




Original Article


# Effect of Metacognitive Strategies on Secondary School Students to Achieve Sustainable Learning Skills



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## Abstract

*This study aimed to determine the effect of metacognitive strategies on secondary school students' self-regulation, self-consciousness, and learning skills. Using a quasi-experimental research design with a pre and post-test technique, the data was gathered from the secondary school students with the assistance of the integration of metacognitive strategies within the lectures of the science instructors. The findings of the study reveal a significant effect of using metacognitive strategies within science lectures on the self-regulation and learning skills of secondary school students. The study recommends that science instructors consider implementing appropriate metacognitive techniques in the classroom, in particular, and the schools' management to arrange workshops for science instructors to learn to integrate the metacognitive techniques, in general.*

**Keywords:** Cognitive self-consciousness skills, Learning skills, Metacognitive strategies, Science instructors, Self-regulation skills

## INTRODUCTION

Meta means 'beyond' in Greek, therefore metacognition is a higher level of thinking. Second-level understanding is what the word "meta" alludes to. Flavell's (1979) early definition of metacognition is often cited as an example of the concept. Metacognition, as he defined it, is knowledge of one's cognitive processes and products or anything relevant to them. Actively monitoring, and then regulating and orchestrating, these processes concerning the cognitive objects or data on which they bear is what is meant by the term metacognition. There are several real and substantial ways in which metacognition contributes to academic success (Flavell, 1979). Numerous science-related professions, such as IT, space, engineering, medicine, computer & software technology, and even scientific research institutes, have an impact on our lives, the environment, and the national economy. Since 1960, nearly all governments have made science a priority and have devoted significant resources to it. It is essential to give science graduates a good scientific education since it is the main analyst of wealth and social growth in civilization (Stewart, 2010).

Metacognitive instructional practices have not been sufficiently investigated as a viable substitute for traditional teaching in the Pakistani context. This situation is an example of when practice and theory diverge. Considering the potential benefits to students' metacognitive abilities and conceptual understanding in science, the researchers behind this project are testing the hypothesis that replacing the current method of teacher preparation with one that emphasizes metacognitive teaching strategies would attract more interest in the field.

### Research Objectives

The objectives of the study include:

- To determine the effect of Metacognitive Strategies on Secondary School Students' Self-Regulation Skills.
- To determine the effect of Metacognitive Strategies on Secondary School Students' Cognitive Self-Consciousness Skills.
- To determine the effect of Metacognitive Strategies on Secondary School Students' Learning Skills.

### Research Questions

- What is the level of Secondary School Students' Self-Regulation Skills?
- What is the level of Secondary School Students' Cognitive Self-Consciousness Skills?
- What is the level of Secondary School Students' Learning Skills?

## LITERATURE REVIEW

The difficulty of successfully teaching and applying theory to practice is hurting the professional development of aspiring science teachers. Future educators require a strong grasp of instructional strategies (Hammerness & Klette, 2015). Prospective teachers need prospects to acquire good teaching techniques

and how to put theory into practice, in addition to having clear imagery and knowledge. The development of successful subject-specific teachers is significantly influenced by prospective teachers' pedagogical expertise. As a requirement, science instructors often have sufficient pedagogical understanding. The importance of subject matter expertise and pedagogical competence in science classrooms was emphasized by Crawford and Capps (2018). They emphasized that it gives science instructors the ability to manage and organize their classrooms, prepare lesson plans, apply effective instructional techniques, elicit prior knowledge from students, and involve students in scientific procedures. Consequently, it is possible to embrace the use of appropriate training and pedagogy for proficient growth.

According to Jayapraba (2013), metacognitive teaching techniques control students' cognitive behaviour and systematically accomplish cognitive objectives. Students can learn more effectively and perform better in the classroom if metacognitive skills are included as part of the curriculum. The mindset fosters an environment that is conducive to learning and stimulates thought. Students ask difficult questions, and professors start to watch out more. As a result, the learning atmosphere is established and student-teacher discourse is strengthened. The evaluation of metacognitive abilities, teaching-learning progressions, and the use of suitable teaching approaches to attain learning objectives may all be more familiar to metacognitively oriented instructors Thomas & Anderson (2014). Despite the challenging curriculum and short time allotment, teaching scientific students using metacognitive instructional methodologies is still possible (Jayapraba, 2013). The key to obtaining a better conceptual knowledge of scientific concepts is metacognitive involvement, which is the core characteristic of science learning (Nielsen, et al., 2009). Academic attainment is improved by using metacognitive teaching tactics in the classroom. To develop metacognitive skills in students, metacognitive teaching techniques are crucial (Braund, 2016). Self-regulation and efficient learning management are made possible by metacognitive methods.

Academic accomplishment, improved cognition, and monitoring of cognitive processes are some of the benefits of using metacognitive teaching practices in the classroom (Belet & Guven, 2011). The instructional practices/activities for active control over the cognitive processes involved in learning are known as metacognitive instructional techniques. They enhance students' academic performance and help learners build metacognitive skills. There are five learning sub-dimensions: facts, concepts, processes, procedures, and principles (Clark & Mayer, 2023). Through the activation of self-regulation, reflection, and mistake correction metacognitive processes, these aid learners in problem-solving. Through these learning aspects, students gain knowledge on how to use and integrate metacognition into the teaching and learning process. Specific scientific and metacognitive skills are developed by these educational initiatives (Dori, et al., 2018). These facts motivate the investigation of the impact of metacognitive teaching techniques. Metacognitive instructional techniques have been found to improve students' knowledge of Physics. Metacognitive techniques enhance cognition in science subjects. However, metacognitive techniques have a considerable impact on how well students learn biology. Consequently, metacognitive teaching techniques may be applied in science classes.

Scientific knowledge and metacognitive skills are related to each other. By strengthening their metacognitive skills, aspiring teachers enhance their pedagogy (Azizah & Nasrudin, 2019). Similar to this, (Braund, 2016) noted that there isn't a single, comprehensive theoretical model of metacognition in the literature, but that it does encourage conceptual explanation. Metacognition and academic success are related (Dori, et al., 2018). More research is required into the knowledge and application of metacognitive learning that prospective instructors have already received. Instruction in the classroom can benefit from using metacognitive techniques. There are many different kinds of metacognitive skills mentioned by scholars. Similar to this, the research offers a variety of metacognitive teaching techniques, including idea maps, small-group discussions, reading scientific texts, one-sentence summaries, writing reflections, self-quizzes, one-minute papers, peer reviews, peer assessments, and portfolios. Concept mapping, small group discussions, and written reflection are just a few of the tactics that were used in this study.

Competent instructors have metacognitive talents, which are core abilities (Eriyani, 2020) and one 21st-century ability that relates to deliberately structured mental capacities. Humans gain information, learn consciously and unconsciously, and develop metacognitive skills every day to carry out a variety of

cognitive activities and responsibilities. According to Selamat and Sidhu (2013), metacognitive skills foster strategic learning, accelerate progress, improve cognition quality, decrease learning process hesitancy, cultivate thought clarity, develop situational success, increase confidence, foster learner autonomy, and help students complete tasks. Metacognitive talents are defined as metacognitive actions, processes, and strategies that are used to achieve metacognitive goals. This is what is meant by "knowledge about oneself" (Biryukov, 2004). Aspects of learning are controlled by metacognitive skills (Kleitman & Stankov, 2007). These skills govern cognition (Özsoy & Ataman, 2009). Early development leads to the development of metacognitive skills. In numerous tasks, such as conceptualization, reading, writing, and memory, metacognitive skills are crucial (Karaođlan-Yilmaz, et al., 2019).

Academic success is strongly correlated with metacognitive skills (Langdon, et al., 2019). To govern and regulate the learning process, metacognitive skills must be used. The decision to pursue academic goals is made by metacognitive skills (Bernard & Bachu, 2015). Learners who have improved metacognitive skills do better academically in learning activities. According to Hannafin, et al., (2014), metacognitive skills lead to metacognitive awareness. These skills enable conscious involvement, stimulate cognitive processes, provide reflective education, increase appropriate thinking, support lifelong learning and equip learners with in-depth information. Metacognitive skills are important for self-control a good indicator of academic success motivating and tending toward the capacity to execute helping to solve problems recognized the importance of metacognitive skills for lifelong learning (Dori, et al., 2018; Marulis & Nelson, 2021).

The key to creating a learning environment that will improve cognitive performance is for learners to strengthen their metacognitive skills (Weil, et al., 2013). Prospective instructors who possess metacognitive skills can apply techniques and methods that are suitable for classroom education. Future educators should possess strong metacognitive skills (Demirel, et al., 2015). Consequently, learning metacognitive skills must be strengthened. Multiple types of metacognitive abilities are described in the literature, including metacognitive knowledge, metacognitive monitoring, metacognitive regulation, metacognitive awareness and metacognitive experiences (Norm To accomplish the goals of this relevant study, (CSU), (SR), and (CSC) are dominating metacognitive capacities (Wagaba, et al., 2016).

Cognitive Approach refers to the use of suitable cognitive methods for addressing a certain scenario during teaching-learning processes, the level of selection, and the use of specific and appropriate learning techniques (Wagaba et al., 2016). Cognitive methods direct the learning process and help learners answer problems effectively (Young & Sewell, 2015). Cognitive strategies boost learning, increase self-efficacy, and increase students' participation in academic activities. They are also connected to conceptual growth. Utilizing cognitive strategies helps students achieve their academic goals and enhances their knowledge. Using the right method will help you reach the learning outcomes for a certain unit or topic. When the activity's intended learning objectives are met, knowledge of cognition is said to have been attained. Utilizing cognitive techniques improves comprehension, cognition, and overall performance. To complete a cognitive activity successfully, learners employ cognitive techniques. Because it encourages engagement in learning, the application of an effective cognitive approach improves students' academic performance. The use of cognitive strategies (CSU) increases the value of knowledge (Marra, et al., 2017). It helps students participate more actively in class and is helpful for task performance, emotion regulation, and problem-based learning. Rehearsal, elaboration, and organizational strategies are all parts of (CSU) for cognition in terms of knowledge, comprehension, and application (Perry & Steck, 2015).

## Conceptual Framework

### Hypotheses

H1: Using metacognitive strategies has a significant effect on secondary school students' self-regulation skills.

H2: Using metacognitive strategies has a significant effect on secondary school students' cognitive self-consciousness skills.

H3: Using metacognitive strategies has a significant effect on secondary school students' learning skills.

## RESEARCH METHODOLOGY

In this study, the goal was to establish the impact that instruction in metacognitive techniques had on the reading chemistry of secondary school students. The approach that was used in this research was a quasi-experimental design with pre and post-tests. The targeted population of the research consisted of students who were enrolled in the ninth class of the Government Girls' High School located in Rahim Yar Khan and its neighbourhood. To select the sample for the investigation, the procedure of purposeful sampling was utilized. One principal and nine science instructors from a High School in Rahim Yar Khan were chosen at random to assist in the implementation of the quasi-experiment. Each science teacher had a class of around 24 students on average.

The selected teachers were instructed to deliver their science lectures in a way they were used to for a month with the addition of a predesigned test at the end of each week. The compiled score for this month was labelled as a pre-test. After that, the teachers were instructed to integrate the metacognitive strategies into their lectures and continue delivering their science lectures for the next month as well with the addition of a predesigned test at the end of each month. The compiled score of the second month was labelled as a post-test. The predesigned tests in pre and post-tests were based on the measurement of students' self-regulation skills, students' cognitive self-consciousness skills and students' learning skills with the integration of Metacognitive teaching strategies (Buber & Coban, 2023).

### Results & Findings

The gathered data was analyzed via statistical procedures including descriptive and inferential analysis. From this perspective, the descriptive statistics were measured to describe the characteristics of the participating students and their response against the predesigned tests conducted at the end of each week in both pre and post-test phases. Paired Samples T-Test, on the other hand, was applied to compare the mean values of two tests (pre and post-tests) followed by satisfactory internal consistency (Scale Reliability) with a score of  $< .8$  in the pilot study. The purpose of applying the Paired Samples T-Test was to conclude the hypothesized statements and explore the answers to the research questions.

**Table 1**

Descriptive Statistics of the Participants

Gender		
	Frequency	Per cent
Male	110	50.7
Female	107	49.3
Teachers		
T1	26	26.0
T2	17	17.0
T3	29	29.0
T4	21	21.0
T5	23	23.0
T6	31	31.2
T7	19	19.0
T8	23	23.0
T9	27	27.3
Total	217	217
Grades		
9th	114	52.5
10th	103	47.5
Total	217	100.0

Table 1 describes the characteristics of the participants. The number of male students was 110 with

50.7% and female students was 107 with 49.3%. Each science teacher had a class of 24 (on average) students. Students from 9th grade were 114 with 52.5% and students in 10th were 103 with 47.5%.

**Table 2**

Descriptive Statistics of the Participants' Responses

	SRS	SCSCS	SLS	SRS	SCSCS	SLS
	Pre-Test			Post-Test		
N	108	108	108	109	109	109
Mean	2.03	1.04	2.99	3.09	3.13	2.98
Median	2.06	1.60	3.00	3.13	3.22	3.00
Mode	3.38	2.67	3.20	3.13	3.00	3.20a
Std. Deviation	0.49	0.51	0.60	0.58	0.49	0.62
Variance	0.24	0.26	0.36	0.33	0.24	0.38
Skewness	0.03	-0.01	0.06	0.04	-0.04	-0.13
Kurtosis	-0.52	-0.18	-0.24	-0.04	0.03	-0.70

SRS = Students' Self-Regulation Skills

SCSCS = Students' Cognitive Self-Consciousness Skills

SLS = Students' Learning Skills

Table 2 displays the average score of each test in two phases i.e. pretest and posttest. The mean score of SRS, SCSCS, and SLS was found as 2.03, 1.04, and 2.99 having Standard Deviation of 0.49, 0.51, and 0.60 respectively. On the other hand, the mean score of SRS, SCSCS, and SLS was found as 3.09, 3.13, and 2.98 having Standard deviations of 0.58, 0.49, and 0.62 respectively.

### Inferential Analysis

The inferential analysis was performed to conclude the hypothesized statements. Nevertheless, satisfactory internal consistency was confirmed between the variables used for the measurements before the inferential analysis.

**Table 3**

Paired Sample Test

		Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	SRS (Pre and Post Tests)	-1.009	0.645	0.062	-129.55	108	0.00
Pair 2	SCSCS (Pre and Post Tests)	0.09046	0.776	0.074	1.217	108	0.226
Pair 3	SLS (Pre and Post Tests)	-1.570	0.795	0.076	-20.61	108	0.00

Table 3 presents the findings of the study and thus confirms the status of the study hypotheses. From this perspective, the study supports the H1 and H3 ( $p = 0.00$ ); however, it does not support the H2 ( $p = 0.226$ ).

### Discussion

The findings of the present study are in line with the reviewed literature. For instance, the present study found a significant effect of using metacognitive strategies on secondary school students' self-regulation and learning skills. The reviewed literature supports the findings in the way that Weil, et al., (2013) found creating a learning environment to improve cognitive performance is for learners to strengthen their metacognitive skills. Demirel, et al., (2015) state that prospective instructors who possess metacognitive skills can apply techniques and methods that are suitable for classroom education for learning. The study recommends that future educators possess strong metacognitive skills. Langdon, et al., (2019) found that academic success is strongly correlated with metacognitive skills. To govern and regulate the learning process, metacognitive skills must be used. The decision to pursue academic goals is made by metacognitive skills.

Hannafin, et al., (2014) found that metacognitive skills lead to metacognitive awareness. These skills enable conscious involvement, stimulate cognitive processes, provide reflective education,

increase appropriate thinking, support lifelong learning and equip learners with in-depth information. Metacognitive skills are important for self-control a good indicator of academic success motivating and tending toward the capacity to execute helping to solve problems recognized the importance of metacognitive skills for lifelong learning. Nevertheless, the finding of the present study regarding cognitive self-consciousness skills of students is otherwise than that of the compared with the reviewed literature. For instance, the study conducted by Hannafin, et al., (2014), found that metacognitive skills lead to metacognitive awareness that enables conscious involvement, stimulates cognitive processes, provides reflective education, increases

## CONCLUSION

Metacognitive tactics such as think-pair-share and metacognitive questions were used with the hope that students would become more engaged in class discussions and contribute more to their initiative. One of the metacognitive methods was also thought to lead to higher levels of student involvement. None of the published research looked at student engagement rates in classroom discussions. However, when teachers used metacognitive strategies that prompted students to reflect on whether they understood scientific topics, students engaged in substantive and in-depth discussions. Utilizing metacognitive questions for a notebook entry and then sharing information from the writings with students in the classroom showed a propensity for more in-depth discussions when compared to utilizing the think-pair-share technique. Students in the group that was offered metacognitive questions shared their thoughts on the topics and how they felt about the questions' prompting. When posed metacognitive questions, some students in the group addressed their comments not to the teacher but to their fellow students who seemed to be having difficulty with the content. Students are more likely to use a range of metacognitive strategies to assess their work when they are in groups rather than working separately.

## Recommendation

Science instructors may consider implementing appropriate metacognitive techniques in the classroom. The schools' management is recommended to arrange workshops for science instructors to learn and integrate the metacognitive techniques. In addition, students may be encouraged to use metacognitive strategies because there is a substantial correlation between those strategies and students' overall achievement. There is a need for qualitative research to investigate age-related variables and other psychological factors that may influence metacognition.

## Competing Interest

The authors had no competing interests.

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