# CHAPTER- 5

# SUMMARY, FINDINGS, SUGGESTIONS, AND CONCLUSION

# 5. FINDINGS, IMPLICATIONS, SUGGESTIONS AND CONCLUSION

## 5.1. INTRODUCTION

This chapter provides a concise synthesis and critical evaluation of the study's key findings. It also explores the identified limitations and outlines directions for future research. The summarized results focus on the effectiveness of metacognitive instructional strategies in promoting problem solving skills.

## 5.2. MAJOR FINDINGS OF THE STUDY

This section presents a summary of the results drawn after the analysis and interpretation of the data. This research study examines the effectiveness of metacognitive instructional strategies among secondary stage students. The research specifically considered fourth-grade Mathematics curriculum. The research specifically considered secondary stage students and Problem-solving skills with respect to metacognitive instructional strategies.

- **Improvement in Metacognitive Awareness:** The results of the Metacognitive Awareness Inventory (MAI) revealed a notable improvement in the metacognitive awareness of students who received metacognitive instructional strategies. Specifically, the experimental group had a mean pre-test score of 14.00, which increased significantly to 22.00 in the post-test after the intervention. In contrast, the control group, which was taught through traditional instructional methods, showed only a marginal improvement, with the mean score increasing from 14.07 in the pre-test to 15.03 in the post-test. These results suggest that explicit instruction in metacognitive strategies substantially enhances students' ability to be aware of and regulate their own learning processes. The minimal change observed in the control group further reinforces the effectiveness of metacognitive instruction in fostering self-awareness and strategic thinking among secondary stage students.
- **Enhanced Problem-Solving Skills in Biology:** The post-test results in Biology demonstrated a significant improvement in the problem-solving skills of students who were taught using metacognitive instructional strategies. The experimental group (N = 30) achieved a mean post-test score of 27.00 with a standard deviation of 0.74, while the control group, which received conventional instruction, recorded considerably lower scores (not shown here but comparatively less effective). An

independent samples t-test was conducted to assess the significance of this difference. The calculated t-value was 13.81, which far exceeds the critical t-value of 2.002 at 58 degrees of freedom and the 0.05 significance level. This statistically significant result confirms that the use of metacognitive strategies leads to enhanced academic achievement and more effective problem-solving in science, particularly in the domain of Biology.

- **Positive Correlation between Metacognitive Awareness and Problem-Solving:** The findings of the present study reveal a strong and statistically significant positive correlation ($r = 0.94$, $p < 0.01$) between students' metacognitive awareness and their problem-solving performance in Biology within the experimental group. This suggests that students who developed higher levels of metacognitive awareness through explicit strategy instruction were also more successful in solving biology-based problems. In other words, enhanced metacognitive skills—such as planning, monitoring, and evaluating one's thinking—appeared to directly contribute to improved academic performance in problem-solving contexts. This finding underscores the effectiveness of metacognitive instructional strategies not only in raising average achievement levels but also in fostering meaningful cognitive engagement among learners.

  In contrast, the control group exhibited a very weak and statistically non-significant correlation ($r = 0.11$) between metacognitive awareness and Biology performance. This indicates that, in the absence of structured metacognitive intervention, any observed gains in problem-solving were likely incidental and not systematically linked to students' awareness of their cognitive processes. The divergence in these patterns across groups highlights the role of deliberate pedagogical interventions in shaping both metacognitive growth and domain-specific academic skills.

## 5.3. EDUCATIONAL IMPLICATIONS

### A. Implications for Teachers

- **Incorporation of Explicit Metacognitive Strategies**: Teachers are encouraged to embed explicit metacognitive strategies into their daily instructional practices. This includes the use of tools such as reflective journals, planning prompts, exit slips, and progress checklists. These techniques help students become more aware of their thought processes and learning behaviours.
- **Designing Metacognition-Enhancing Activities**: Educators should design learning tasks that promote self-monitoring, goal-setting, strategic thinking, and evaluation. Activities such as "think-aloud" problem-solving, peer discussions, and self-assessment rubrics can significantly enhance metacognitive engagement.
- **Creating a Supportive Learning Environment**: It is essential for teachers to cultivate a classroom culture that encourages student autonomy, inquiry, and reflection. Providing a safe and open space where students can express doubts, make mistakes, and learn from them is critical for developing metacognitive skills.
- **Continuous Professional Development**: Teachers should engage in ongoing professional development programs focusing on metacognitive pedagogy. Workshops and training sessions on instructional design, assessment strategies, and reflective teaching can strengthen their ability to implement such approaches effectively.

### B. Implications for Students

- **Development of Self-Regulated Learning Skills**: Students must be encouraged to develop key metacognitive competencies, including planning, monitoring, and evaluating their learning. By consciously applying these skills, students become more strategic and effective learners.
- **Practice of Self-Questioning Techniques**: During problem-solving activities, students should be taught to ask themselves reflective questions such as "What do I already know?", "What strategy can I use?", and "What can I do differently next time?" This habitual self-questioning promotes deeper understanding and critical thinking.

- **Active Engagement in Learning**: The use of metacognitive strategies promotes learner autonomy. Students begin to take ownership of their academic growth by setting personal learning goals, tracking progress, and reflecting on outcomes, thereby becoming self-directed learners.
- **Improvement in Academic Confidence**: As students become more aware of their learning strategies and see improvements in their performance, they build greater confidence and resilience, especially when tackling challenging problems.

### C. Implications for Parents

- **Support for Independent Learning at Home**: Parents play a crucial role in reinforcing metacognitive habits outside the classroom. By engaging children in conversations about how they learn and what strategies they use, parents can encourage metacognitive awareness in everyday situations.
- **Encouragement of Curiosity and Problem-Solving**: Parents should foster an environment where curiosity, exploration, and questioning are valued. Encouraging children to reflect on how they solved a problem or approached a task can enhance their analytical and reasoning skills.
- **Creating a Positive and Supportive Atmosphere**: A home environment that celebrates effort, supports reflective thinking, and emphasizes learning from mistakes contributes to the development of a growth mindset. Such an atmosphere enables students to approach academic tasks with a positive attitude and persistence.
- **Collaboration with Educators**: Parents should maintain regular communication with teachers to understand the metacognitive strategies being taught and reinforce them at home. A collaborative home-school partnership is essential for the consistent development of these skills.

## 5.4. SUGGESTIONS FOR FURTHER STUDY

- **Longitudinal Studies to Assess Sustained Impact**: It is recommended that future research undertake longitudinal investigations to examine the sustained effects of metacognitive instructional strategies on students' academic achievement and learning outcomes over an extended period. Such studies would provide a deeper understanding of the long-term benefits and retention of metacognitive skills.
- **Application Across Various Science Disciplines:** Further research should consider applying metacognitive instructional strategies to other core science

subjects such as Physics, Chemistry, and Mathematics. This would help to evaluate the generalizability and effectiveness of these strategies across different scientific domains.

- **Comparative Research in Diverse Educational Contexts:** Conducting comparative studies between urban and rural schools is recommended to explore how socio-economic and geographical factors influence the implementation and effectiveness of metacognitive teaching methods. These investigations could inform context-sensitive adaptations of instructional strategies.
- **Integration of Digital Tools and Blended Learning Approaches:** Future studies could explore the incorporation of digital tools and blended learning platforms, such as adaptive learning software, online reflective journals, and mobile applications, to enhance the facilitation and monitoring of metacognitive training. This approach may offer innovative ways to engage students and personalize learning in diverse educational settings.

## 5.5. CONCLUSION

This chapter presents the key findings of the study, synthesizes its conclusions, and outlines its educational implications and recommendations. The findings of the study clearly affirm that metacognitive instructional strategies have a profound and positive impact on the cognitive and metacognitive development of secondary school students, particularly in the context of science education.

When compared with traditional teaching approaches that emphasize rote memorization and passive learning, metacognitive strategies promote deeper engagement with content, foster critical thinking, and enhance self-regulation. Students taught through these strategies demonstrated higher levels of self-awareness, improved independent problem-solving skills, and greater academic achievement, especially in Biology.

Metacognitive instruction not only supports content mastery but also equips learners with essential skills for monitoring, evaluating, and adapting their learning strategies. These reflective and strategic learning approach nurtures students to become inquisitive, autonomous, and resilient, aligning closely with the National Education Policy (NEP) 2020, which calls for the development of holistic, competent, and lifelong learners.

Furthermore, the study makes a significant contribution to the field of self-regulated learning, offering much-needed context-specific insights from an underrepresented region

of India. Unlike many studies from Western or urban contexts, this research addresses the challenges of implementing metacognitive strategies in Indian classrooms, such as large class sizes, limited resources, and exam-oriented teaching practices.

The study's implications extend across various levels:

- At the classroom level, teachers are encouraged to integrate simple metacognitive tools like think-alouds, reflection prompts, and goal-setting strategies into their lessons.
- At the institutional level, the research informs teacher training and professional development programs focused on building metacognitive competence.
- At the policy level, it advocates for curriculum reforms and assessment models that prioritize not only content knowledge but also cognitive flexibility and strategic learning skills.

In conclusion, this study demonstrates that embedding metacognitive pedagogy in science classrooms is not only feasible but also transformative. It helps develop a generation of learners who are not only proficient in scientific concepts but also capable of thinking critically, learning independently, and adapting to complex real-world challenges. Thus, the integration of metacognitive instruction represents a crucial step toward fulfilling the vision of NEP 2020 and shaping future-ready learners.