THE EFFECT OF GUIDED REFLECTION STRATEGIES ON THE DEVELOPMENT OF METACOGNITION IN ADOLESCENTS

Monica MAIER, **Assoc. Prof. Ph.D.,**
Technical University of Cluj-Napoca
monica.maier@dspp.utcluj.ro

Abstract: *This paper investigates the impact of guided reflection strategies on the development of metacognition in high school students. The present study used a quasi-experimental design with two parallel groups (experimental and control), assessing changes in self-awareness and cognitive self-regulation over an eight-week period. The results showed significant improvements in metacognitive awareness and academic performance in the experimental group, suggesting that guided reflection can be successfully integrated into teaching activities. The results indicated a significant increase in scores on the Metacognitive Awareness Inventory (MAI) and improved academic performance in Mathematics and Romanian Language for the experimental group. The conclusions support the integration of guided reflection into the curriculum as an effective teaching approach for stimulating self-regulated learning.*

Keywords: *metacognition; guided reflection; self-awareness; cognitive self-assessment; cognitive self-regulation.*

Introduction

Metacognition, a term introduced by Flavell (1979), describes an individual's ability to monitor, control, and regulate their own cognitive processes. Numerous studies (Schraw & Dennison, 1994; Zimmerman, 2002) have shown that students with high metacognitive skills demonstrate better academic performance, adopt more effective learning strategies, and adapt more quickly to new academic and non-academic demands.

Guided reflection strategies involve a set of planned activities that encourage students to analyze their thinking processes, evaluate their progress, and adjust their working methods. Recent research (Veenman et al., 2006; Dignath & Büttner, 2008) shows that integrating guided reflection into teaching increases both cognitive awareness and self-regulation of learning.

The theme of this paper is in line with the current trend in educational psychology studies that promote active and reflective learning methods, with an emphasis on the development of self-assessment and planning skills.

Research questions

In a rigorous scientific approach, the formulation of research questions is an essential step in clearly defining the direction of the investigation and ensuring methodological coherence. Given the aim of the study—to investigate the effect of guided reflection strategies on the development of metacognitive skills and academic performance in high school students—the research questions were designed to capture both the metacognitive dimension and the impact on academic performance. They aimed to identify the relationships between the proposed intervention and changes in metacognitive awareness, as well as the differences between students who benefit from guided reflection and those who follow the standard curriculum exclusively.

Thus, the present research started from the following questions:

1. To what extent can guided reflection strategies increase metacognitive awareness in high school students?
2. What is the impact of guided reflection on academic performance in mathematics and Romanian language?
3. Are there significant differences between students who participate in guided reflection sessions and those who follow only the standard curriculum?

Research objectives

Based on the purpose of the study and the research questions, the research objectives were as follows:

O1. To assess the initial level of metacognitive awareness and academic performance.

O2. To implement a guided reflection-based intervention in order to increase the level of cognitive awareness and self-regulation of work strategies.

O3. To compare the post-intervention results between the experimental group and the control group.

O4. Identifying the dimensions of metacognition that were most strongly influenced by guided reflection.

Research hypotheses

In the context of the present study, the hypotheses reflect the expectation that guided reflection strategies will produce a significant increase in the level of metacognitive awareness and an improvement

in academic performance in the targeted subjects, as well as notable differences between students who benefit from this intervention and those who follow the standard curriculum. These hypotheses guided the data analysis and also allowed the initial assumptions to be validated, thus contributing to the substantiation of the research conclusions.
The hypotheses formulated were as follows:
H1: Students in the experimental group will achieve significantly higher MAI scores after the intervention compared to students in the control group.
H2: Academic performance in mathematics and Romanian language will increase significantly in the experimental group after the application of guided reflection.
H3: Differences between groups in the post-test stage will be due to the intervention, not to initial variations.

Study sample
The study included 60 eleventh-grade students (30 in the experimental group, 30 in the control group) from two urban high schools.
The choice of this age group is motivated by the importance of adolescence in the formation of self-regulation skills and the development of metacognitive strategies, as well as the high potential of guided reflection to support the process of autonomous learning. The division of the sample into two groups—experimental and control—allowed for the implementation of a pretest–posttest design, facilitating the comparison of progress and the isolation of the intervention effect.
The selection criteria were as follows:
- regular school attendance;
- average or above-average school results;
- consent of students and their parents.

Research tools
The pedagogical research used the Metacognitive Awareness Inventory (MAI) developed by Schraw & Dennison (1994).
The MAI is an assessment tool for measuring the extent to which a person is aware of their own cognitive processes and can manage them effectively.
The test consists of 52 items formulated as statements to which respondents respond on a Likert scale (usually 1–5, from *"never true"* to *"always true"*) and measures two main dimensions:
- Knowledge of Cognition:

· Declarative knowledge: what the person knows about their own cognitive abilities (*"*I know what kind of information is important to me");
· Procedural knowledge: knowledge of how to apply strategies ("I know how to use effective learning strategies");
- Conditional knowledge: when and why to use certain strategies ("I know in which situations to use a particular strategy").
- Regulation of Cognition:
· Planning: setting goals and choosing strategies before the task;
· Information management: organizing and structuring learning material;
· Monitoring: tracking progress during the task;
· Error correction: identifying and correcting mistakes;
· Evaluation: analyzing the effectiveness of the strategy after completing the task.
The test was administered in groups (lasting 20 minutes), with students receiving instructions on how to complete the items beforehand. They were also informed of the purpose of the assessment and asked for their consent to be tested.
Other tools used in this research were:
- four docimological tests in Romanian language and mathematics (two for each class, applied in the two stages of the research);
- reflection journals (only for the experimental group).
All these tools were used for qualitative analysis.
Following the application of the docimological tests and the MAI inventory, descriptive statistics (frequency, mean, and standard deviation) and the *t* test for independent samples were also used for quantitative analysis.

Research design
The present study used a quasi-experimental design with two parallel groups: the experimental group and the control group.
In the context of this research, comparing the results obtained by the experimental group and the control group in the two stages—pre-test and post-test—was essential for the correct evaluation of the effect of guided reflection strategies on the development of metacognition and academic performance. The pretest stage allowed the initial level of metacognitive awareness and results in the targeted subjects (Romanian language and mathematics) to be established, providing a clear benchmark for measuring subsequent progress. The posttest stage highlighted the changes that occurred after the intervention, and the differences between the two moments reflected the extent of progress in each group.

The presence of the control group, which followed the standard curriculum exclusively, served to differentiate the specific effects of guided reflection from the possible influences of other factors, such as natural maturation, usual school experiences, or the general educational context. Thus, the "pretest–posttest with control group" design provided a solid methodological framework for testing hypotheses and formulating valid conclusions, while also increasing the credibility of the results and the relevance of the proposed pedagogical recommendations.

The experimental group participated in weekly guided reflection sessions (using a guide with questions about planning, monitoring, and evaluating their own learning). For 8 weeks, a 20-minute guided reflection session was organized each week.

After each working session, the students completed metacognitive journals, in which they specified aspects related to the following:

- what skills they used in solving the tasks;
- why they used those strategies;
- what results they obtained from applying those strategies in terms of quality and quantity;
- what and how many mistakes they made while solving the tasks;
- how many of the mistakes they managed to correct following the feedback received and how they managed to adjust their working strategies.

In the pre-test and post-test stages, the students in the two groups completed the MAI test, as well as the docimological tests in the two study subjects.

The control group followed the same curriculum, but without additional reflection activities. For the pre-test and post-test evaluations, docimological tests and the MAI inventory were used for the control group.

Results

Data analysis shows clear differences between the experimental and control groups at both the initial and final stages.

For a detailed interpretation, we present the results obtained by the students in the two groups in the two stages of the research in the comparative tables and graphs below.

Tools used		Initial score	Final score
Docimological test	Romanian Language	72	81
	Mathematics	68	77
Standardized test	MAI	55	67

Table 1. Results of students in the experimental group in the pre-test and post-test stages

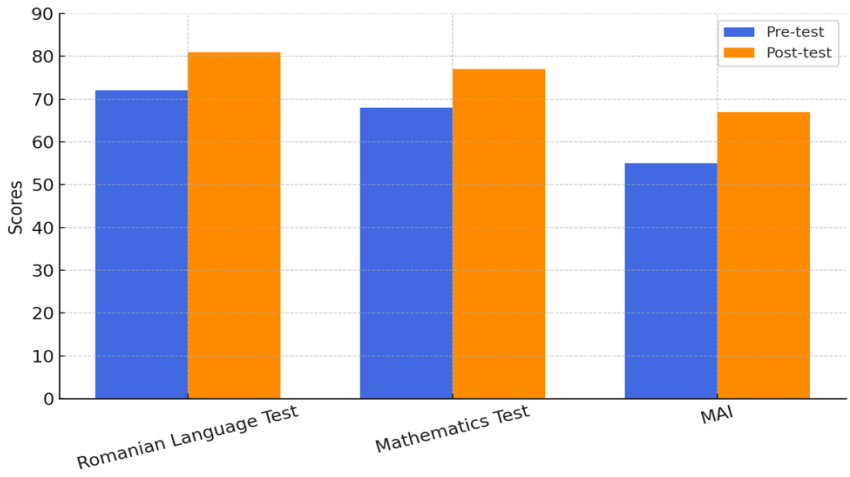

Figure 1. Results of students in the experimental group in the pre-test and post-test stages

The final performance and progress of students in the experimental group showed considerable improvement in all areas:
- **Romanian language**: +9 points (~12.5%)
- **Mathematics**: +9 points (~13.2%)
- **MAI**: +12 points (~21.8%)

Tools used		Initial score	Final score
Docimological test	Romanian Language	73	75
	Mathematics	69	71
Standardized test	MAI	54	56

Table 2. Results of students in the control group in the pre-test and post-test stages

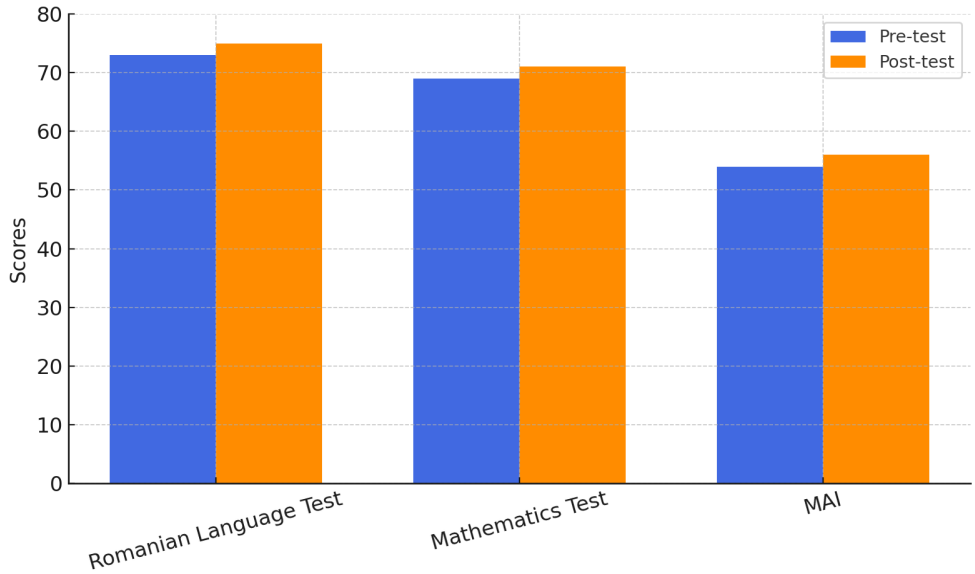

Figure 2. Results of students in the control group in the pre-test and post-test stages

Students in the control group showed minor and consistent performance in the two stages of the study:

- **Romanian language**: +2 points (~2.7%)
- **Mathematics**: +2 points (~2.9%)
- **MAI**: +2 points (~3.7%)

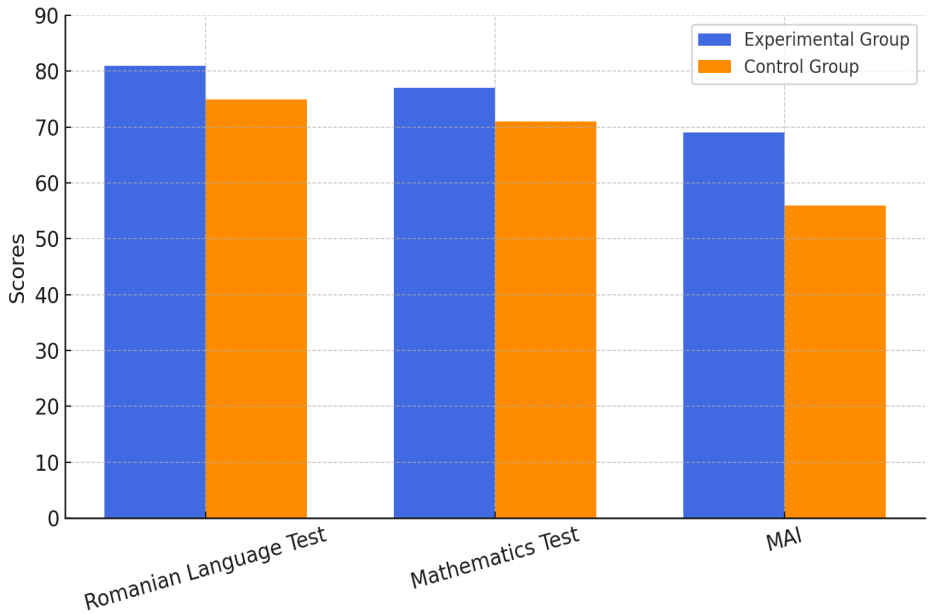

Figure 3. Results of students in the two groups in the post-test stage

Data analysis showed statistically significant increases in MAI scores in the experimental group ($p < 0.05$) compared to the control group. Also, performance on math and Romanian language tests increased in the experimental group compared to the control group.
In terms of initial performance, the two groups started from similar values for each subject:
- in Romanian language, students in the experimental group scored *72*, compared to students in the control group who scored *73;*
- in mathematics: students in the experimental group scored *68*, while students in the control group scored *69*;
- in MAI: students in the experimental group scored *55*, while students in the control group scored *54*.

These results suggest that the initial level was comparable and that any subsequent differences can be attributed to the intervention.
Following statistical processing of the data, the differences between the two groups are significant:

- The calculation of the mean shows that the improvement in performance in the experimental group is 10 points, compared to only 2 points in the control group, which means that the improvements observed in the experimental group are not just the result of chance, but probably the real effect of the intervention applied.
- The dispersion (standard deviation) is higher in the experimental group (1.73), which indicates that in some areas (such as MAI), students in this group benefited from better results than in Romanian language and mathematics after the intervention.
- In the MAI test (metacognition assessment), the increase in results is significantly higher in the experimental group, suggesting a strong effect of guided reflection strategies on the awareness and regulation of cognitive processes.
- The t-test results show $t=8.00$, $p=0.015$; as the p-value is lower than the conventional significance threshold (0.05), we can say that the differences in progress between the experimental and control groups are statistically significant.

Limitations of the research

Any scientific endeavor, regardless of the methodological rigor applied, is subject to factors that can influence the results and their interpretation to varying degrees. Identifying and presenting the limitations of the research is an essential step, as it contributes to the

transparency of the investigative process and to the clear delimitation of the field of validity of the conclusions drawn.
In this study, the limitations are associated with both the characteristics of the sample and the duration of the intervention, as well as with contextual and methodological factors that may affect the generalisation of the results and the long-term evaluation of the observed effects. The presentation of these aspects does not diminish the value of the research, but provides a realistic framework for interpreting the conclusions and formulating directions for further investigation.
The following limitations of the present study can be listed:
- the relatively short duration of the intervention (8 weeks) limits the generalizability of the results;
- the lack of follow-up after the intervention is an important limitation, as it was not possible to assess the persistence of the observed effects in the long term; the results were measured only immediately after the end of the intervention, which does not allow determining the extent to which the progress achieved was maintained or diminished over time; in the absence of a follow-up evaluation, conclusions regarding the sustainability of the impact remain limited;
- other important variables in terms of cognitive and metacognitive development (such as intrinsic motivation, teacher-student relationship, etc.) were not taken into account;
- the generalizability of the results obtained is limited due to the fact that other learning environments (students from rural areas) were not taken into account;
- the generalisation of the results obtained is limited given that only a certain age group was taken into account; future research on this topic could also consider students from lower levels of education;
- the potential “novelty effect” is a possible limitation of the study, as the improvements observed could be partly attributed to the enthusiasm or interest generated by the novelty of the intervention, and not exclusively to its effectiveness; this initial positive reaction, driven by novelty, is often temporary, which may influence the sustainability of long-term results; in the absence of follow-up measurements, it cannot be determined with certainty whether progress is maintained after the novelty effect wears off.

Conclusions

Guided reflection is an effective strategy for developing metacognition in high school students, and its integration into the curriculum can support self-regulated learning and improve academic performance.
The research results show that the three hypotheses were validated:

- the increase in MAI scores was significantly higher in the experimental group, which means that guided reflection stimulates self-regulation of learning;
- academic performance increased by 9–12 points in the experimental group (the integration of guided reflection can support academic performance improvement);
- although the groups were comparable at the outset, academic performance in mathematics and Romanian increased significantly in the experimental group after the application of guided reflection; the method is scalable and applicable in various disciplines.

Following this research, we consider three recommendations for teachers to be useful, which we believe are important for the development of metacognition:

- integration of guided reflection into teaching activities, in the form of metacognitive questions and exercises adapted to each subject;
- monitoring student progress using tools (such as MAI) to tailor interventions to individual needs;
- creating a reflective learning environment in which students are encouraged to analyze their own thinking process and adjust their learning strategies;
- ensuring regular follow-up to verify progress and prevent performance decline after the intervention ends.

The results of this study show that the importance of metacognition development extends beyond immediate school performance, representing an extremely important key competence. Students who know and manage their cognitive processes are better prepared to face academic and personal challenges.

Developing metacognitive skills is not only a way to improve school performance, but also a long-term investment in the development of individuals capable of lifelong learning. Consistent implementation of strategies that encourage reflection, critical thinking, and self-regulation can help create an adaptable educational environment in which students not only accumulate information but learn how to manage and apply it effectively in real-life contexts.

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