.

This agreement between data types strengthens the evidence that the intervention helped with learning outcomes and how students experienced learning. This is especially relevant for teaching approaches that aim to be inclusive and responsive to different cultural

and individual needs (Anthonysamy, 2023; Saada, 2021).

The study offers several key takeaways. Theoretically, it confirms that teaching metacognitive strategies is essential for helping students with SEN manage their learning. From a teaching perspective, the results show the value of structured and reflective learning activities. The findings suggest that such interventions can be adapted for a wide range of learners and educational settings.

However, the study is not without limitations. The relatively short duration of the intervention may limit how well the findings apply to long-term learning development. Additionally, while self-reports and observations provided useful insights, they may be affected by students' or teachers' desire to give positive responses. The study did not look at other factors, such as the classroom environment or the teachers' skills, which might influence the results.

*** Conclusion**

This study explored how direct teaching of metacognitive strategies affects the ability of students with special educational needs (SEN) in Palestine to manage their learning. Based on Zimmerman's (2000) model of self-regulated learning (SRL) and Flavell's (1979) theory of metacognition, the research used a quasi-experimental approach to assess whether guided instruction in planning, monitoring, and evaluation could strengthen students' learning regulation skills.

The results clearly show that structured metacognitive instruction significantly improves students' self-regulation. Students in the experimental group made notable progress in overall SRL and its key areas. These improvements did not appear in the control group, confirming that the intervention was the main reason for the gains. Additionally, the program proved effective for all students, regardless of gender or disability, highlighting its inclusive design and educational value.

Beyond the numbers, the intervention had clear benefits in practice. Students didn't just learn strategies—they used them thoughtfully. Their journals, classroom actions, and growing awareness of how they learn showed deeper engagement. Teachers also observed more active participation, improved thinking habits, and stronger independence in learning, important achievements considering the unique learning challenges these students face.

This study supports the idea that SRL is not a fixed ability but a set of skills that can be taught and adjusted when instruction is carefully designed and tailored to students' needs. It also adds valuable, locally based evidence to an area of research that is often shaped by studies in Western contexts.

From a practical standpoint, the findings present a promising model for special education. The study shows that metacognitive instruction can be effectively delivered in Palestinian classrooms and can lead to real improvements in student learning. This is particularly important in Arabic-speaking areas where resources may be limited, and where there is a need for teaching methods that are both effective and culturally relevant.

In conclusion, the research confirms that teaching metacognitive strategies is a powerful and fair approach to helping SEN students become more independent, motivated, and successful in learning. It highlights the need for wider use, ongoing development, and more research to make SRL a core part of inclusive and forward-thinking education systems.

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