education sciences

MDPI

Article

Metacognitive Monitoring in Written Communication: Improving Reflective Practice

István Zsigmond [1,*], Panagiota Metallidou [2], Plousia Misailidi [3], Kalypso Iordanou [4] and Eleonora Papaleontiou-Louca [5]

[1] Faculty of Technical and Human Sciences, Sapientia Hungarian University of Transylvania, 547366 Târgu Mures, Romania
[2] School of Psychology, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece; pmetall@psy.auth.gr
[3] Department of Primary Education, University of Ioannina, 45110 Ioannina, Greece; pmisaili@uoi.gr
[4] School of Sciences, UCLan Cyprus, 7080 Larnaca, Cyprus; kiordanou@uclan.ac.uk
[5] School of Humanities, Social and Education Sciences, Department of Social and Education Sciences, European University of Cyprus, 1516 Nicosia, Cyprus; e.papaleontiou@euc.ac.cy
* Correspondence: zsigmond.istvan@ms.sapientia.ro; Tel.: +40-265-206-210

Abstract: Educational programs aimed at developing metacognitive skills usually focus on students, neglecting the development of teachers by teaching metacognitively aware instructional methods. The effectiveness of such development programs is well-established, but there is a gap between research findings and their application in schools. A framework for a training program was developed in the context of an international partnership project aimed at enhancing the metacognitive abilities of both children and teachers. The final form of classroom activities was developed at the country level using action research methods with the involvement of teachers. After implementing a 3-week educational program involving 35 experimental and 19 control groups from Romanian public schools, a comparison of pre- and post-test scores indicated a significant increase in the number of children in the experimental group with improved efficiency in metacognitive monitoring in reading. Teachers' metacognitive awareness significantly improved after the Teacher Training Program, as indicated by a comparison of the pre- and post-training results of the Metacognitive Awareness Inventory for Teachers (MAIT). No correlation was found between teachers' development scores (as expressed by differences between pre- and post-intervention MAIT results) and the number of students from their classes whose progress in metacognitive monitoring significantly increased. The cyclical process of the action research methodology proved to be useful for increasing the efficiency of the intervention program. However, due to methodological limitations, the results are primarily interpretable within a local context. The results confirm expert recommendations aimed at integrating the targeted development of metacognitive teaching skills into both pre-service and in-service teacher training programs.

Keywords: metacognition; development program; action research

Academic Editor: Lawrence Jun Zhang

Received: 31 October 2024
Revised: 11 February 2025
Accepted: 19 February 2025
Published: 27 February 2025

Citation: Zsigmond, I., Metallidou, P., Misailidi, P., Iordanou, K., & Papaleontiou-Louca, E. (2025). Metacognitive Monitoring in Written Communication: Improving Reflective Practice. *Education Sciences*, *15*(3), 299. https://doi.org/10.3390/educsci15030299

1. Introduction

Metacognition is defined as the knowledge and regulation of one's thinking processes, consisting of planning, monitoring, and evaluating how one learns or solves problems. The essence of metacognition is reflecting on our own cognitive processes (Rivas et al., 2022).

There is consistent experimental evidence that metacognitive processes play a central role in determining successful learning and problem-solving (Wang et al., 1990; Efklides &

Metallidou, 2020). Recent meta-analytical findings indicate that metacognition serves as a crucial predictor of achievement in various domains, maintaining its significance even when accounting for intelligence and other potential moderators, such as chronological age (Ohtani & Hisasaka, 2018; Veenman et al., 2004). In general, the ability to become an expert in a field is associated with a higher performance in using metacognitive strategies (Veenman et al., 1997).

In learning contexts, metacognitive processes allow learners to judge when they understand a topic and when they need to change their study techniques. Metacognitive reflection is oriented on the actions, outcomes, and experiences of teaching and learning for improving performance. In general, metacognition helps students think critically about their learning process, leading to a deeper understanding of the subject matter. For teachers, metacognition consists of critically analyzing teaching practices to check their effectiveness in reaching the teaching goal. Metacognition plays an important role in self-directed learning and transferring knowledge to new areas (Rivas et al., 2022). Researchers justify the importance of metacognition and its urgency in both educational settings and in our daily lives by arguing that it is an essential skill to "teach how to learn" and also "learn how to learn".

Empirical results indicate that metacognitive strategies can be taught and learned. Instructional programs and methods have been elaborated to teach metacognitive strategies or facilitate their implementation (Thomas & Barksdale Ladd, 2000). Experimental results indicate that structured metacognitive instruction leads to substantial improvements in students' reading performance (Hornby & Greaves, 2022). Teaching reading skills designed to enhance metacognition, such as questioning and summarizing, improves reading comprehension (Cromley, 2023).

1.1. Promoting Use of Metacognitive Strategies in School Settings

School intervention studies tend to focus on developing the metacognitive practices of students, neglecting the importance of improving the metacognitive awareness of educators in teaching. However, it is essential to consider that educators fulfill a dual function as reflective thinkers and learners while also being required to facilitate students' reflective thinking and learning, serving as metacognitive role models (Wall & Hall, 2016; Wafubwa et al., 2022). In a study examining the effects of metacognitive strategy instruction on reading comprehension, Dabarera et al. (2014) trained teachers in the reciprocal teaching method (Palincsar & Brown, 1984) to instruct secondary school students in using metacognitive strategies. This was achieved via metacognitive scaffolding, a technique in which teachers modeled the use of metacognitive strategies, such as thinking aloud. The development of teachers' metacognitive awareness was not an explicit objective of the program; their teaching metacognition abilities were not directly evaluated. Similarly, Mevarech and Kramarski (2003) described a metacognitive instructional program implemented in cooperative settings aimed at enhancing primary students' mathematical reasoning and mathematical communication. The instructional program effectively enhanced students' ability to explain their mathematical reasoning during discourse and writing, which is a clear performance indicator in metacognitive monitoring. Nevertheless, the instructional program did not focus on enhancing teachers' self-reflection or developing metacognitive awareness of their teaching practices.

Researchers have begun to investigate teachers' levels of metacognitive awareness and skills only recently. The critical question concerns the extent to which teachers are equipped with metacognitive practices, both as metacognitively aware educators and as facilitators of their students' metacognitive development, within their routine instructional methods.

A growing number of researchers argue that teacher training should include explicit instruction on teaching metacognitive strategies and that metacognitive awareness in teaching practices, in particular, or metacognitively aware teaching, in general, should be clearly articulated during pre-service teacher training (Wafubwa et al., 2022; Ozturk, 2017; Hartman, 2001; Baylor, 2002). Metacognitively aware teaching is an instructional approach where teachers address their students' metacognitive awareness in a conscious and targeted way, guiding them to become mindful of their own learning processes, self-regulation, and reflection (Hartman, 2001; Baylor, 2002; Beach et al., 2020). In educational practice, this means a self-assessment of educators fostering a continuous improvement mind-set that encourages adapting lessons and methods based on what works best for students' learning outcomes.

Halamish's examination of metacognitive knowledge of learning strategies among pre-service and in-service teachers revealed a deficiency in their understanding of several established learning strategies, suggesting that teacher training programs should incorporate explicit instruction on empirically supported learning strategies (Halamish, 2018). Implementing qualitative research methods, Fono and Zohar (2024) pointed out that pre-service and novice in-service teachers engaged in a preparation course for teaching higher-order thinking could create new learning activities designed to enhance students' metacognitive thinking. They also successfully implemented metacognitive instruction in their classrooms. The authors argued that the rationale for metacognitive instruction in general and for teaching low-achieving students in particular needs to be strengthened in teacher education. Shi and Cheng (2021) investigated the effect of metacognitive teaching methods on students' reading comprehension, demonstrating that metacognitive teaching strategies (teaching methods that teachers use to promote students' awareness of how to track their progress in problem-solving) developed students' reading comprehension. They pointed out that their findings support Veenman et al.'s (2006) conclusion, which states that a key component of effective metacognitive teaching is "embedding metacognitive instruction in the content matter to ensure connectivity".

We can conclude that although researchers argue for the importance of metacognitively aware teaching, developing programs that address teachers' metacognition in addition to supporting students' metacognitive strategies is a neglected area.

1.2. Educational Research and Classroom Application

Several authors have pointed out the gap between educational research and classroom practice. An action research methodology is often recommended by educational researchers to facilitate the classroom application of instructional programs (Mertler, 2024, 2021; Mills, 2000; Young et al., 2010). Action research is a collaborative and introspective approach that encompasses a repetitive cycle of planning, executing, observing, and reflecting. This method was initially promoted by Kurt Lewin to address practical issues present in the everyday social landscape via research application. It involves collaboration between researchers and participants, who are often active contributors to both the problem identification and solution processes. Studies conducted with this methodology evolve through a cyclic process of planning, executing, observing, and reflecting, facilitating the ongoing enhancement and adjustment of strategies informed by insights gained in each application session. Reflection plays a crucial role, as individuals consistently evaluate the results of their actions and modify their strategies accordingly. This approach's primary benefit is its adaptability, enabling the process to be modified in response to new discoveries and insights. In the classroom environment, action research allows researchers to identify issues in their own environment with the help of teachers involved in an experimental program and to plan the intervention cycles accordingly.

Authors argue for the benefits of action research in translating educational research into practical applications. For example, Mills (2000) discusses how action research serves as a bridge between theory and practice, enabling teachers to implement and assess educational strategies derived from research, highlighting the role of action research in fostering reflective practice and continuous professional development. Mertler (Mertler, 2024, 2021) also argues that this methodology allows educators to adapt research-based methods to their specific classroom settings, leading to improved teaching and learning outcomes.

Using the action research paradigm for designing and implementing developmental programs aimed at improving metacognitive skills is, nevertheless, a neglected area. Moreover, researchers using the action research methodology to improve educational practices have concentrated on collecting data from students to improve educational materials and teaching methods, neglecting the opportunity to address teachers' reflective thinking to fine-tune classroom applications. For example, Wagaba et al. (2016) used the action research design to investigate the effectiveness of a repertoire of interventions to enhance 9-year-old students' metacognitive capabilities to facilitate their understanding of scientific concepts in various topics. Their methodology included collecting qualitative data from students (using methods such as reflective journals and the construction of concept maps), allowing researchers to calibrate and reformulate the developing activities to increase their effectiveness. There were no reports on collecting data from teachers. Similarly, Kung and Aziz (2020) used action research to investigate the effects of instruction in metacognitive reading strategies to improve students' reading comprehension. The cycles of action research were used to improve the content of the intervention using feedback collected from participants (13-year-old students) when preparing the teaching materials for the next cycles. Although the authors did not explicitly state this, it appears that qualitative data collection was conducted solely with students.

This paper presents the design and implementation of a Teacher Training Program (TTP) in elementary school settings intended to foster teachers' personal development as metacognitive learners and thinkers while simultaneously assisting students in developing metacognitive awareness and skills. The intervention was designed per the principles of action research to facilitate the classroom application of the developmental methods included in the TTP. An important goal was to evaluate the interrelation between the advancements of teachers and students by actively involving both groups in the instructional program.

2. Materials and Methods

In the framework of an Erasmus+ strategic partnership program, experts from the involved higher education institutions developed a Teacher Training Program (TTP) to promote teachers' and students' metacognition in elementary school settings.[1] The main goal was to make teachers aware of the importance and development potential of different aspects of metacognitive thinking and to prepare them to carry out instructional practices aimed at developing metacognition. The TTP outlined the theoretical framework and empirical evidence for the development of metacognitive skills in educational contexts, alongside addressing the development of metacognitively aware teaching methods.

The developmental activities included in the TTP were implemented in educational institutions in the participating countries (Cyprus, Hungary, Romania, Portugal, Greece, and Hungary) in the school years of 2022–2023 and 2023–2024. Following the cyclical nature of action research (planning, acting, observing, and reflecting), the classroom practices were evaluated and refined during country-level training sessions. This paper presents the program's application and results in Romania.

Elementary school teachers from Romanian public schools, teaching students aged 9 to 11, were invited to participate in the program voluntarily. Of the 79 teachers who responded

to the call for participation, 70 agreed to continue participating in the program during the introductory training session. After enrollment, teachers were assigned to two treatment groups: an experimental group (47 teachers with their classes) and a control group (23 classes). Teachers in the control group did not participate in the following training sessions; however, they and their classes were invited to take the same test as the teachers and students in the experimental group. All teachers and students participating in the project were native Hungarian speakers, and the teaching language was also Hungarian. Tests were translated and presented in the Hungarian language.

Upon enrollment, educators submitted administrative information, including their experience (years of teaching) and educational qualifications, along with a performance rating for each student in their class included in the program, using a 1–10 Likert scale, where 10 represented the highest achievement. In addition, teachers were given a two-column table describing the characteristics of children with high and low metacognition (Table 1) and were asked to indicate their general assessment of each student concerning the provided behavioral descriptors using a 5-point Likert scale (1—very low; 5—very high) (adapted from Sperling et al., 2002, Gonida Eleftheria, personal communication, 1 October 2022).

Table 1. Descriptors intended to differentiate students exhibiting high and low levels of metacognition.

High Metacognition	Low Metacognition
1. Focuses attention (He/she is very careful).	1. Attends randomly (He/she is careful where and when)
2. Studies purposefully (Makes study plans)	2. Studies haphazardly (Does not plan much)
3. Analyses a problem or question starting from its givens (elements) before dealing with it	3. Solves a problem or answers a question without deconstructing it into its components
4. Plans the solution to a problem, or the answer to a question	4. Does not plan much of a solution to a problem or answer to a question
5. Asks questions to insure understanding	5. Continues work without understanding
6. Can explain her/his answer to a question or her/his solution to a problem	6. Usually cannot explain her/his answer to a question or her/his solution to a problem
7. Usually judges/evaluates own performance accurately	7. Usually does not judge/evaluate own performance accurately

2.1. Structure of Teacher Training Program

Seven online training sessions, each lasting 90 min, focused on enhancing children's metacognitive skills alongside teachers' metacognitively aware instructional approaches. The rationale of the intervention and basic concepts were presented in the first two training sessions. The concept and methodology of action research were presented, and a framework for cooperation between researchers and teachers was established (Table 2). The importance and methodology of writing diaries after each classroom implementation session were discussed. Per the action research methodology, teachers contributed with their practical suggestions and approaches or innovative approaches for the upcoming classroom activities in each training session.

Table 2. Schedule and content of Teacher Training Program.

Topic	Session: Content	
Introduction	1	Rationale of intervention and working method; the concept of metacognition; metacognitively aware teaching: concept and examples.
	2	The action research paradigm: theoretical background and methodology of implementation; using error detection tasks for evaluating and improving comprehension.
Metacognitive monitoring	3	Teaching metacognitive skills in classroom: practical guidance; verbalizing monitoring processes in reading; think-aloud demonstration of monitoring comprehension; the role of questioning, predicting, clarifying, and summarizing in text comprehension.
	4	Metacognitive control (strategies and skills); the role of declarative, procedural, and conditional knowledge in metacognition.
	5	Metacognitive experiences; the REI method; lessons learned while teaching metacognition; translating theory into practice using teacher's reflections as source.
Feedback	6	Teachers relate obstacles and benefits regarding classroom application.
	7	Teachers summarize their work and experience and discuss the effectiveness of the TPP.

During the next three training sessions (3–5; see Table 2), classroom activities aimed at teaching metacognitive skills in reading were proposed for implementation. Teachers were informed about the importance of planning, monitoring, and evaluation processes in reading and how the accuracy of the monitoring process can be observed by using texts with inconsistencies, as described in Markman's seminal work (Markman, 1979). Examples of error-detection tasks, including various types of errors, such as syntax and semantic errors, were presented. Educators also received guidance on developing error-detection tasks for students, such as utilizing hypothetical scenarios involving a physics problem solution, prompting students to identify errors and offer corrective feedback to peers via explanation. Detecting inconsistencies was not practiced with children during the implementation period but was used when testing students' metacognitive monitoring skills.

The action research approach mainly aimed to increase the effectiveness of the training program based on collaboration with teachers. Accordingly, although the methods to be used in the classroom were proposed by researchers during training sessions, the specific procedures were chosen by the teachers (Table 2). Teachers also made a significant methodological contribution regarding how the selected methods could fit into the local curriculum and how activities should be organized. The researchers shared the methodological descriptions thus generated with the trainers after each training session.

Training sessions 3–5 were succeeded by a 1-week classroom application of the selected exercises following the discussed methodology: They were implemented four times a week as part of the established teaching curricula involving reading assignments, and instructional activities were conducted during classroom exercises lasting for at least 20 min. At the end of the week, reflective diaries were submitted, reporting on their experiences of the methods used and their work with students. Researchers analyzed

the diaries, which served as a starting point for initiating discussions and planning class activities in subsequent training sessions.

During the last two training sessions, teachers made general comments and proposals on the development program. Based on these comments, a guide will be developed for educational practitioners describing the final form of the instructional procedures that have proved to be useful in practice, as well as guidance on their application.

In summary, the action research cycles were as follows:

- Briefing the trainers on the areas to be developed and the relevant development proposals and classroom activities and finalizing the final format of the first week's activities;
- Following the first week of activities, online data collection (in the form of a questionnaire and discussions during the training) and the development of the second week of developmental activities based on the experience gained;
- Collecting feedback from teachers following the second week of activities and finalizing the third week of developmental activities;
- Collecting feedback from teachers regarding an overall evaluation of the program.

2.2. Testing

At the beginning of the training sessions, teachers were invited to complete an online version of the Metacognitive Awareness Inventory for Teachers (MAIT) (Balcikanli, 2011). The MAIT, particularly its abbreviated form (MAIT-18), is valid and reliable for use by in-service teachers in various disciplines. The inventory's structural reliability has been confirmed via confirmatory factor analyses, which indicate its reliability as an instrument for assessing metacognitive awareness in education professionals (Kallio et al., 2017; Balcikanli, 2011).

The MAIT has been widely adopted in educational research to examine the relationship between teachers' metacognitive awareness and student outcomes. Studies using the MAIT have found that teachers with high metacognitive awareness are more likely to implement teaching practices that promote self-regulation and adaptive learning strategies in students (Balcikanli, 2011). The tool also helped to establish that teachers' metacognitive skills improve their flexibility and responsiveness to students' needs, making them more effective in dynamic classroom settings. This suggests that the MAIT can assess metacognitive teaching practices. The Hungarian translation of the original MAIT (consisting of 24 items) was used in this research. After concluding the training session and all classroom implementation activities, teachers were required to complete the online version of the MAIT questionnaire (post-tests).

Before starting classroom activities, students in the experimental and control groups undertook a paper-and-pencil assessment evaluating their metacognitive monitoring skills in reading using inconsistency tasks for measuring individual differences in comprehension monitoring (pre-tests). The test included two brief fictional narratives (approximately 150 words each) containing inconsistencies (information that is logically contradictory within the context of the text (Kinnunen & Vauras, 2010; Oakhill et al., 2005). The inconsistency paradigm demonstrates versatility, as researchers have utilized it to illustrate that readers are attuned to various types of inconsistencies, including spatial, causal, and temporal inconsistencies (Tibken et al., 2022). After reading, students were asked to indicate whether they found any aspect of the story confusing (with yes and no answer options), as well as an open-ended question requesting an explanation of the identified inconsistencies.

Students from the control group completed the same tests but continued to participate in traditional classroom activities. After finishing all the activities of the instructional program, students undertook a post-test analogous to the pre-training assessment using two different texts.

2.3. Procedure

During the first implementation week, teachers used think-aloud methods to demonstrate the use of four reading strategies (Table 3). Students were given a text to practice the strategies in groups of two. The second implementation week focused on practicing the prediction of text content starting from the title and the content already read and on how to formulate questions while reading the text.

Table 3. Timing and content of classroom activities.

W.	Act.	Strategy	Activity
1	1 2 3 4	Think-aloud, questioning, predicting, clarifying, and summarizing	Think-aloud: Educators demonstrated the reading of a narrative text aloud while articulating their cognitive processes. They illustrated the processes of questioning, predicting, clarifying, and summarizing during reading, prompting pupils to use analogous tactics for independent reading. Practice.
2	5 6	Prediction exercise	Prior to reading a section, students were instructed to anticipate potential developments based on the title, headings, or images. Following the reading, students were requested to reflect on the alignment of their predictions with the actual occurrences.
	7 8	Interrogating the text	Students were prompted to pose inquiries about the text during their reading, focusing on characters' motives, plot advancements, or possible themes.
3	9 10 11 12	REI (recall, interpretation, and evaluation)	Students summarized or recollected the most important facts and details from the text, analyzed and interpreted the text's themes or characters' motivations, and, subsequently, formulated a personal judgment about the text. Practice.

In the third implementation week consisting of developmental activities focused on the REI method (recall, interpretation, and evaluation), children were provided with narrative texts that contained omissions and were directed to complete them with appropriate words or phrases that corresponded to the text. Then, the text was summarized. In the second phase, participants were instructed to collaborate in pairs to propose potential explanations for the events described in the text, analyzing and interpreting the text's themes or characters' motivations. Students were also requested to provide alternate scenarios to advance the narratives at various points in the events detailed in the text or formulate personal judgments about the reading content. The teachers provided an explicit explanation of the reading conditions, recommendations for different strategies, and benefits of using them.

3. Results

Some teachers did not submit the required tests; hence, 35 experimental groups and 19 control groups were included in the quantitative data analysis (Table 4). Students who did not complete the pre- or post-tests and those with special education requirements were excluded from the analysis during a data-cleaning procedure.

Table 4. Number of classes and students in two treatment groups.

	Experimental	Control	Total
Teachers	35	19	54
Students	589	251	840

3.1. Effectiveness of Metacognition Development Program

The effectiveness of the training program was assessed by comparing the results of the pre- and post-tests. After reading each of the two inconsistency tests, the children were asked to answer if they found any part of the story confusing (by circling the yes or no answer); 1 point was given if the children answered yes. In the next question, the children were required to explain their answer (in narration): "If so, what is it (explain the problem)?" The narrative explanations of the source of confusion were categorized into three categories and scored accordingly: 0 indicated no (or irrelevant) explanation of the source of confusion; 1 indicated the children identified the confusing point with no or an incomplete explanation; and 2 indicated the response determined that the inconsistency was properly recognized (e.g., a mammal described in an earlier part of the text was later described as laying eggs).

The children were categorized into two groups based on the sum of the scores. The high-metacognitive-monitoring group (HM) included those who identified the inconsistency in the text while also providing a reasonable explanation for both error-detection tasks. The low-metacognitive-monitoring group (LM) included all other children who failed one of the four questions related to the two texts. The working hypothesis predicted that the number of children assigned to the HM group would considerably increase following the completion of the intervention program.

According to the test results, 33 (5.6%) students in the experimental group (of a total of 589; Table 4) were classified as having high metacognitive monitoring abilities before the intervention, while 556 students (94.5%) were classified as having low metacognitive abilities. Following the intervention, the number of HM children increased to 170 (29%), with a concomitant reduction in the number of LM children to 419 (71%). This change was a consequence of 144 pre-intervention LM children becoming HM post-intervention, alongside seven participants who were initially HM becoming LM following the intervention. An exact McNemar's test determined that the difference in the proportion of HM children pre- and post-intervention was statistically significant ($p < 0.01$), indicating that the education program was effective.

In the control group, 251 students from 19 classes performed identical pre- and post-tests on the same days as the students in the experimental group. According to the pre-test findings, 15 students (5.9%) were included in the HM group, while 236 students (94.1%) were classified as having low metacognitive monitoring abilities (LM). The post-test data indicated that the number of HM children rose to 26 (29%), while that of LM children decreased to 225 (71%). This resulted from 20 pre-intervention low-motivation students transitioning to high-motivation post-intervention, while nine participants who were initially high-motivation reverted to low-motivation after the intervention. An exact McNemar's test determined that the difference in the proportion of HM children before and after the intervention was not statistically significant ($p = 0.063$).

3.2. Relationship Between Teacher and Student Development

Both educators and learners engaged in the development program. Were their advancements interrelated? Did the students of teachers with higher levels of progress benefit more from that progress?

Teachers' self-reflective metacognitive processes regarding their teaching methods were evaluated both before and after training with the Metacognitive Awareness Inventory for Teachers (MAIT). One teacher in the experimental group did not complete the MAIT test; therefore, a total of 34 teachers were included in the analysis. The paired-samples t-test indicated a significant difference in the pre–post-MAIT scores for teachers in the experimental group (pre-test mean = 96.62 and post-test mean = 97.41; $p = 0.017$), whereas the difference for teachers in the control group (pre-test mean = 97.18 and post-test mean = 97.00) was not significant.

A teacher's effectiveness in applying the training program was indicated by the percentage of their students who benefited from the training, as revealed by the percentage of students who progressed from the LM group to the HM group in their class. According to the working hypothesis, teachers with increased benefit from the TTP (as expressed by the difference between pre- and post-MAIT scores) would be more effective in implementing the instruction program. A linear regression analysis was conducted for the experimental group to analyze the relationship between teachers' development of metacognitively aware teaching skills (as evidenced by changes in MAIT scores) and students' metacognitive monitoring performance. A scatterplot of the percentage of children who benefited from the training against the differences in MMPI scores with a superimposed regression line was plotted for the experimental group to assess the linearity. Visual inspection of these two plots indicated a linear relationship between the variables. Homoscedasticity and normality were observed for the residuals, with no outliers. The average difference in teachers' MAIT scores did not significantly predict group-level changes in the percentage of children with a high monitoring performance (HM) ($F(1, 32) = 1.561$; $p = 0.2211$). Teachers' progress accounted for 4.7% of the variation in the percentage of HM children in their group.

Teachers in the experimental group were divided into two categories using an alternative approach: those who had improved MAIT post-test results (23 teachers) and those who did not (N = 11). The percentage of children in classes who made progress from the LM to HM group was calculated for each teacher. The independent-samples t-test did not reveal a significant difference in the results of these two groups.

How accurate are teachers in evaluating students' metacognitive skills? Kendall's tau-b correlation analysis was carried out to determine the relationship between teachers' rating of students' metacognitive skills and individual monitoring skills, as evidenced by the number of points received by students in the two inconsistency tasks in the pre-tests. There was a strong, positive, statistically significant correlation ($\tau b = 0.084$; $p = 0.003$).

3.3. Association Between Teachers' Experience, Metacognitive Awareness, and Success Rates

According to previous research results, a positive relationship between MAIT scores and teacher experience was expected. Several studies revealed that experienced teachers tended to score higher in the MAIT than less-experienced teachers, suggesting that teaching experience improves metacognitive awareness (Balcikanli, 2011).

A correlation between pre-intervention MAIT scores and teacher experience (expressed in years of schooling) was calculated to test this assumption. Since four teachers did not provide information about their years of schooling, 50 teachers were included in the analysis. A preliminary analysis showed the relationship to be monotonic (but non-linear), as assessed via visual inspection of a scatterplot. Spearman's rank-order correlation analysis was performed, indicating no statistically significant correlation between pre-intervention MAIT scores and teachers' experience ($rs(48) = -0.21$; $p = 0.889$).

As some researchers mention, acquisition of experience does not automatically denote expertise (Berliner, 2001). Previous research findings in this area are mixed. Several research results indicate a significant correlation between the number of years of teaching

experience and development of teacher's metacognitive skills as well as the ability to teach metacognitive strategies to students (Farrelly, 2023), while other findings suggest that the relationship between teaching experience and metacognitive awareness may vary across different educational contexts or grade levels (Thienngam et al., 2020). Targeted interventions may be more effective in developing metacognitive awareness than years of teaching experience alone (Amarasinghe et al., 2024). Consequently, useful conclusions can be drawn from an analysis if more experienced teachers are more efficient in implementing the educational program. For the experimental group, Spearman's rank-order correlation analysis was conducted to assess the relationship between teachers' years of schooling and their classroom performance, as indicated by the percentage of their students who benefited from the training. The correlation was not statistically significant ($rs(32) = 0.78$; $p = 0.661$).

3.4. Qualitative Analysis of Teachers' Diaries

Several recurring themes and comments can be identified in the teachers' diaries following classroom applications. Teachers indicated that students showed improvement in critical thinking and metacognitive skills via engaging exercises. Contradictions in texts were often missed by students, indicating a need for better comprehension strategies. Teachers agreed that group discussions enhanced understanding and encouraged students to analyze texts more critically.

Most participants noted that students were initially skeptical but became engaged and enthusiastic as they progressed through the exercises. For instance, many students expressed excitement about finding contradictions in the texts, which turned into a competitive spirit to identify errors quickly. Many participants observed improvements in students' metacognitive skills, such as critical thinking and self-assessment, as they engaged with the texts and discussed their findings with peers. There were recurring recommendations to utilize group discussions to foster critical thinking and peer learning and to focus on simplifying language in tasks to improve understanding among lower-grade students.

Several teachers mentioned difficulties due to differences between students. A common theme was the students' ability to recognize contradictions in the texts. However, this ability significantly varied among students, with some quickly identifying inconsistencies, while others struggled. Several participants suggested that the exercises should be adapted to better suit the reading levels of different grades. This was particularly emphasized for lower-grade students who found the texts too complex or overwhelming.

The classroom environment and dynamics also influenced responses. In some classes, students worked collaboratively and supported one another in identifying errors, while in others, there was a noticeable divide between those who did and did not understand the material. Participants noted different emotional responses to the exercises. Some students expressed joy and satisfaction upon discovering contradictions, while others felt frustrated or bored, particularly those who struggled with reading comprehension.

Participants also reported varying levels of responsiveness to feedback. Some students were eager to discuss and correct their misunderstandings, while others remained indifferent or unaware of their errors.

4. Discussion

Educational programs aimed at developing metacognitive skills focus primarily on classroom practices. However, attention should also be paid to developing metacognitively aware teaching skills. It is recommended to fine-tune development programs using action research to facilitate the transition between theoretical research and classroom practice, considering the instructors' practical experience as well as local curricular particularities. The

results of this study, involving 35 experimental groups and 19 control groups (9–11-year-old students), indicate that students' metacognitive monitoring skills in a text-reading environment can significantly improve after a 3-week training program. The results of the post-tests indicate a significant increase in the number of children in the research group who successfully completed the tasks, verifying their ability to identify inconsistencies in a text they had read, while no such change was observed in the control group. Considering that the instructional program was relatively short (12 training activities over three weeks), it is reasonable to conclude that collaboration with the teachers on the details of the classroom application had a significant impact on the effectiveness. This research highlights the importance of involving teachers in the final design of research-based school improvement programs, as suggested by previous researchers (Mertler, 2021; Mills, 2000; Young et al., 2010), a process for which action research provides an appropriate framework.

The instructional program was aimed at developing students' metacognitive monitoring skills alongside teachers' metacognitively aware teaching skills, an area usually neglected by development programs. Pre- and post-test comparisons of the Metacognitive Awareness Inventory for Teachers (MAIT) indicated that the scores of the teachers who participated in the training significantly improved, indicating that the TTP was efficient in stimulating metacognitively aware teaching methods. These findings corroborated previous literature in demonstrating that teachers' cognitive and metacognitive skills improved significantly when they engaged in professional development programs designed to enhance the development of both their personal and teaching skills (Efklides & Metallidou, 2020; Iordanou & Constantinou, 2014). The developmental impact of the TTP on experimental group teachers' metacognitive awareness and their students' gains in metacognitive monitoring in reading support previous suggestions that school-based development programs should target the development of instructors' and students' metacognitive skills simultaneously, a dual approach neglected by previous researches (Wagaba et al., 2016; Kung & Aziz, 2020).

No association was found between the increase in MAIT scores and the proportion of students showing improvement after instructional activities, indicating an individual teacher's benefit from the training program might not have influenced the success of classroom activities. Although these results are not consistent with previous research findings, it is worth noting the limiting factor that only 3 weeks elapsed between the pre- and post-tests. Another possible explanation of these finding stemming from acknowledging metacognition not only as competence but as disposition (Kuhn, 2022), is that teachers or students might not have sufficiently developed the disposition needed to put into practice the strategies they have learned or recognize the value of these strategies. Acquiring new knowledge or strategies involves the development of a clear, discernible purpose in the eyes of the potential user (Iordanou & Kuhn, in press).

Teaching experience (number of years spent teaching) was not associated with metacognitively aware teaching scores nor with the classroom-level effectiveness of the instructional program. This is in concordance with the contradictory research results investigating the association between teaching experience and the ability to teach metacognitive abilities (Farrelly, 2023; Thienngam et al., 2020; Amarasinghe et al., 2024).

The qualitative analysis of teachers' feedback diaries highlights a complex interplay between factors affecting student engagement and comprehension during the training exercises. While there are commonalities in enthusiasm and recognition of contradictions, significant differences exist in reading abilities, classroom dynamics, and emotional responses. The overall sentiment is that the exercises are valuable, but adjustments are needed to maximize their effectiveness across diverse student populations. These insights

can inform future adaptations of the training materials to better meet the diverse needs of students.

The final design of the instructional program limits the applicability of the results to a wider audience. Although the general framework for designing the presented instructional program has been used in four other countries, the specific content of the classroom activities was finalized via the collaboration of trainers in local training sessions, and the content and timing of class application were adapted to the local curriculum.

The results support previous suggestions (Fono & Zohar, 2024; Shi & Cheng, 2021) that metacognitively aware teaching and the explicit teaching of metacognitive strategies should be clearly articulated in pre-service teacher training. In particular, teaching metacognitive strategies for low-achieving students needs to be strengthened in teacher education.

The results indicate that teachers are fairly accurate in their assessment of students' metacognitive abilities, which is another argument for involving them in the design of educational programs. Despite the limitations of action research, it is recommended that the details and methodology of classroom activities be finalized with the help of the teachers in the target group.

Author Contributions: Conceptualization, P.M. (Panagiota Metallidou), P.M. (Plousia Misailidi), K.I., E.P.-L. and I.Z.; methodology, P.M. (Panagiota Metallidou), P.M. (Plousia Misailidi), K.I., E.P.-L. and I.Z.; software, I.Z.; formal analysis, I.Z.; investigation, I.Z.; resources, P.M. (Panagiota Metallidou) and P.M. (Plousia Misailidi); data curation, I.Z.; writing—original draft preparation, I.Z.; writing—review and editing, P.M. (Panagiota Metallidou), I.Z., P.M. (Plousia Misailidi), K.I. and E.P.-L.; project administration, E.P.-L. and I.Z.; funding acquisition, E.P.-L., P.M. (Panagiota Metallidou), P.M. (Plousia Misailidi), K.I. and I.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Union's Erasmus+ Programme, Key Action 2 (KA2)—Cooperation for innovation and the exchange of good practices, grant number 2022-1-CY01-KA220-SCH-000088168.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by Cyprus National Bioethics Committee (approval number 22353878, EUBC OP 2023.01.30).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data supporting research results can be downloaded from https://doi.org/10.5281/zenodo.14770867.

Acknowledgments: We are grateful to Ágnes Bálint (University of Pécs, Hungary) for her involvement in developing the application for funding the ProMeTom project. Tests used in the presented research were selected by Panayiota Metallidou from Aristotle University of Thessaloniki, Greece. We are grateful to for her helpful guidance on data analysis.

Conflicts of Interest: The authors declare no conflicts of interest. The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use that may be made of the information contained therein. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Note

[1] Institutes involved in the partnership: European University of Cyprus (coordonator), University of Cyprus, University of Central Lancashire (Cyprus), Aristotle University of Thessaloniki (Greece), University of Ioannina (Greece), Universitate de Coimbra (Portugal), University of Pécs (Hungary), Sapientia—Hungarian University of Transylvania (Romania).

References

Amarasinghe, A., Agarwal, N., & Kodituwakku, G. (2024). Review studies related to metacognition of teachers: Awareness, skills, understanding and practices. *International Journal of Research and Innovation in Social Science*, *8*, 5508–5518. [CrossRef]

Balcikanli, C. (2011). Metacognitive awareness inventory for teachers (MAIT). *Electronic Journal of Research in Educational Psychology*, *9*, 1309–1332. [CrossRef]

Baylor, A. L. (2002). Expanding preservice teachers' metacognitive awareness of instructional planning through pedagogical agents. *Etr&D-Educational Technology Research and Development*, *50*, 5.

Beach, P. T., Anderson, R., Jacovidis, J. N., & Chadwick, K. L. (2020). *Making the abstract explicit: The role of metacognition in teaching and learning* (pp. 8–27). International Baccalaureate Organization.

Berliner, D. C. (2001). Learning about and learning from expert teachers. *International Journal of Educational Research*, *35*, 463–482. [CrossRef]

Cromley, J. G. (2023). Metacognition, cognitive strategy instruction, and reading in adult literacy. In *Review of Adult Learning and Literacy* (Vol. 5, pp. 187–204). Routledge.

Dabarera, C., Renandya, W. A., & Zhang, L. J. (2014). The impact of metacognitive scaffolding and monitoring on reading comprehension. *System*, *42*, 462–473. [CrossRef]

Efklides, A., & Metallidou, P. (2020). *Applying metacognition and self-regulated learning in the classroom*. Oxford University Press. [CrossRef]

Farrelly, P. D. (2023). *Determining correlations between global history teacher's metacognitive awareness and teaching demographics*. St. John's University.

Fono, D., & Zohar, A. (2024). Metacognitive instruction: Central aspects of pre-service and novice in-service teachers' knowledge and professional development. *Professional Development in Education*, 1–24. [CrossRef]

Halamish, V. (2018). Pre-service and in-service teachers' metacognitive knowledge of learning strategies. *Frontiers in Psychology*, *9*, 2152. [CrossRef]

Hartman, H. J. (2001). Teaching metacognitively. In *Metacognition in learning and instruction* (pp. 149–172). Springer.

Hornby, G., & Greaves, D. (2022). Metacognitive strategies. In *Essential evidence-based teaching strategies: Ensuring optimal academic achievement for students* (pp. 95–104). Springer International Publishing.

Iordanou, K., & Constantinou, C. P. (2014). Developing pre-service teachers' evidence-based argumentation skills on socio-scientific issues. *Learning and Instruction*, *34*, 42–57. [CrossRef]

Iordanou, K., & Kuhn, D. (in press). Investigating climate change through argumentation: Purposeful questioning supports argumentation and knowledge acquisition. *J. Exp. Psychol. Appl.*.

Kallio, H., Virta, K., Kallio, M., Virta, A., Hjardemaal, F. R., & Sandven, J. (2017). The utility of the metacognitive awareness inventory for teachers among in-service teachers. *Journal of Education and Learning*, *6*, 78–91. [CrossRef]

Kinnunen, R., & Vauras, M. (2010). Tracking on-line metacognition: Monitoring and regulating comprehension in reading. In A. Efklides, & P. Misailidi (Eds.), *Trends and Prospects in Metacognition Research* (pp. 209–229). Springer.

Kuhn, D. (2022). Metacognition matters in many ways. *Educational Psychologist*, *57*, 73–86. [CrossRef]

Kung, L. Y., & Aziz, A. A. (2020). An action research on metacognitive reading strategies instruction to improve reading comprehension. *International Journal of English Language and Literature Studies*, *9*, 86–94. [CrossRef]

Markman, E. M. (1979). Realizing you don't understand: Elementary school children's awareness of inconsistencies. *Child Development*, *50*, 643–655. [CrossRef]

Mertler, C. A. (2021). Action research as teacher inquiry: A viable strategy for resolving problems of practice. *Practical Assessment, Research & Evaluation*, *26*, 19.

Mertler, C. A. (2024). *Action research: Improving schools and empowering educators* (7th ed.). Sage Publications.

Mevarech, Z. R., & Kramarski, B. (2003). The effects of metacognitive training versus worked-out examples on students' mathematical reasoning. *British Journal of Educational Psychology*, *73*, 449–471. [CrossRef]

Mills, G. E. (2000). *Action research: A guide for the teacher researcher*. ERIC.

Oakhill, J., Hartt, J., & Samols, D. (2005). Levels of comprehension monitoring and working memory in good and poor comprehenders. *Reading and writing*, *18*, 657–686. [CrossRef]

Ohtani, K., & Hisasaka, T. (2018). Beyond intelligence: A meta-analytic review of the relationship among metacognition, intelligence, and academic performance. *Metacognition and Learning*, *13*, 179–212. [CrossRef]

Ozturk, N. (2017). An analysis of teachers' self-reported competencies for teaching metacognition. *Educational Studies*, *43*, 247–264. [CrossRef]

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition And Instruction*, *1*, 117–175.

Rivas, S. F., Saiz, C., & Ossa, C. (2022). Metacognitive strategies and development of critical thinking in higher education. *Frontiers in Psychology*, *13*, 913219. [CrossRef]

Shi, L., & Cheng, E. C. (2021). Developing metacognitive teaching in Chinese language through conducting lesson study in Shanghai. *International Journal for Lesson & Learning Studies*, *10*, 75–88.

Sperling, R. A., Howard, B. C., Miller, L. A., & Murphy, C. (2002). Measures of children's knowledge and regulation of cognition. *Contemporary Educational Psychology*, *27*, 51–79. [CrossRef]

Thienngam, S., Promlek, A., & Thongsaard, K. (2020). Influence of teachers' metacognitive skills on development of early-childhood students. *Australian Journal of Teacher Education*, *45*(1), 19–30. [CrossRef]

Thomas, K. F., & Barksdale Ladd, M. A. (2000). Metacognitive processes: Teaching strategies in literacy education courses. *Reading Psychology*, *21*, 67–84. [CrossRef]

Tibken, C., Richter, T., Wannagat, W., Schmiedeler, S., von der Linden, N., & Schneider, W. (2022). Measuring comprehension monitoring with the inconsistency task in adolescents: Stability, associations with reading comprehension skills, and differences between grade levels. *Discourse Processes*, *59*, 439–461. [CrossRef]

Veenman, M. V., Van Hout-Wolters, B. H., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and Learning*, *1*, 3–14. [CrossRef]

Veenman, M. V. J., Elshout, J. J., & Meijer, J. (1997). The generality vs domain-specificity of metacognitive skills in novice learning across domains. *Learning and Instruction*, *7*, 187–209. [CrossRef]

Veenman, M. V. J., Wilhelm, P., & Beishuizen, J. J. (2004). The relation between intellectual and metacognitive skills from a developmental perspective. *Learning And Instruction*, *14*, 89. [CrossRef]

Wafubwa, R. N., Csíkos, C., & Opoku-Sarkodie, R. (2022). In-service mathematics teachers' conception and perceptions of metacognition in their teaching experience. *SN Social Sciences*, *2*, 21. [CrossRef]

Wagaba, F., Treagust, D. F., Chandrasegaran, A., & Won, M. (2016). An action research in science: Providing metacognitive support to year 9 students. *International Journal of Environmental and Science Education*, *11*, 5376–5395.

Wall, K., & Hall, E. (2016). Teachers as metacognitive role models. *European Journal of Teacher Education*, *39*, 403–418. [CrossRef]

Wang, M. C., Haertel, G. D., & Walberg, H. J. (1990). What influences learning? A content analysis of review literature. *Journal of Educational Research*, *84*, 30–43. [CrossRef]

Young, M. R., Rapp, E., & Murphy, J. W. (2010). Action research: Enhancing classroom practice and fulfilling educational responsibilities. *Journal of Instructional Pedagogies*, *3*. Available online: https://www.aabri.com/manuscripts/09377.pdf (accessed on 30 October 2024).