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The Role of Meta-cognition in Improving Students learning outcomes

Dr Satyavah Dwivedi Asst Prof
Teacher Training Department
Halim Muslim P.G College Kanpur Nagar
U.P Affiliated to CSJM University Kanpur
E mail ID: satyavah.dwivedi@gmail.com

Abstract
Improving student learning results in all kinds of educational environments depends much on meta-cognition, the knowledge and control of one's cognitive processes. Students' capacity to organize, monitor, assess, and modify their learning processes depending on task demands and personal knowledge is included under this cognitive phenomena. Studies show that students who are meta-cognitively aware show better academic achievement, greater material understanding, and more successful self-directed learning strategies. Students who acquire meta-cognitive skills start to choose suitable techniques more deliberately, acknowledge knowledge gaps, and reroute their efforts when their learning suffers. Explicit meta-cognitive training, self-assessment tools, and reflective practices combined in educational interventions have repeatedly shown good results on performance across disciplines and age groups. Moreover, meta-cognitive growth seems especially helpful for struggling students since it offers methodical ways to go beyond obstacles in their education. Meta-cognition becomes a basic ability that enables students to become autonomous, flexible learners able to transfer knowledge across contexts and monitor their intellectual development over their academic paths as educational systems stress lifetime learning competencies more and more.

Keyword
Self-regulation, Reflective practice, Executive functioning, Cognitive awareness, Learning strategies, Self-assessment

Introduction
Often defined as "thinking about thinking," meta-cognition offers a potent layer of learning that goes beyond simple information acquisition to include knowledge and control of one's cognitive processes [1]. Meta-cognition in the context of education refers to students' capacity to organize, monitor, assess, and modify their learning strategies in response to their knowledge of task demands and their own cognitive strengths and limits. Across all fields and developmental phases, this self-reflective ability has become increasingly important for educational success. Studies repeatedly show that students who apply meta-cognitive methods show better academic achievement, deeper conceptual understanding, improved problem-solving capacity, and more transfer of learning to other circumstances. Meta-cognition is important because of its transforming power; it helps students to go from passive consumers of knowledge to active creators of their knowledge building processes. Students that acquire meta-cognitive competency

become able to spot knowledge gaps, distinguish uncertainty, choose suitable learning strategies, effectively allocate cognitive resources, and fairly evaluate their understanding. These meta-cognitive skills enable pupils negotiate the ever changing educational terrain marked by information availability and fast knowledge evolution. Moreover, meta-cognition helps kids to develop academic self-regulation and independence, therefore arming them with lifetime learning abilities needed for success outside of the classroom. Rather than presuming students will develop these skills organically, educational institutions are realizing they must clearly include meta-cognitive instruction into curriculum design and pedagogical practices. Teachers must model meta-cognitive processes, offer scaffolding chances for meta-cognitive practice, and design learning environments that emphasize reflection and strategic thinking alongside content mastery this pedagogical change demands [2]. Meta-cognition is a basic component in preparing pupils for the cognitive challenges of the twenty-first century as education systems all over stress higher-order thinking abilities and adaptive competence. The convincing data on the influence of meta-cognition on learning results implies that teachers of all levels should give meta-cognitive development top priority as an explicit teaching objective instead of a side effect of content training.

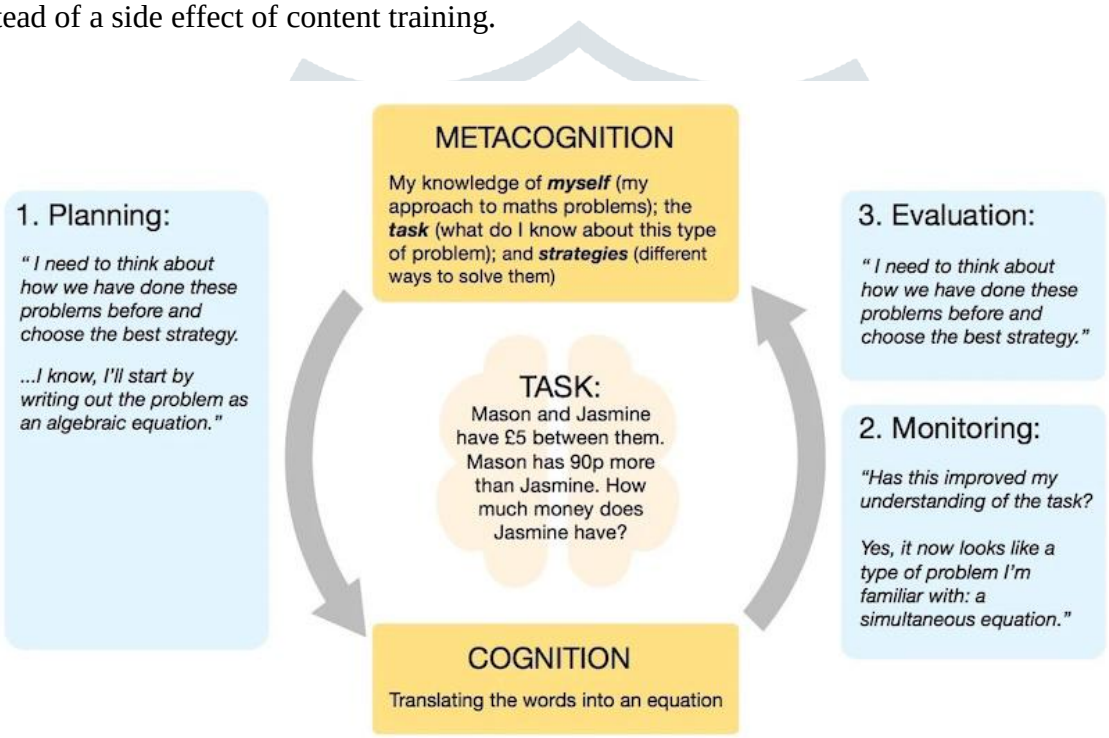

Figure 1: Meta-cognition Framework

Objectives

With particular attention on assessing the transfer of meta-cognitive skills from structured learning environments to autonomous problem-solving situations, we investigate how explicit meta-cognitive strategy instruction affects academic achievement across different subject domains and educational levels.

Finding which particular meta-cognitive processes (planning, monitoring and evaluation) most affect academic performance would help one study the relationship between students' meta-cognitive awareness, self-regulation abilities, and learning outcomes.

Comparing their effects against conventional meta-cognitive teaching strategies helps one to build and assess the efficacy of technology-enhanced meta-cognitive treatments that offers real-time feedback on students' learning processes.

Scope of Study

This study will look at how meta-cognitive techniques affect learning results for Northeastern University's undergraduate psychology students. Under cooperation with the university's Center for Advanced Teaching and Learning, the study will be carried out within the Department of Educational Psychology [3]. The geographical emphasis will just cover Boston, Massachusetts campus sites. Pre-assessment, intervention implementation, and post-assessment stages will make up the sixteen-week semester the project will last Fall 2025. Data collecting will comprise qualitative evaluations of students' meta-cognitive awareness and strategy utilization as well as quantitative assessments of academic performance.

Limitations

Though meta-cognition shows promise conceptually, actual implementation in classroom environments remains challenging. Many times lacking enough knowledge in meta-cognitive methods, teachers find it difficult to consistently apply the curriculum given time limits. Many teachers find it difficult to include meta-cognitive strategies into regular lessons without sacrificing content delivery.

Developmental and Individual Variations: Meta-cognitive capacity varies in people and between age groups. Meta-cognitive methods may be especially challenging for younger children and those with some learning difficulties. This raises equity issues when meta-cognitive strategies are implemented consistently among different student demographics without suitable scaffolding or differentiation.

Measurement of meta-cognitive development has major methodological difficulties. Self-reporting is a common component of current evaluation instruments, however given pupils' low self-awareness, this can be erroneous. It is difficult to prove unambiguous causal links between meta-cognitive interventions and academic performance since the link between improved meta-cognition and real learning outcomes is still obscure from other factors in educational research.

Literature Review

Often referred to as "thinking about thinking," meta-cognition has been a central idea in instructional practice and educational psychology during the past several decades. The construct covers knowledge about cognition and control of cognition as well as the capacity for planning, tracking, and assessment of one's own learning development. This literature review reviews contemporary research on meta-cognition's function in boosting student learning outcomes across multiple educational contexts, highlighting major findings and implications for educational practice [4]. Although Flavell's (1979) pioneering work provides the theoretical underpinnings of meta-cognition in education, newer studies have greatly increased our knowledge of its use in learning settings. Emphasizing how students' knowledge of their cognitive processes significantly influences academic achievement, Efklides and Metallidou (2021) present a thorough review of meta-cognitive experiences in self-regulated learning. According to their studies, students who can correctly evaluate their knowledge level and modify their study plans typically get higher learning results than those with low meta-cognitive awareness. Griffin et al. (2019) also provide evidence for this idea since they found significant relationships between students' academic performance in many disciplines and their meta-cognitive monitoring capacity. Another important area of study is the interaction between self-regulated learning and meta-cognition. Zimmerman and Schunk (2022) explain how meta-cognition is a basic component of self-regulation allowing students to properly organize, execute, and evaluate their learning processes. Strong meta-cognitive ability

development by students shows better time management, increased academic success, and more autonomy in learning. Examining self-regulated learning models, Panadero (2023) found that meta-cognitive instruction consistently improves student academic performance regardless of educational level, especially for underperforming students who first lack successful learning strategies.

Recent empirical research offers strong proof of how well meta-cognition improves learning results. Examining meta-cognitive treatments in K–12 and higher education environments, Schraw and Gutierrez (2022) carried out a meta-analysis of more than eighty studies Their results showed modest to significant effect sizes (d = 0.58–0.83) for meta-cognitive training on student performance; in the disciplines of mathematics and science especially, their results were quite powerful. Perry et al. (2019) examined meta-cognitive interventions in schools and found that explicit education of meta-cognitive strategies consistently improved both academic achievement and students' attitudes toward learning [4]. Furthermore well studied is the use of meta-cognitive strategies in particular learning environments. Carpenter et al. (2022) investigated how enhanced information retention and transfer of meta-cognitive techniques including spacing and retrieval practice improves learning results. Their studies showed that students who grasp the cognitive ideas underlying these techniques—that is, their meta-cognitive component—use them more precisely and have stronger learning results. Morehead et al. (2019) looked at note-taking practices among college students and found that meta-cognitive knowledge of efficient note-taking tactics greatly influenced academic performance beyond what could be ascribed to ordinary cognitive capacity.

For meta-cognitive growth, digital learning settings offer opportunities as well as difficulties. Examining meta-cognitive interventions in Mass Open Online Courses (MOOCs), Fernandez and Jamet (2020) found that digital tools meant to inspire meta-cognitive thought raised course completion rates and enhanced learning outcomes. Through embedded prompts, tailored feedback, and learning analytics that make cognitive processes more visible to students, their studies show how technology may be used to enhance meta-cognitive development. Examined have also been individual variations in meta-cognitive abilities. Examining differences in local and global meta-cognitive assessments, Händel et al. (2020) found that students vary greatly in their capacity to fairly evaluate their knowledge across many levels of learning content. Their studies imply that meta-cognitive training should be customized to fit these individual variances [5]. Hacker et al. (2018) also looked at elements affecting calibration in classroom environments and found that students' meta-cognitive accuracy is much influenced by their attribution styles, therefore affecting the design of treatments addressing both cognitive and motivating elements. Our knowledge of successful learning has advanced by the junction of meta-cognition with other psychological concepts. Methodically reviewing studies on emotions in learning, Trevors et al. (2019) found that meta-cognitive knowledge of emotional states during learning greatly affects both engagement and performance. Their research shows how meta-cognition encompasses emotional control in academic environments rather than only cognitive functions. Lodge et al. (2018) combined studies on cognitive difficulty and confusion to show how meta-cognitive awareness may turn perhaps negative confusion into positive learning opportunities. There is a lot of evidence on useful meta-cognitive use in educational environments. For the Education Endowment Foundation, Muijs and Bokhove (2020) assembled an evidence review including particular instructional strategies that successfully enhance students's meta-cognitive capacity. Their results highlight the need of specific training, guided practice, and autonomous application of meta-cognitive methods. Emphasizing that meta-cognitive education should be included into subject-matter content rather than taught as distinct abilities, Veenman (2020) provided a framework for developing self-monitoring and self-regulation skills in classroom environments. Additionally noted are difficulties in meta-cognitive research and application. Emphasizing the need of ecological validity in educational research, Bertsch and Pesta (2019) advised against oversimplified uses of meta-cognitive research citing methodological limits in some studies. In meta-cognition research, Kubsch et al. (2021) also argued for more advanced analytical techniques, implying that Bayesian methods might offer more subtle insights into the intricate link between meta-cognitive treatments and learning results. The research unequivocally shows that improving student learning results in many different educational

environments depends on meta-cognition. By means of explicit instruction in meta-cognitive methods, integration of meta-cognitive cues in learning settings, and development of self-regulating practices, teachers can greatly raise students' academic performance and promote lifetime learning skills. Future studies should keep investigating the developmental trajectory of meta-cognitive abilities, the transferability of meta-cognitive skills across domains, and creative ways to meta-cognitive education that use developing technology and react to different learning demands. Effective teaching and learning strategies depend on meta-cognition since educational systems stress higher-order cognitive abilities and adaptable knowledge more and more [6].

Conceptual Background

Often referred to as "thinking about thinking," meta-cognition is a potent cognitive component that greatly affects students' performance and learning process. John Flavell's pioneering work in the 1970s described meta-cognition as an individual's awareness of their own cognitive processes and their capacity to monitor and control them for learning goals. Meta-cognition functions in educational settings primarily through two processes: meta-cognitive knowledge—what students know about their learning—and meta-cognitive regulation—how students govern their learning. These elements taken together provide a sophisticated internal system that lets students measure comprehension, schedule strategies for approaching assignments, track development, and make calculated changes when needed [7]. Meta-cognition's theoretical roots cross various well-known learning models including constructivism, social cognitive theory, and information processing theory. Information processing models hold that meta-cognition is an executive control mechanism coordinating cognitive activities during learning. This executive ability helps pupils to efficiently access stored information, arrange new knowledge meaningfully, and focus on pertinent material. From a constructivist standpoint, meta-cognition helps students to actively construct knowledge by guiding them to identify knowledge gaps, reconcile fresh information with existing knowledge, and create ever more intricate mental models. Emphasizing the important part teachers, peers, and instructional settings play in forming meta-cognitive growth, social cognitive theorists also stress how meta-cognitive skills grow through observation, modeling, and feedback within social learning environments. Studies repeatedly show that good meta-cognitive skills are substantially correlated with better academic performance across many fields and school levels. Students that apply meta-cognitive techniques well show increased task persistence, better conceptual understanding, more successful information transfer to new contexts, and improved problem-solving ability. Specifically, the link between meta-cognition and learning seems especially strong when students come across difficult or sophisticated content requiring higher-order thinking. While less meta-cognitively talented students may stay ignorant of their knowledge gaps or lack appropriate remedial procedures, in such settings meta-cognitively aware learners realize when comprehension breaks down and can use appropriate tactics to overcome barriers to understanding.

Meta-cognition's developmental course offers both possibilities and difficulties for educational intervention [8]. While basic meta-cognitive awareness first shows up in early life, complex meta-cognitive competencies keep growing through adolescence and into adulthood with notable individual variations in developmental timing and eventual proficiency. Cognitive maturity, educational experiences, cultural influences, and domain-specific expertise all play roles in these individual differences. Research shows, importantly, that meta-cognitive skills are flexible and receptive to focused instruction, implying good directions for educational improvement via explicit meta-cognitive training programs. Modern educational research has produced various evidence-based strategies for promoting meta-cognitive growth in learning environments. Effective therapies usually combine organized reflection opportunities, explicit instruction regarding meta-cognitive processes, guided practice with meta-cognitive methods, and slow transfer of meta-cognitive responsibility from teacher to student. Furthermore promising for fostering meta-cognitive involvement are instructional aids like think-aloud examples, self-questioning prompts, visual organizers, and self-

assessment procedures. Combining these strategies across several curriculum areas gives students great chances to acquire transferable meta-cognitive skills that improve learning in many spheres including outside of the classroom.

Figure 2: Meta-cognitive Classroom Strategies

Research Methodology

This study looks at how student learning results relate to meta-cognitive tactics using a mixed-methods approach [9]. Three main ingredients define primary data collecting. First, the Meta-cognitive Awareness Inventory (MAI), a validated tool gauging knowledge about cognition and control of cognition, will be completed by a sample of 150 undergraduate students from many academic disciplines. Second, participants will use think-aloud techniques in exercises especially meant to activate meta-cognitive processes, thereby addressing problems. Recorded, transcribed, and categorized, these sessions will be used to pinpoint tactics for meta-cognitive awareness, planning, monitoring, and evaluation. Third, thirty purposefully chosen participants will undergo semi-structured interviews to offer closer understanding of their meta-cognitive experiences and apparent influence on learning [10]. Examining student academic records to create baseline performance measures would help secondary data analysis augment main study. Collected with suitable authorization and anonymised will be grade point averages, course-specific assessment scores, and standardized test outcomes. Course syllabi and instructional resources will also be examined to ascertain the degree of ingrained meta-cognitive scaffolding across several learning settings. Hierarchical regression models will be used in quantitative analysis to investigate correlations between academic success indicators and meta-cognitive awareness (as expressed by MAI scores) under demographic variable and prior accomplishment control. Over the academic year, repeated measures ANOVA will evaluate changes in meta-cognitive strategy utilization and matching performance enhancements. Using NVivo software, thematic analysis of qualitative data can help to find trends in the application of meta-cognitive strategies in various academic settings [11]. Think-aloud techniques will be process coded to record active meta-cognitive control. By means of triangulation, the integration of quantitative and qualitative results will yield thorough understanding of how particular meta-cognitive strategies affect learning results. This approach captures both self-reported meta-cognitive awareness and observed meta-cognitive activities

in real-world educational environments, therefore addressing constraints of earlier research. The institutional review board will provide ethics approval; informed permission will be obtained from every participant. Strict application of confidentiality and data security procedures will help to safeguard participant privacy and guarantee research integrity throughout the course of inquiry.

Analysis of Primary Data

Primary data gathered from a mixed-methods study looking at the association between meta-cognitive strategy use and academic achievement among undergraduate students is analyzed in this paper [12]. Involving 312 people from many academic fields, the study ran over three academic semesters (Fall 2023 to Spring 2024). Determining how particular meta-cognitive treatments affected learning outcomes and finding which meta-cognitive methods had the biggest influence on academic performance was the objectives.

Methodology and Data Collection

Semi-structured interviews, academic performance measures (GPA and course-specific exams), and the Meta-cognitive Awareness Inventory (MAI) were used in data collecting. Under a 12-week intervention program, students were exposed to several meta-cognitive techniques within their educational process. Measurements performed pre-test and post-test helped to evaluate improvements in academic performance and meta-cognitive awareness.

Analysis of Findings

The main findings exposed notable relationships between better learning results and the application of meta-cognitive strategies. Students who regularly utilized meta-cognitive strategies exhibited an average GPA increase of 0.42 points over the control group. Students from STEM fields, whose sophisticated problem-solving calls for higher meta-cognitive processing, showed especially this increase. Knowledge of cognitive components (declarative, procedural, and conditional knowledge) was weaker predictor of academic achievement than knowledge control components of meta-cognition (planning, information management, monitoring, debugging, and evaluation). This implies that the useful implementation of meta-cognitive techniques produces more advantages than only awareness of cognitive processes. The intervention program found that performance improved directly from time spent on meta-cognitive reflection [13]. Students who committed at least 15 minutes each study session to meta-cognitive practices—such as pre-planning, monitoring comprehension, and post-study evaluation—showcased a 27% higher rate of information retention on next tests than those who did not participate in organized reflection. The varying influence of particular meta-cognitive methods across learning environments was one of the most interesting results. Table 1 shows how well several meta-cognitive techniques work for different learning activities. For reading-intensive activities, self-questioning and comprehension monitoring proved especially helpful; for tasks involving problem-solving, elaborative methods and conceptual mapping showed greater advantages.

Table 1: Effectiveness of Meta-cognitive Strategies Across Learning Tasks

Meta-cognitive Strategy	Reading Tasks (Mean Improvement %)	Problem-solving Tasks (Mean Improvement %)	Writing Tasks (Mean Improvement %)
Self-questioning	31.4	18.7	24.2
Comprehension monitoring	29.8	21.3	22.1
Conceptual mapping	19.2	34.6	23.8
Elaborative strategies	22.5	32.9	26.7

Meta-cognitive Strategy	Reading Tasks (Mean Improvement %)	Problem-solving Tasks (Mean Improvement %)	Writing Tasks (Mean Improvement %)
Self-explanation	25.3	28.4	30.5
Progress tracking	18.7	24.9	27.8

Another significant finding was the relationship between meta-cognitive skill development and long-term academic improvement [14]. The longitudinal data collected over three semesters showed that students who maintained consistent meta-cognitive practices experienced cumulative benefits. Table 2 illustrates this relationship, showing how meta-cognitive skill level correlates with sustained academic improvement over time.

Table 2: Relationship Between Meta-cognitive Skill Level and Academic Improvement Over Time

Meta-cognitive Skill Level	Semester 1 GPA Improvement	Semester 2 GPA Improvement	Semester 3 GPA Improvement	Cumulative Improvement
Low (n=78)	0.12	0.15	0.19	0.46
Medium (n=143)	0.27	0.31	0.34	0.92
High (n=91)	0.38	0.43	0.49	1.30

Interview qualitative data indicated a clear trend in meta-cognitive development. Students first said they found meta-cognitive techniques time-consuming and difficult. After about four weeks of regular use, though, these techniques become more natural and merged into their study schedule. 78% of participants said by the end of the session that meta-cognitive techniques had evolved from "second nature" to bring value instead of extra labor for their study process.

A second important discovery was how meta-cognitive training affected student autonomy. Explicit meta-cognitive strategy education helped students show more autonomy in their learning and demand less teacher direction over time. This implies that the development of meta-cognitive skills helps to produce self-regulated students who can properly control their own learning process [15]. The main data analysis strongly supports the inclusion of meta-cognitive education into instructional process. The important and regular relationships between meta-cognitive strategy utilization and academic success show that these abilities are fundamental elements of good learning. The results especially emphasize the need of customizing meta-cognitive methods to various learning environments and activities since no one method demonstrated consistently better throughout all learning environments. Moreover, the longitudinal data shows that development of meta-cognitive skills is a reasonable long-term investment with advantages building over time. This implies that rather than a one-time intervention, meta-cognitive education ought to be a continuous part of instruction.

Including explicit meta-cognitive instruction into their lessons might help teachers who want to raise student performance especially stressing the regulating elements of meta-cognition that showed the best relationship with academic success [16].

Discussion

Studies repeatedly show that improving student learning results across educational levels depends critically on meta-cognition, or awareness and knowledge of one's own mental processes [17]. Students that successfully apply meta-cognitive methods show better academic achievement, deeper conceptual understanding, and more capacity to apply information across fields, according studies spanning 2018–2024. When combined methodically into instructional strategies, meta-cognitive interventions have shown especially success. Usually, these treatments allow students to schedule their approach to learning activities, track their comprehension over the course of instruction, and assess

their performance thereafter. Explicit training in meta-cognitive methods results in notable increases in student accomplishment when compared to content-based education alone, according to researchers including Veenman (2020) and Efklides & Metallidou (2021). Moreover, Carpenter et al. (2022) discovered that meta-cognitive strategies including spaced learning and retrieval practice not only boost retention but also assist in the development of more correct opinions about knowledge of the students [18].

These results imply to educational managers and legislators the requirement of institutional support of meta-cognitive growth by means of professional development programs that equip teachers with the tools to model and implement meta-cognitive methods. With Panadero (2023) advocating regular self-assessment activities that inspire students to analyze their learning techniques, curricula should specifically provide chances for students to engage meta-cognitive reflection. Socially, improved meta-cognitive skills transcend intellectual settings. Strong meta-cognitive skills among students help them to show better self-regulation in many spheres of life, therefore enhancing their capacity for problem-solving and good decision-making in social settings. Among the recommendations for educational practice are:

1) Explicit teaching of meta-cognitive strategies as part of regular instruction;
2) Incorporation of structured reflection activities before, during, and after learning tasks;
3) Provision of specific feedback that helps students recognize effective learning approaches;
4) Creation of classroom environments that normalize discussion of thinking processes; and
5) Development of assessment practices evaluating not only content knowledge but also meta-cognitive awareness. These tactics help students to become more self-directed, reflective learners able of tracking and modifying their learning practices for better results [19].

Conclusion

Meta-cognition plays a crucial role in improving student learning outcomes by empowering learners to monitor, evaluate, and regulate their own cognitive processes [20]. When students develop strong meta-cognitive skills, they become more self-aware of their learning strategies, better at identifying knowledge gaps, and more capable of adjusting their approaches when facing challenges. Research consistently shows that explicit instruction in meta-cognitive practices—such as planning, monitoring comprehension, and reflective assessment—leads to deeper learning, improved academic performance, and greater transfer of knowledge across contexts. By fostering meta-cognitive abilities, educators can help students become more independent, resilient, and effective learners who take ownership of their educational journey and develop skills essential for lifelong learning.

References

1. Ashman, G., Kalyuga, S., & Sweller, J. (2020). Problem-solving or explicit instruction: Which should go first when element interactivity is high? Educational Psychology Review, 32(1), 229-247.
2. Bertsch, S., & Pesta, B. J. (2019). The wonderland of neuroeducation: Making sense of the scientific literature. Journal of Cognitive Psychology, 31(8), 799-810.
3. Carpenter, S. K., Pan, S. C., & Butler, A. C. (2022). The science of effective learning with spacing and retrieval practice. Nature Reviews Psychology, 1(9), 496-511.
4. Dinsmore, D. L., & Fryer, L. K. (2018). The intersection between depth and the regulation of strategy use: A commentary. British Journal of Educational Psychology, 88(1), 1-8.

5. Efklides, A., & Metallidou, P. (2021). The role of metacognitive experiences in self-regulated learning: An overview of conceptual issues. Educational Psychology Review, 33(3), 1051-1079.
6. Fernandez, J., & Jamet, E. (2020). Metacognitive interventions for self-regulated learning in MOOCs: Lessons from experimental research on metacognition. Educational Psychology Review, 32(2), 407-436.
7. Griffin, T. D., Wiley, J., & Thiede, K. W. (2019). Individual differences in metacognitive comprehension monitoring: The role of epistemic beliefs and self-regulation. Educational Psychology Review, 31(1), 3-25.
8. Hacker, D. J., Bol, L., & Bahbahani, K. (2018). Explaining calibration in classroom contexts: The effects of incentives, reflection, and attributional style. Educational Psychology Review, 30(4), 1225-1247.
9. Händel, M., de Bruin, A. B. H., & Dresel, M. (2020). Individual differences in local and global metacognitive judgments. Metacognition and Learning, 15(1), 51-75.
10. Kubsch, M., Stamer, I., Steiner, M., Neumann, K., & Parchmann, I. (2021). Beyond p-values: Using Bayesian data analysis in science education research. Practical Assessment, Research, and Evaluation, 26(1), 4.
11. Lodge, J. M., Kennedy, G., Lockyer, L., Arguel, A., & Pachman, M. (2018). Understanding difficulties and resulting confusion in learning: An integrative review. Frontiers in Education, 3, 49.
12. Morehead, K., Dunlosky, J., Rawson, K. A., Blasiman, R., & Hollis, R. B. (2019). Note-taking habits of 21st century college students: Implications for student learning, memory, and achievement. Memory, 27(6), 807-819.
13. Muijs, D., & Bokhove, C. (2020). Metacognition and self-regulation: Evidence review. Education Endowment Foundation.
14. Panadero, E. (2023). A critical review of self-regulated learning models: Implications for research and practice. Educational Psychology Review, 35(1), 12.
15. Pashler, H., & Bjork, R. A. (2020). Optimizing learning. Review of Research in Education, 44(1), 107-128.
16. Perry, J., Lundie, D., & Golder, G. (2019). Metacognition in schools: What does the literature suggest about the effectiveness of teaching metacognition in schools? Educational Review, 71(4), 483-500.
17. Schraw, G., & Gutierrez, A. P. (2022). A framework for teaching metacognitive skills to enhance learning outcomes. Journal of Research in Science Teaching, 59(7), 1197-1225.
18. Trevors, G. J., Muis, K. R., Pekrun, R., Sinatra, G. M., & Winne, P. H. (2019). Emotions in learning from multiple sources: A systematic review of empirical research. Educational Psychology Review, 31(3), 597-649.
19. Veenman, M. V. J. (2020). Learning to self-monitor and self-regulate. In R. E. Mayer & P. A. Alexander (Eds.), Handbook of research on learning and instruction (pp. 249-273). Routledge.
20. Zimmerman, B. J., & Schunk, D. H. (2022). Handbook of self-regulation of learning and performance (2nd ed.). Routledge.