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THE IMPACT OF METACOGNITIVE SKILLS ON STUDENTS' COGNITIVE DEVELOPMENT

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Abstract
This article analyzes the impact of metacognitive skills on students' cognitive development. According to research, metacognitive strategies — monitoring, evaluating, and regulating one's thinking process — significantly enhance students' critical thinking, problem-solving abilities, and academic performance. Developing these skills in primary and secondary education supports students in improving reading comprehension, information retention, and logical thinking. Improving metacognitive skills also increases learners' motivation and readiness for independent learning. Recent studies shov that assigning tasks based on a metacognitive approach helps students improve self-regulation and the conscious use of learning strategies. As a result, students become more engaged and responsible participants in the educational process. The article emphasizes the importance of integrating metacognitive techniques into everyday learning to support holistic cognitive development in schoolchildren.

Keywords: Metacognition, metacognitive skills, cognitive development, self-regulation, independent learning, education, learning strategies, academic achievement.

Introduction

One of the primary goals that education must encompass is to assist students in becoming independent and effective learners. The ability of students to utilize strategies that help them direct their own motivation and channel it toward a common goal is a central aspect that should be given special attention in

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educational planning. This is where metacognition—that is, knowledge about knowledge—plays a crucial role. Metacognition refers to the component responsible for directing, monitoring, regulating, organizing, and planning our cognitive abilities once they are engaged.

The modern educational process is no longer limited to the transmission of knowledge; rather, it also aims to develop learners' abilities to think independently, manage themselves, analyze problems, and acquire knowledge efficiently. In particular, metacognitive skills—such as the ability to understand, plan, monitor, and evaluate one's own thinking process—play a vital role in students' cognitive development.

In this regard, President Shavkat Mirziyoyev has emphasized the urgency of addressing key issues in the field of education, stating:

"Today, our top priority is to reform the education system in accordance with modern requirements, and to enhance students' independent thinking, analytical approach, and creative potential."[1]

LITERATURE REVIEW

The theory and methodology of metacognition have been the subject of extensive research by many scholars. Metacognition refers to an individual's capacity to monitor, plan, organize, observe, and evaluate their own thinking processes. The term was first introduced into academic discourse in the 1970s by American researcher John Flavell. Scholars such as Ann Brown, Lev Vygotsky, Gregory Schraw, and Dennison have conducted comprehensive studies aimed at analyzing and developing metacognitive processes.

Flavell defines metacognition as "understanding and controlling one's own cognitive processes" and divides it into two major components: metacognitive knowledge and metacognitive regulation strategies. According to his framework, metacognition consists of the following two core components:

1. Metacognitive knowledge – the individual's declarative knowledge about their own cognitive activity and learning tasks;

[1] Mirziyoyev Sh. Address of the President of the Republic of Uzbekistan to the Oliy Majlis [Electronic resource] // Official website of the President of the Republic of Uzbekistan. – 2020. – December 29. – Access mode: https://president.uz/oz/lists/view/4057

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2. Metacognitive regulation (also referred to as self-regulated learning) – a procedural process involving the intentional management, planning, and monitoring of learning.

For example, when a student is solving a complex math problem, they first identify which formulas to apply (metacognitive knowledge), and then monitor their approach, analyze any mistakes, and revise their strategy if necessary (metacognitive regulation). In doing so, the student is not only learning but also observing how they are learning — a process that leads to deeper and more qualitative knowledge acquisition. Developing metacognitive strategies also contributes to fostering students' critical thinking skills. Critical thinking involves not only analyzing information but also reflecting on one's own thoughts, identifying flawed reasoning, and making appropriate corrections. For instance, a student writing an essay may organize their main arguments, assess supporting evidence, recognize faulty conclusions, and revise them accordingly — demonstrating the interrelation between metacognitive and critical thinking skills.

In today's rapidly changing world, the principle of "learning how to learn" is of growing importance. Therefore, promoting a metacognitive approach in education enhances students' ability not only to acquire knowledge but also to analyze, manage, and apply it across various domains. According to Flavell[2], a good learner is an individual who possesses a robust knowledge base that includes metacognitive knowledge, awareness of the cognitive task at hand, and strategies for achieving intended learning goals.

Metacognition enables students to understand the demands of a task, identify available cognitive resources, and consciously select or create strategies based on their prior experiences with similar problems.[3] Schraw and Graham emphasize that metacognition is a critical component of effective learning, enabling individuals to plan, monitor, and regulate their cognitive activities.[4] Ann Brown emphasizes the importance of applying metacognition in the teaching process and highlights the necessity of deliberately instructing these skills. Lev Vygotsky, through his concept

[2] Flavell, J.H. Speculations about the nature and development of metacognition. In Weinert, F.E. & Kluwe, R.H., (Eds.), Metacognition, motivation and understanding 1987. pp. 21-29). Hillsdale, New Jersey: Lawrence Erlbaum Associates

[3] Pennequin, V., & Sorel, O., Mainguy, M. Metacognition, executive function and aging: the effect of training in the use of metacognitive skills to solve mathematical word problems. Adult Development Vol 1. 2010. pp: 3-12

[4] Schraw, G & Graham, T. Helping gifted students develop metacognitive awareness. Roeper Review, Vol 20. No 1. 1997. pp 4-8

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of the "Zone of Proximal Development," reveals the potential for developing metacognitive skills. David Hammer and Andrew Elby have extensively studied the application of metacognitive approaches in teaching physics. They analyze how students can expand their knowledge by critically reflecting on their own conceptual understanding and integrating it with new information. Similarly, José Mestre and Irvin Halloun demonstrated the effectiveness of metacognitive strategies in solving physics problems, showing that these methods enhance students' analytical and evaluative abilities.

Stella Vosniadou investigated the importance of metacognitive skill development in the process of forming scientific concepts and encouraged students to integrate new knowledge into their existing cognitive frameworks. Researchers in the post-Soviet region have also made significant contributions to the study and development of metacognitive processes. Sergey Polat, Elena Kazakova, Rakhmatulla Nuriddinov, and Dilnoza Kadirova have carried out substantial work on integrating metacognitive strategies into the educational process. Notably, Polat and Kazakova have played a key role in promoting metacognitive approaches within the Russian scientific community.

Despite the proven importance of metacognitive skills in the learning process, many classrooms today still lack a systematic focus on their development. Many educators prioritize content delivery, often neglecting to consider how students are actually learning. In other words, students are expected to acquire the skills necessary for effective learning on their own, without guided instruction. According to McGilly, many students do not engage in meaningful learning and instead rely on rote memorization as their primary learning strategy. He argues that students should be explicitly taught essential skills such as learning strategies, social competencies, problem-solving techniques, and information organization methods, and that these should be integrated into the curriculum.

From this perspective, the role of the teacher is crucial in helping students develop metacognitive skills. As White points out, teachers can foster metacognitive growth by explaining to students how to think about what they are doing and by providing clear guidance. The teacher must be motivated to guide students in analyzing how they learn and what challenges they face during the learning process. In addition, educators should assist students in identifying ways to improve their learning and become more effective learners. Thomas emphasizes that metacognitive

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development can emerge through the process of mastering academic content. In other words, learning skills can and should be developed directly within the classroom environment, through the ongoing interaction between teaching and learning.

RESULTS

In order to investigate the impact of metacognitive skills on students' cognitive development, a total of 80 seventh-grade students from School No. 1 in Margilan city were selected as research participants. The students were divided into two groups: 40 students in the experimental group and 40 in the control group. The study was conducted over a six-week period, including a one-month active intervention phase. Diagnostic tools used in the study included the Junior Metacognitive Awareness Inventory (Jr. MAI), the Otis–Lennon School Ability Test (OLSAT), and the Logical Thinking Test (LTT). In addition to testing, classroom observations and interviews with both teachers and students were conducted to gather qualitative data. The experimental group received targeted metacognitive skill development interventions. These included:

- Goal-setting exercises
- Learning journals
- Reflection logs (Thought-monitoring journals)
- "How do I learn?" assignments

Student engagement with these tasks was systematically observed and documented throughout the intervention.

Table 1. MAI-J Indicators

Indicator	Experimental (Pre-test)	Experimental (Post-test)	Control (Pre-test)	Control (Post-test)	Difference / p-value
Planning	2.75	3.40	2.73	2.76	+0.65 / p < 0.01
Monitoring	3.05	3.55	3.04	3.07	+0.50 / p < 0.01
Evaluation	2.95	3.50	2.91	2.94	+0.55 / p < 0.01
Overall MAI-J	2.96	3.44	2.94	2.96	+0.48 / p < 0.01

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Table 2. **Results of Cognitive Tests**

Type of test	Experimental (Pre-test)	Experimental (Post-test)	Control (Pre-test)	Control (Post-test)	Difference / p-value
Memory	11.2	14.8	11.4	11.9	+3.6 / $p < 0.001$
Thinking	5.6	7.6	5.4	5.6	+2.0 / $p < 0.01$
Attention	17.1	22.3	16.9	17.2	+5.2 / $p < 0.001$

DISCUSSION

This study aimed to determine the impact of developing metacognitive skills on the cognitive and metacognitive functions of 7th-grade students. To assess key indicators such as memory, thinking, attention, self-monitoring, and readiness for independent learning, a combination of methods was used, including the Junior Metacognitive Awareness Inventory (Jr. MAI), cognitive tests, classroom observattions, and interviews. The students were divided into experimental and control groups, with only the experimental group receiving metacognitive training sessions. These sessions included activities such as maintaining learning journals, setting academic goals, practicing thought monitoring and regulation tasks, and engaging in self-awareness exercises such as “How do I learn?” Through these activities, students not only acquired knowledge but also learned to manage, observe, and regulate their own learning processes. Statistical analysis revealed that the experimental group demonstrated a significant improvement in all metacognitive components (planning, monitoring, and evaluation) as well as in cognitive indicators (memory, thinking, and attention). This suggests that the intentional development of metacognitive skills has a meaningful positive effect on students’ overall cognitive functioning and learning efficiency. For instance, based on the Jr. MAI indicators, the experimental group showed an average increase of 0.48 points ($p < 0.01$), indicating the effectiveness of the intervention. According to the cognitive test results, significant improvements were observed in memory (+3.6 points), logical thinking (+2.0 points), and attention (+5.2 points) — all of which were statistically significant ($p < 0.001$ and $p < 0.01$). Furthermore, data from classroom observations and interviews revealed that students in the experimental group began to demonstrate a more active and responsible attitude

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toward their own learning process. They developed the ability to set personal learning goals, reflect on their learning strategies, identify and correct ineffective approaches, and take greater ownership of their academic progress. Learning journals showed a noticeable improvement in students' self-awareness and time-management competencies. In contrast, such improvements were not observed in the control group, suggesting that traditional instruction alone is limited in fostering these metacognitive and cognitive developments. The key conclusion of this research is that a learning process grounded in metacognitive activity helps shift students from passive recipients of information to active, independent, and reflective learners. This approach not only enhances their current academic performance but also prepares them for lifelong learning and self-directed personal development.

CONCLUSION

Based on the research findings, the following scientific and practical conclusions can be drawn:

1.When systematically implemented, metacognitive training activities significantly enhance students' academic performance and comprehension.

2. Through reflective approaches, students develop the ability to select, adapt, and evaluate their own learning strategies.

3. Emphasizing metacognition within psychological and pedagogical processes provides a foundation for personalized education.

Therefore, the integration of methodological approaches aimed at developing metacognitive skills in school education is essential. Such integration not only improves learning outcomes but also plays a critical role in shaping students' self-discipline, independent thinking, and self-directed learning culture. Based on the analysis of the results, the following scientific-theoretical and practical recommendations are proposed:

1. Metacognitive strategies should be systematically integrated into the educational process. These skills should not be considered supplementary, but rather an integral part of classroom instruction. By consistently incorporating tasks related to planning, monitoring, and evaluating one's learning process, students' readiness for independent learning will increase. For this reason, each lesson should include reflective activities based on questions such as:

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"What do I want to learn today?",
"What difficulties did I face?", and
"How did I learn?"
Additionally, it is recommended to implement professional development programs for teachers focusing on metacognitive approaches.

2. Special methodologies should be developed to cultivate a culture of reflection among students. Learners should not only acquire knowledge but also understand how they are learning. This can be facilitated through the use of:

- Learning journals
- Self-assessment logs
- Weekly progress tracking charts
- Cognitive reflection diaries

Practical tools such as the "Thought Monitoring Journal" are recommended for fostering metacognitive awareness.

3. Enrich educational curricula with metacognitive competencies.
Currently, metacognitive skills are not represented as a separate component in most school curricula. Therefore, it is recommended to integrate metacognitive tasks and exercises into each subject area (e.g., mathematics, native language, biology, etc.). This can be achieved by embedding metacognitive strategies into every topic. Additionally, an interdisciplinary module focused on "learning how to learn" can be developed to promote deeper, cross-subject metacognitive engagement.

4. Utilize metacognitive approaches within school psychological services.
School psychologists should monitor not only students' emotional and volitional development but also their self-awareness and learning strategies. To this end: Psychological diagnostic tools (e.g., the Junior Metacognitive Awareness Inventory - MAI-J) should be used regularly. Metacognitive training programs tailored to students' needs should be developed and implemented in practice.

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