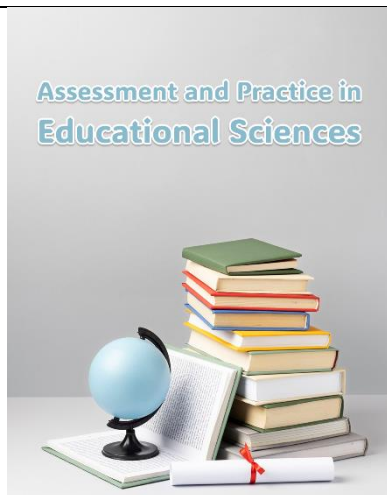




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1. Esmat. Nabipoor^{ID}: PhD Student, Department of Educational Sciences, Isf.C., Islamic Azad University, Isfahan, Iran
2. Maryam. Baratali^{ID}: Department of Educational Sciences, Isf.C., Islamic Azad University, Isfahan, Iran (Email: maryambaratali@iau.ac.ir)
3. Jahanbakhsh. Rahmani^{ID}: Department of Educational Sciences, Isf.C., Islamic Azad University, Isfahan, Iran

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Implementation Methods of a Metacognition-Based Curriculum for Reducing Learning Disorders among Elementary School Students

ABSTRACT

The aim of the present study was to identify the implementation methods of a metacognition-based curriculum for reducing learning disorders among elementary school students. This study was conducted using a qualitative approach and thematic analysis with an inductive-exploratory orientation. Data were collected through the study of documents, scientific texts, and relevant research literature. The research domain included documents available in reputable databases and websites during the years 2007 to 2025 in Persian sources and 1991 to 2025 in English sources in the fields of learning disorders and metacognition. The data collection technique was based on an inductive-exploratory approach, the data collection instrument was note-taking from texts, and the data analysis method was three-stage inductive coding. The findings obtained from the qualitative analysis of the data showed that the implementation methods of a metacognition-based curriculum for reducing learning disorders among elementary school students are diverse, integrative, and flexible in nature. These methods include direct instruction, active and play-based approaches, multisensory and combined methods, environment-oriented teaching, self-management strategies, metacognition-oriented instruction, technology- and research-based strategies, feedback-oriented strategies, effective instructional strategies, cognition-oriented strategies, phonological strategies, mindful teaching strategies, and participatory strategies. The conclusion of the study indicated that implementing a metacognition-based curriculum for reducing learning disorders requires the use of a range of methods that can simultaneously respond to students' individual differences, cognitive and executive weaknesses, emotional and motivational needs, and environmental conditions of learning.

Keywords: implementation methods, learning disorders, metacognition, elementary school.

Introduction

Learning disorders constitute one of the most persistent and consequential categories of neurodevelopmental and educational difficulties in childhood, particularly during the elementary-school years, when foundational academic competencies in reading, writing, mathematics, attention regulation, and strategic learning are established. Children with specific learning disorders may display unexpected and sustained difficulties in acquiring core academic skills despite adequate intelligence,

educational opportunity, and sensory functioning. These difficulties are not limited to academic performance; rather, they often affect self-concept, motivation, classroom participation, emotional adjustment, and long-term educational trajectories. In elementary education, the problem becomes especially critical because early weaknesses in decoding, spelling, written expression, mathematical reasoning, or executive control may gradually transform into broader academic disengagement and secondary psychological vulnerability. Accordingly, contemporary educational and psychological research increasingly views learning disorders not only as skill deficits but also as complex patterns of cognitive, metacognitive, motivational, emotional, and contextual difficulties that require multidimensional curriculum responses (1-4).

Elementary-school students with learning disorders frequently experience difficulties in using cognitive and metacognitive strategies effectively. Although many students can acquire information through instruction, children with learning disorders often struggle to plan learning activities, monitor comprehension, regulate attention, evaluate errors, select appropriate strategies, and transfer learned strategies to new tasks. These weaknesses are especially evident in tasks that require sustained mental effort, such as reading comprehension, spelling, mathematical problem solving, and written expression. Research has shown that learning disorders may influence students' use of cognitive and metacognitive strategies in elementary school and that these students often need explicit, structured, and repeated support to develop strategic learning behaviors (5, 6). Therefore, any curriculum designed to reduce learning disorders must move beyond the direct remediation of isolated academic skills and address the learner's capacity to think about, regulate, and evaluate his or her own learning processes.

Metacognition refers to the learner's awareness of cognitive processes and the capacity to regulate those processes through planning, monitoring, control, and evaluation. In educational psychology, metacognition has been recognized as a central mechanism of effective learning because it enables students to understand task demands, select appropriate strategies, check their progress, identify errors, and modify their behavior in response to feedback. Reviews of metacognition in science and STEM education have emphasized that metacognitive knowledge and metacognitive regulation are essential for deeper learning, conceptual understanding, and transfer of knowledge across contexts (7, 8). In the context of elementary education, metacognition is particularly important because young learners are still developing executive control, self-regulation, and awareness of learning strategies. When these processes are systematically taught, students become more capable of managing academic tasks, understanding their own errors, and using strategy-based approaches instead of relying only on trial and error.

The relevance of metacognition becomes even stronger when learning disorders are considered. Students with learning disabilities or learning difficulties often show impairments in metacognitive functioning, including limited awareness of strategies, weak monitoring of performance, difficulty evaluating errors, and reduced capacity for self-regulation during academic tasks. A systematic literature review on metacognitive functioning in students with learning disabilities or difficulties indicates that metacognitive deficits are not peripheral features but are closely connected to the persistence of learning problems and to the effectiveness of intervention programs (9). Similarly, studies comparing students with and without special learning difficulties suggest that students with learning difficulties use metacognitive knowledge and regulation strategies less efficiently, which may reduce their ability to compensate for academic weaknesses (6). These findings imply that intervention and curriculum design should not merely provide more practice but should teach students how to regulate the learning process itself.

Metacognitive approaches have demonstrated practical value across different academic domains. In mathematics, metacognitive instruction has been used to support students in understanding problem conditions, selecting solution pathways, monitoring calculation steps, and evaluating final answers. Studies on primary students' non-routine mathematical word-problem solving have shown that metacognitive-based instruction can help learners approach complex problems more systematically (10). Similarly, research on Primary 6 students with dyslexia using a metacognitive-based problem-solving

approach for algebraic word problems highlights the potential of metacognitive scaffolding for students who face difficulties in both language processing and mathematical reasoning (11). In geometry, didactic designs based on metacognitive approaches have been proposed to overcome students' learning difficulties by strengthening creative thinking skills and strategic awareness (12). These studies indicate that metacognition is not an abstract psychological concept but an operational instructional framework that can be translated into teachable classroom strategies.

In the field of mathematics learning disorders, metacognitive training has received special attention because mathematical performance requires planning, working memory, error checking, symbolic processing, and anxiety management. Research has shown that metacognitive training can reduce mathematics problems in students with reading, writing, and mathematics learning disorders (13). A review of metacognition programs for elementary-school students with mathematics learning disorders also emphasizes the importance of structured metacognitive interventions in improving mathematical learning outcomes (14). Moreover, studies comparing metacognition training and working-memory training among students with mathematics learning disorder have indicated that both approaches may contribute to mathematics performance and anxiety reduction, while metacognition is especially relevant to the regulation of task demands and emotional responses during mathematical activity (15). Thus, a curriculum for reducing learning disorders should integrate metacognitive instruction with attention to working memory, academic anxiety, and task-specific learning demands.

Reading and spelling difficulties also require metacognitive support. Children with reading disabilities frequently experience problems in decoding, comprehension monitoring, and strategic reading. Teachers' use of metacognitive strategies has been examined as a means of supporting reading comprehension among children with learning disabilities, showing that instructional practices should include explicit modeling, guided questioning, comprehension monitoring, and strategy evaluation (16). In spelling disorders, metacognition-based strategies have been found to improve academic self-concept among students, suggesting that strategic instruction can influence both academic skill development and students' beliefs about their own learning capacity (17). These findings are important because reading and spelling difficulties often produce repeated academic failure, which may weaken motivation and self-confidence. A metacognition-based curriculum can help students reinterpret errors as information for learning, rather than as evidence of personal inadequacy.

Beyond academic skills, metacognitive interventions are associated with motivational and affective outcomes. Students with learning disorders often experience reduced academic motivation, lower self-efficacy, negative motivational beliefs, and decreased academic vitality. Research has shown that metacognitive strategies can enhance self-efficacy and motivational beliefs in students with learning disorders (18). Cognitive-metacognitive strategy training has also been reported to improve achievement motivation and academic vitality among students with learning disabilities (19). Similarly, cognitive and metacognitive strategy training has been found to affect academic motivation, academic engagement, and school quality of life among students with specific learning disorder (20). These findings suggest that metacognitive curriculum design should not be restricted to cognitive remediation; it should also create learning conditions that support motivation, engagement, persistence, and positive academic identity.

The relationship between metacognition, motivation, and self-regulation is supported by broader theoretical developments in educational psychology. Regulation of learning is not only an individual cognitive process but also a socially situated activity influenced by affect, motivation, classroom interaction, and shared learning contexts. An integrated model of socially shared regulation of learning emphasizes the interconnected roles of metacognition, affect, and motivation in collaborative and classroom-based learning (21). This perspective is important for elementary students with learning disorders because these students often require support not only from teachers but also from peers, parents, counselors, and structured classroom

environments. Consequently, a curriculum model should include direct instruction, guided practice, peer interaction, feedback, and opportunities for socially supported self-regulation.

Classroom implementation is a critical issue in metacognitive curriculum design. Even when metacognitive strategies are theoretically effective, their impact depends on whether teachers can promote self-regulated learning directly and indirectly in daily classroom practice. Video-based classroom observations and teacher interviews have shown that teachers' promotion of self-regulated learning may occur through explicit strategy instruction, modeling, questioning, feedback, classroom routines, and learning environments that encourage reflection (22). For students with learning disorders, such teacher-mediated support is particularly necessary because spontaneous use of strategies is often limited. Therefore, implementation methods must be practical, structured, developmentally appropriate, and compatible with the realities of elementary classrooms.

Several empirical studies from the field of exceptional education and learning disabilities indicate that metacognitive-strategy training can reduce core symptoms associated with learning disorders and related attentional difficulties. Metacognitive-strategy training has been shown to affect attention-deficit symptoms and learning-disorder symptoms, highlighting its relevance for students whose academic problems are accompanied by executive-function weaknesses (23). Other findings indicate that metacognitive-strategy training can improve cognitive self-awareness and self-regulation in students with learning disorders (24). Since attention, inhibition, planning, and cognitive flexibility are fundamental to classroom learning, these studies support the inclusion of executive-function-oriented activities, self-monitoring routines, and guided reflection in curriculum implementation.

The connection between academic mediators, cognitive-metacognitive strategies, and motivational beliefs further reinforces the multidimensional nature of learning disorders. Research on children with specific learning disorders has shown relationships among academic mediators, cognitive-metacognitive strategies, and motivational beliefs, suggesting that academic difficulties are shaped by interactions among strategy use, beliefs, and learning conditions (25). Moreover, the use of metacognitive-based learning strategies has been linked to improvements in decision-making and cognitive dissonance, indicating that metacognitive learning can influence higher-order judgment and adaptive thinking processes (26). These findings imply that curriculum methods should foster not only academic achievement but also reflective judgment, decision-making, and adaptive responses to cognitive conflict.

Recent international and national studies also indicate that metacognition-based intervention should be evidence-based, flexible, and responsive to learner diversity. Students with learning difficulties are heterogeneous; their profiles may include dyslexia, dyscalculia, spelling disorder, attention problems, working-memory limitations, low academic self-concept, and emotional distress. Therefore, a single instructional method is unlikely to be sufficient. Metacognitive instruction can be combined with direct teaching, multisensory learning, feedback-based intervention, cognitive strategy instruction, working-memory activities, technology-assisted learning, and participatory methods. Metacognition and error-focused self-regulatory training have been shown to have positive implications for children with specific learning disabilities, especially because error awareness and self-correction are essential for adaptive learning (27). Likewise, the use of metacognitive instruction as a strategy for students with special needs supports the idea that metacognition can function as an inclusive instructional framework when adapted to learner characteristics (28).

The design of a metacognition-based curriculum for reducing learning disorders must also attend to environmental and technological dimensions. Contemporary learning environments increasingly include digital tools, adaptive systems, neurocognitive training platforms, feedback technologies, and game-based resources. Although technology alone cannot replace pedagogical planning, it can support individualized practice, immediate feedback, motivation, and self-monitoring when integrated with instructional goals. At the same time, environmental factors such as classroom structure, family support,

social interaction, sensory conditions, time allocation, and teacher guidance influence the effectiveness of interventions. Learning disorders may also affect students' mental health, making it necessary to design curricula that reduce pressure, support emotional safety, and strengthen the learner's sense of competence (4). Therefore, implementation methods should be comprehensive enough to respond to cognitive, emotional, motivational, social, and environmental needs.

Despite the growing body of evidence on metacognitive interventions, there remains a need for curriculum models that clarify how such approaches should be implemented for elementary-school students with learning disorders. Many studies have examined the effectiveness of specific strategies, such as metacognitive training in mathematics, reading comprehension, self-regulation, academic motivation, or working memory; however, fewer studies have synthesized these findings into an organized curriculum framework with clear implementation methods. Existing literature suggests that effective implementation should include direct instruction, active and play-based learning, multisensory and combined methods, environment-oriented teaching, self-management strategies, metacognition-oriented instruction, technology- and research-based methods, feedback-oriented strategies, cognition-oriented and phonological strategies, mindful teaching, and participatory approaches. Such a framework can help teachers, counselors, curriculum planners, and educational psychologists design interventions that are theoretically grounded and practically applicable in elementary education.

The aim of the present study was to identify and organize the implementation methods of a metacognition-based curriculum model for reducing learning disorders among elementary-school students.

Methods and Materials

This study was conducted using a qualitative approach, thematic analysis, and an inductive–exploratory orientation. Data were collected through the review and study of documents, scientific texts, and relevant research literature. The research population in this study included a collection of scientific works related to metacognition-based learning disorders among elementary school students that had been published in reputable databases and scientific websites. In addition to scientific articles, several authoritative books in the field of learning disorders and metacognitive approaches were also used as analytical sources. In the first stage of the source search, 114 articles related to metacognition-based learning disorders were extracted from reputable scientific databases. After the initial review and comparison with the inclusion criteria of the study, which focused on metacognition-based learning disorders among elementary school students, 12 articles were excluded because they were not consistent with the aim of the study. Subsequently, the abstracts of the remaining 102 articles were carefully reviewed. At this stage, it was found that no code or concept related to the intended research axes could be extracted from 25 abstracts; therefore, these articles were also excluded from the analysis process. In the next step, the full texts of 77 articles were studied, and after content evaluation, four additional articles were excluded because they were not aligned with the research framework. Finally, 73 scientific sources were selected for the final analysis. Of these, 43 sources were in Persian and related to the period from 2007 to 2025, and 30 sources were in English and related to the years 1991 to 2025; all were indexed in reputable scientific databases. These sources formed the basis for extracting the main concepts and themes of the study. In the data collection process, an inductive–exploratory approach was used, and the main data collection instrument was note-taking from scientific texts. Data analysis was also conducted using three-stage coding, including open, axial, and selective coding, in order to extract and organize the main concepts and themes related to the implementation methods of a metacognition-based curriculum for reducing learning disorders. In the section on ethical considerations, efforts were made to observe all principles of research ethics. All scientific sources used in the study were cited with accuracy and academic integrity, and complete referencing was provided. In addition, qualitative data analysis was conducted according to the accepted principles of thematic analysis and in accordance with criteria of scientific credibility. The findings of the study were reported without distortion, exaggeration, or

bias, and efforts were made to present the results honestly and accurately. Moreover, in the final report of the study, any misuse of the results for the benefit of specific individuals or groups was avoided, and the principles of academic honesty and scientific responsibility were fully observed.

Findings and Results

Table 1 presents the basic and organizing themes related to the global theme of implementation methods, that is, the implementation-methods dimension.

Table 1. Basic and Organizing Themes Related to the Global Theme of Implementation Methods, Implementation-Methods Dimension, in the Metacognition-Based Curriculum Model for Reducing Learning Disorders among Elementary School Students

Basic Themes	Organizing Themes	Global Theme
Necessity of direct instruction for children with learning disorders	Direct instruction	Implementation methods
Classification and instruction of children with learning disorders	Direct instruction	Implementation methods
Structured direct instruction	Direct instruction	Implementation methods
Necessity of practicing executive strategies, including planning, inhibitory control, and attention shifting	Direct instruction	Implementation methods
Rereading	Direct instruction	Implementation methods
Asking questions	Direct instruction	Implementation methods
Participating in discussion	Direct instruction	Implementation methods
Using educational games	Active and play-based approaches	Implementation methods
Exercise and physical activity to improve attention	Active and play-based approaches	Implementation methods
Recommendation to use active and play-based teaching	Active and play-based approaches	Implementation methods
Game design	Active and play-based approaches	Implementation methods
Social play	Active and play-based approaches	Implementation methods
Use of gamified activities and digital tools for motivation and assessment	Active and play-based approaches	Implementation methods
Existing special educational services	Multisensory and combined methods	Implementation methods
Multiple performance	Multisensory and combined methods	Implementation methods
Behavior modification techniques, including token reinforcement, response cost, and related methods	Multisensory and combined methods	Implementation methods
Effectiveness of special educational programs in reducing ADHD-related problems	Multisensory and combined methods	Implementation methods
Combination of methods	Multisensory and combined methods	Implementation methods
Combined approaches as an instructional innovation	Multisensory and combined methods	Implementation methods
Use of multisensory strategies	Multisensory and combined methods	Implementation methods
Positive effect of a combined program on reading and writing	Multisensory and combined methods	Implementation methods
Combining rules and prior knowledge to achieve new learning	Multisensory and combined methods	Implementation methods
Creation of new knowledge and experience	Multisensory and combined methods	Implementation methods
Successful learners use their previous experiences and thinking processes	Multisensory and combined methods	Implementation methods

Use of a multisensory method	Multisensory and combined methods	Implementation methods
Foundations of learning processes	Multisensory and combined methods	Implementation methods
Multisensory approach	Multisensory and combined methods	Implementation methods
Combination with a healthy lifestyle to enhance cognition and learning	Multisensory and combined methods	Implementation methods
Increasing connectivity among brain networks	Multisensory and combined methods	Implementation methods
Combining neurofeedback with instructional and behavioral strategies	Multisensory and combined methods	Implementation methods
Evidence-based programs	Environment-oriented teaching methods	Implementation methods
Family conditions	Environment-oriented teaching methods	Implementation methods
Social environment	Environment-oriented teaching methods	Implementation methods
Cognitive flexibility and its role in complex environments	Environment-oriented teaching methods	Implementation methods
Resolving deficiencies and problems in face-to-face sessions	Environment-oriented teaching methods	Implementation methods
Control of environmental stimuli	Environment-oriented teaching methods	Implementation methods
Attention to classroom lighting and temperature	Environment-oriented teaching methods	Implementation methods
Designing an educational space with minimal distraction	Environment-oriented teaching methods	Implementation methods
Alignment of the program with school conditions	Environment-oriented teaching methods	Implementation methods
Attention to regional facilities and resources	Environment-oriented teaching methods	Implementation methods
Emphasis on compliance with classroom rules	Environment-oriented teaching methods	Implementation methods
Necessity of reducing environmental stimuli	Environment-oriented teaching methods	Implementation methods
Short and flexible scheduling of activities	Environment-oriented teaching methods	Implementation methods
Allocation of more time	Environment-oriented teaching methods	Implementation methods
Reduction of content volume	Environment-oriented teaching methods	Implementation methods
Presence of a facilitator, teacher, or therapist to regulate the level of learning	Environment-oriented teaching methods	Implementation methods
Training teachers and counselors to implement and sustain interventions in the classroom	Environment-oriented teaching methods	Implementation methods
Child characteristics	Self-management strategies	Implementation methods
Ability for regulation and self-direction	Self-management strategies	Implementation methods
Training focused on sustained attention	Self-management strategies	Implementation methods
Focusing on a specific goal during exercises	Self-management strategies	Implementation methods
“Stop” and “one-minute breathing” techniques	Self-management strategies	Implementation methods
Experience of new behavioral options	Self-management strategies	Implementation methods
Breaking the vicious cycle of previous thoughts and behaviors	Self-management strategies	Implementation methods
Learning to establish a relationship with irrational thoughts and feelings	Self-management strategies	Implementation methods
Developing a broader perspective toward thoughts and feelings	Self-management strategies	Implementation methods

Nonjudgmental attention to present-moment experience	Self-management strategies	Implementation methods
Creating a new attitude and nonjudgmental acceptance	Self-management strategies	Implementation methods
Free and undistorted perception of realities	Self-management strategies	Implementation methods
Achieving a new level of self-regulation	Self-management strategies	Implementation methods
Individual differences among students	Self-management strategies	Implementation methods
Key role of working memory in learning to read	Self-management strategies	Implementation methods
Direct relationship between working memory and reading comprehension	Self-management strategies	Implementation methods
Positive effectiveness of working memory training	Self-management strategies	Implementation methods
Working memory training	Self-management strategies	Implementation methods
Strengthening executive functions	Self-management strategies	Implementation methods
Strengthening working memory	Self-management strategies	Implementation methods
Adjustment based on individual needs	Self-management strategies	Implementation methods
Exercises for strengthening working memory	Self-management strategies	Implementation methods
Adaptive adjustment of task difficulty based on learner performance	Self-management strategies	Implementation methods
Emphasis on motivation and a sense of progress	Self-management strategies	Implementation methods
Activation of neural networks supporting memory retention	Self-management strategies	Implementation methods
Individualization of the learning pathway and clear progress criteria	Self-management strategies	Implementation methods
Metacognitive strategies in improving learning	Metacognition-oriented instruction	Implementation methods
Effect of metacognition on regulation and goal setting	Metacognition-oriented instruction	Implementation methods
Control and guidance of thinking through metacognition	Metacognition-oriented instruction	Implementation methods
Effective management of mathematical problems through metacognition	Metacognition-oriented instruction	Implementation methods
Role of metacognition in improving working memory	Metacognition-oriented instruction	Implementation methods
Application of metacognitive intervention in elementary schools	Metacognition-oriented instruction	Implementation methods
Necessity for teachers to use metacognitive strategies	Metacognition-oriented instruction	Implementation methods
Familiarity of teachers and counselors with metacognitive instruction	Metacognition-oriented instruction	Implementation methods
Use of metacognitive principles in the design and implementation of assignments	Metacognition-oriented instruction	Implementation methods
Use of modern technologies in education	Technology- and research-based strategies	Implementation methods
Neurofeedback as a noninvasive intervention	Technology- and research-based strategies	Implementation methods
Neurofeedback as a tool for cognitive self-regulation	Technology- and research-based strategies	Implementation methods
Enhancement of neural plasticity	Technology- and research-based strategies	Implementation methods
Need for scientific research to design the program	Technology- and research-based strategies	Implementation methods
Use of feedback	Feedback-oriented strategies	Implementation methods

Use of a wide range of responses	Feedback-oriented strategies	Implementation methods
Verbal support and encouragement from instructors, parents, and peers	Feedback-oriented strategies	Implementation methods
Short, frequent, hierarchical sessions with immediate feedback	Feedback-oriented strategies	Implementation methods
Designing an effective educational program	Effective instructional strategies	Implementation methods
Use of conditioned reinforcement principles	Effective instructional strategies	Implementation methods
Reduction of errors, response time, and reaction time	Effective instructional strategies	Implementation methods
Use of varied and staged activities	Effective instructional strategies	Implementation methods
Increasing effectiveness	Effective instructional strategies	Implementation methods
Need for targeted intervention	Effective instructional strategies	Implementation methods
Effective confrontation with emotions, thoughts, and bodily sensations	Cognition-oriented strategies	Implementation methods
Use of alternative strategies in problem solving	Cognition-oriented strategies	Implementation methods
Improvement of problem solving and assignment management	Cognition-oriented strategies	Implementation methods
Mental representation of the problem	Cognition-oriented strategies	Implementation methods
Cognitive instruction	Cognition-oriented strategies	Implementation methods
Use of learning strategies	Cognition-oriented strategies	Implementation methods
Selecting a strategy appropriate to the goal	Cognition-oriented strategies	Implementation methods
Remediation of deficiencies and strengthening of positive aspects	Cognition-oriented strategies	Implementation methods
Preventive and therapeutic role of phonological instruction	Phonological strategies	Implementation methods
Activities involving phoneme identification, blending, and deletion	Phonological strategies	Implementation methods
Improvement of decoding and spelling of words	Phonological strategies	Implementation methods
Increased effectiveness when combined with phonological awareness	Phonological strategies	Implementation methods
Different information processing compared with typically developing individuals	Mindful teaching strategies	Implementation methods
Problem-solving strategies	Mindful teaching strategies	Implementation methods
Deficits in executive functions as a neuropsychological factor	Mindful teaching strategies	Implementation methods
Mindfulness and focus on higher psychological processes	Mindful teaching strategies	Implementation methods
Need to use mental capacities	Mindful teaching strategies	Implementation methods
Role of mindfulness in increasing concentration and accuracy	Mindful teaching strategies	Implementation methods
Observation and action with presence of mind	Mindful teaching strategies	Implementation methods
Effectiveness of mindfulness on cognitive flexibility	Mindful teaching strategies	Implementation methods
Recalling the goal when the mind wanders	Mindful teaching strategies	Implementation methods
Adaptation to new conditions through mindfulness	Mindful teaching strategies	Implementation methods
Metacognitive processing in mindfulness	Mindful teaching strategies	Implementation methods

Calmness and awareness in individual therapy	Mindful teaching strategies	Implementation methods
Mindfulness as a modern therapeutic method	Mindful teaching strategies	Implementation methods
Metacognitive mechanisms of mindfulness	Mindful teaching strategies	Implementation methods
Mindfulness practice and enhancement of self-regulation	Mindful teaching strategies	Implementation methods
Mindfulness as a predictor of executive and cognitive functioning indices	Mindful teaching strategies	Implementation methods
Mindfulness as a strategy for continuous monitoring of current events	Mindful teaching strategies	Implementation methods
Effect of mindfulness on decision-making	Mindful teaching strategies	Implementation methods
Changing mental patterns and avoiding error repetition	Mindful teaching strategies	Implementation methods
Phonological awareness training	Mindful teaching strategies	Implementation methods
Speed of cognitive processing	Mindful teaching strategies	Implementation methods
Theory of neural plasticity	Mindful teaching strategies	Implementation methods
Targeted brain exercises	Mindful teaching strategies	Implementation methods
Ability to change and improve cognitive functions	Mindful teaching strategies	Implementation methods
Strengthening visuospatial processing	Mindful teaching strategies	Implementation methods
Visualization and monitoring of comprehension	Mindful teaching strategies	Implementation methods
Conscious selection of thinking strategies	Mindful teaching strategies	Implementation methods
Awareness of how to use information to achieve a goal	Mindful teaching strategies	Implementation methods
Teacher's role in creating opportunities for attention and self-awareness	Mindful teaching strategies	Implementation methods
Importance of students' participation in learning	Participatory strategies	Implementation methods
More active participation in class	Participatory strategies	Implementation methods
Family participation in the learning process	Participatory strategies	Implementation methods
Increasing the effectiveness of instruction through parental support	Participatory strategies	Implementation methods
Peer-mediated instruction	Participatory strategies	Implementation methods
Active student participation	Participatory strategies	Implementation methods
Verbal exchange	Participatory strategies	Implementation methods
Information exchange	Participatory strategies	Implementation methods
Adequate instruction	Participatory strategies	Implementation methods
Appropriate guidance for parents and teachers	Participatory strategies	Implementation methods
Recommendation to counselors and psychologists to develop specialized programs	Participatory strategies	Implementation methods
Use of concrete and attractive educational materials	Participatory strategies	Implementation methods

The qualitative analysis of the data organized the implementation methods of the curriculum model for reducing metacognition-based learning disorders into 13 main axes: direct instruction, active and play-based approaches, multisensory

and combined methods, environment-oriented teaching methods, self-management strategies, metacognition-oriented instruction, technology- and research-based strategies, feedback-oriented strategies, effective instructional strategies, cognition-oriented strategies, phonological strategies, mindful teaching strategies, and participatory strategies. These axes indicate that the successful implementation of such a program requires diverse, multidimensional approaches based on the learner's active interaction. Table 1 presents the basic and organizing themes related to the global theme of implementation methods.

Direct instruction approach: The first category of themes emphasizes the necessity of direct and structured instruction for children with learning disorders. The findings show that direct instruction is one of the main strategies required by these children. Instruction should be structured, staged, and clear. Classifying students based on the type of learning disorder is an important condition for providing effective instruction. Continuous practice of executive strategies, such as inhibitory control, planning, and attention shifting, is necessary. Activities such as rereading, questioning, and classroom discussion were identified as effective methods in direct instruction. These themes indicate that part of the implementation methods should be completely explicit, guided, and step-by-step.

Active and play-based approaches: The analyses indicate the significant role of play-based activities in reducing learning disorders. The findings include the use of educational games to improve attention, motivation, and participation; the use of physical and sports activities to increase sustained attention; the design of games to strengthen cognitive skills; the use of digital tools, gamified activities, and software for assessment and motivation; and the use of social play as a natural context for learning. These findings show that program implementation should be carried out through activation of the learning environment and engagement of the child.

Multisensory methods and combined approaches: The themes in this section show that the use of multisensory inputs, including visual, auditory, and motor inputs, as well as the combination of instructional methods, plays an important role in improving learning skills. The important indicators of this component include the use of multisensory methods in teaching reading and writing skills; the application of a set of techniques, including token reinforcement, response cost, and feedback; the combination of neurocognitive exercises with strategy-based instruction; the use of multidimensional content to consolidate learning; and attention to a healthy lifestyle, physical activity, and social interactions as complements to instruction. These findings show that implementation methods should be multidimensional and integrative.

Environment-oriented teaching methods: The next category of themes shows that the learning environment is one of the key factors in the success of the program. The findings emphasize attention to family conditions and the social environment; control of environmental stimuli to reduce distraction; regulation of classroom temperature, lighting, and desk arrangement; design of educational spaces with minimal distracting stimuli; adaptation of the program to regional facilities and school conditions; allocation of more time; flexible scheduling and reduction of content volume; and the role of the facilitator, teacher, or counselor in regulating and guiding the level of learning. These findings emphasize that program implementation requires careful attention to environmental, structural, and organizational characteristics.

Self-management strategies: This section includes themes related to empowering students to regulate their own behavior and cognition. These include teaching self-direction and concentration skills; using techniques such as “stop” and “one-minute breathing”; experiencing new behaviors and distancing from dysfunctional patterns; learning a different relationship with thoughts and feelings; nonjudgmental attention and conscious orientation toward experience; achieving a new level of self-regulation; and adjusting assignments based on individual needs and individual differences. These findings show that an important part of implementation methods should target the development of self-control and self-regulation skills.

Metacognition-oriented instruction: This category of themes emphasizes the role of metacognitive instruction as the core of the program. The most important findings include the role of metacognition in regulation, goal setting, and guidance of thinking; management of mathematical problems through metacognitive strategies; strengthening working memory and attention through metacognitive interventions; the need for teachers to use metacognitive strategies in assignment design; teaching metacognitive concepts to teachers and counselors; and the application of these strategies in elementary schools. These findings indicate that implementation methods should be systematically designed and delivered based on metacognition.

Technology- and research-based strategies: The findings in this section indicate the role of emerging technologies in enhancing learning. These strategies include the use of neurofeedback as a noninvasive tool for cognitive regulation, the use of technologies that enhance neural plasticity, the use of feedback and adaptive systems, and the necessity of relying on evidence-based programs and scientific research. These findings emphasize that program implementation should be innovative, technology-based, and research-oriented.

Feedback-oriented strategies: The themes in this section emphasize the importance of rapid, continuous, and targeted feedback in the learning process. This section includes the themes of providing immediate feedback, using a diverse range of student responses, verbal encouragement from teachers, parents, and peers, and designing short, frequent, and hierarchical sessions accompanied by feedback. These findings show that implementation methods should be based on continuous correction and step-by-step guidance of learning.

Effective instructional strategies: Another category of findings refers to strategies formed on the basis of effective instructional principles. These include the use of conditioned reinforcement principles, reduction of errors, response time, and reaction time, the use of staged and gradual activities, and the necessity of targeted and planned intervention. This category shows that program implementation should be precise, goal-directed, and based on principles of effective learning.

Cognition-oriented strategies: The themes in this section indicate the importance of thinking and cognitive processes in program implementation. These include the use of alternative strategies in problem solving, strengthening mental representation of the problem, practicing the selection of a strategy appropriate to the goal, and cognitive instruction as an important part of the implementation method. These findings emphasize that the methods should activate thinking, analysis, and problem solving.

Phonological strategies: This category is particularly important for reading disorders and includes activities involving phoneme identification, blending, and deletion; strengthening decoding and spelling; and combining phonological awareness with other instructional methods. These findings show that interventions should be rooted in phonological processing and reading.

Mindful teaching strategies: The analyses show the prominent role of mindfulness in improving learning. The most important themes in this category include focus on higher psychological processes, increased attention and accuracy, conscious and nonjudgmental observation, coping with new conditions, and enhancement of self-regulation through mindfulness practice. These findings emphasize that implementation methods should be accompanied by the strengthening of attention, presence of mind, and cognitive control.

Participatory strategies: The data indicate the necessity of active participation by students and parents in implementing the program. These strategies include active learner participation in discussions and activities, family participation in educational support, peer-mediated instruction, information exchange, verbal communication, and the guiding role of parents and teachers. These findings show that implementation methods should be social, interactive, and based on collective participation.

Figure 1 presents the organizing themes related to the global theme of implementation methods, that is, the implementation-methods dimension, in the metacognition-based curriculum model for reducing learning disorders among elementary school students.

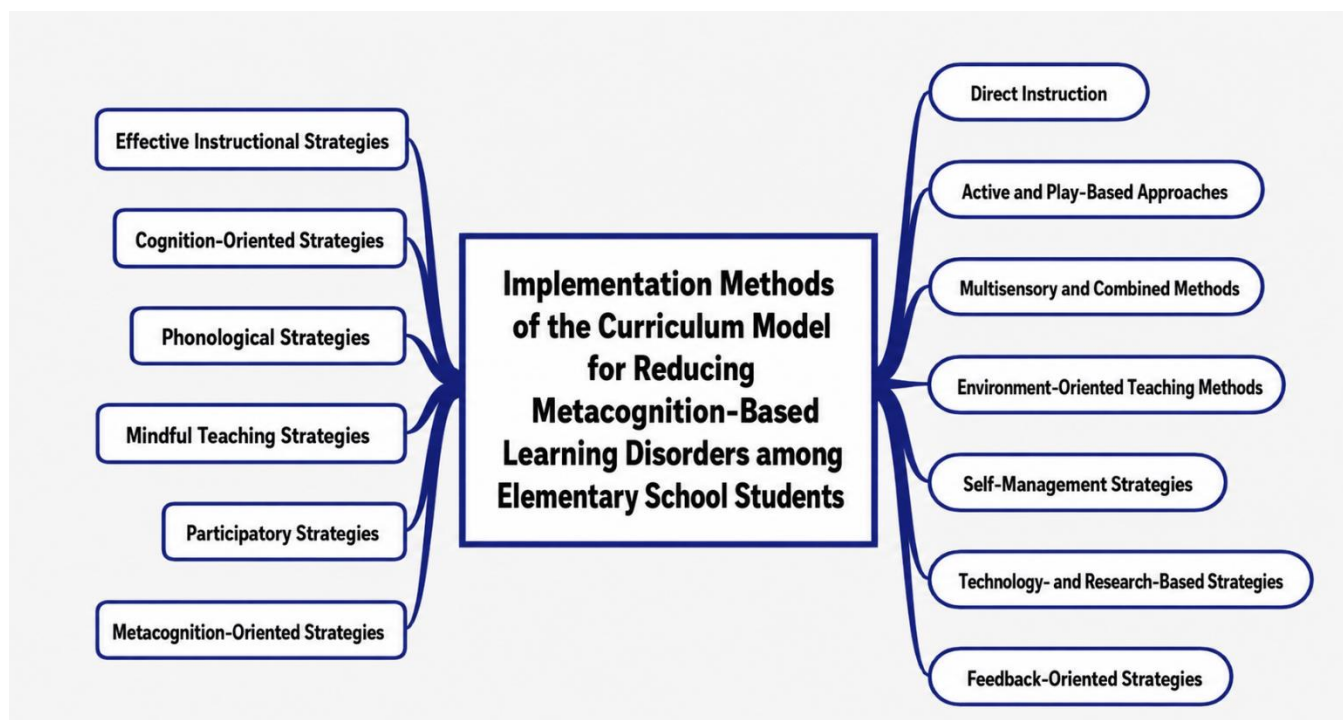


Figure 1. Final Model of the Study

Discussion and Conclusion

The findings of the present study showed that the implementation methods of a metacognition-based curriculum model for reducing learning disorders among elementary school students can be organized into 13 main axes: direct instruction, active and play-based approaches, multisensory and combined methods, environment-oriented teaching methods, self-management strategies, metacognition-oriented instruction, technology- and research-based strategies, feedback-oriented strategies, effective instructional strategies, cognition-oriented strategies, phonological strategies, mindful teaching strategies, and participatory strategies. This thematic structure indicates that the implementation of a curriculum for students with learning disorders cannot be limited to a single instructional technique or a narrow remedial program. Rather, effective implementation requires a multidimensional, flexible, and integrated framework that simultaneously addresses cognitive processing, executive functioning, self-regulation, motivation, classroom interaction, environmental adaptation, and academic skill remediation. This result is consistent with the view that learning disorders are complex educational and neurodevelopmental conditions whose manifestations include difficulties in reading, writing, mathematics, attention, working memory, strategy use, and emotional adjustment (1, 3, 4). Therefore, the findings support a curriculum logic in which learning-disorder reduction is conceptualized not merely as correction of academic errors but as systematic strengthening of the learner's capacity to regulate thinking, learning behavior, and academic engagement.

One of the central findings of the study was the importance of direct instruction as a foundational implementation method. The extracted themes emphasized structured teaching, explicit guidance, classification of students based on type of learning disorder, repeated practice, rereading, questioning, and classroom discussion. This finding is aligned with evidence showing that students with learning disorders often do not acquire learning strategies spontaneously and require explicit, systematic, and

scaffolded instruction. In particular, direct instruction is essential when students have difficulties in reading, mathematics, spelling, and comprehension monitoring, because these areas require clear modeling, guided practice, and progressive transfer of responsibility. Studies on reading disorders and treatment methods have emphasized the necessity of structured and explicit remediation for students who experience reading-related learning problems (2). Similarly, teachers' use of metacognitive strategies to support reading comprehension in children with learning disabilities has been shown to depend on explicit modeling, strategic questioning, and guided monitoring (16). Thus, the present finding confirms that a metacognition-based curriculum should begin with clear and structured instruction before gradually moving learners toward independent regulation.

The identification of active and play-based approaches as another major axis indicates that reducing learning disorders in elementary students requires the activation of motivation, participation, attention, and embodied engagement. The basic themes in this category included educational games, social play, physical activity, game design, digital tools, and gamified strategies for motivation and assessment. This result is theoretically important because elementary learners, especially those with learning disorders, may experience repeated academic failure and reduced motivation; therefore, active and play-based methods can reduce avoidance and increase involvement in learning. The finding is consistent with studies showing that metacognitive and cognitive-metacognitive training can improve academic motivation, engagement, academic vitality, and school quality of life among students with learning disabilities (19, 20). It also corresponds with evidence that metacognitive strategies may strengthen self-efficacy and motivational beliefs in students with learning disorders (18). Accordingly, play-based and active learning approaches can be considered not merely motivational supplements but pedagogical mechanisms for supporting self-regulation, persistence, and strategy use.

The findings also showed that multisensory and combined methods are essential for implementing the curriculum. This axis included the use of visual, auditory, motor, behavioral, neurocognitive, and educational techniques in an integrated manner. Such a result reflects the heterogeneous nature of learning disorders, in which students may present different combinations of deficits in phonological processing, working memory, attention, visual-spatial processing, executive control, and academic fluency. The effectiveness of combined approaches is supported by studies showing that metacognitive training can reduce mathematics problems in students with reading, writing, and mathematics learning disorders (13), and that metacognition and working-memory training can influence mathematics performance and anxiety among students with mathematics learning disorder (15). Similarly, research on neuropsychological skills among students with reading learning disorder suggests that programs focusing on metacognitive knowledge and skills can improve neuropsychological functioning (29). These studies support the present finding that implementation methods should not be isolated; rather, they should combine cognitive, metacognitive, behavioral, and sensory pathways to enhance learning.

Another important finding was the role of environment-oriented teaching methods. The themes in this axis included attention to family conditions, social environment, classroom lighting and temperature, reduction of distracting stimuli, adaptation to school conditions, regional facilities, flexible scheduling, reduced content volume, additional time, and the presence of a teacher or therapist as a facilitator. This finding is compatible with ecological and classroom-based perspectives that consider learning regulation to be shaped by environmental, social, and instructional conditions. Research on socially shared regulation of learning emphasizes that metacognition, affect, and motivation are embedded in social interaction and collaborative learning contexts (21). Similarly, evidence from classroom observations indicates that teachers promote self-regulated learning both directly and indirectly through routines, classroom organization, feedback, and instructional design (22). Therefore, the present result suggests that curriculum implementation for students with learning disorders should not focus solely on the child's deficits; it should also modify the learning environment to reduce cognitive load, enhance predictability, and provide structured opportunities for regulation.

The emergence of self-management strategies as a major axis confirms that the curriculum should gradually empower students to regulate their own cognition, behavior, and emotional responses. The themes included sustained attention, self-direction, goal-focused practice, stopping techniques, breathing exercises, acceptance of thoughts and feelings, nonjudgmental attention, self-regulation, adjustment based on individual needs, and strengthening working memory and executive functions. This finding is strongly aligned with research showing that students with learning difficulties often have weaker metacognitive knowledge and regulation strategies than their peers (6). It is also supported by findings that metacognitive-strategy training improves cognitive self-awareness and self-regulation among students with learning disorders (24). Moreover, evidence that metacognitive-strategy training affects attention-deficit symptoms and learning-disorder symptoms highlights the importance of executive self-management in this population (23). Thus, self-management is not a peripheral skill; it is a core mechanism through which metacognitive curricula may reduce learning problems.

The axis of metacognition-oriented instruction represents the conceptual core of the curriculum model. This finding showed that metacognitive implementation requires teaching students to plan, monitor, control, and evaluate their learning, while also preparing teachers and counselors to use metacognitive principles in assignment design and classroom intervention. This result is consistent with major reviews emphasizing that metacognition contributes to deeper learning, transfer, and strategic regulation across educational domains (7, 8). It also aligns with the systematic review indicating that students with learning disabilities or learning difficulties often show deficits in metacognitive functioning, which should be directly targeted through intervention (9). In mathematics, metacognitive instruction has been shown to support primary students in approaching non-routine word problems (10), and students with dyslexia have benefited from metacognitive-based problem-solving approaches in algebraic word problems (11). Therefore, the present finding strengthens the argument that metacognitive instruction should be designed as a structured curricular process rather than as an occasional teaching technique.

The identification of technology- and research-based strategies indicates the need for innovation and evidence-based design in implementing the curriculum. The extracted themes included modern educational technologies, neurofeedback, cognitive self-regulation tools, neural plasticity, feedback systems, and scientific research for program design. This finding is consistent with contemporary intervention trends that integrate metacognitive approaches with neurocognitive and adaptive instructional tools. For example, research on metacognition and errors in children with specific learning disabilities has emphasized the value of self-regulatory training and error monitoring (27). In addition, didactic designs based on metacognitive approaches have been used to overcome students' learning difficulties in geometry through creative thinking and strategic awareness (12). The present finding suggests that technology can be useful when it is not treated as an isolated tool but is integrated with feedback, self-monitoring, adaptation, and evidence-based curriculum design.

Feedback-oriented and effective instructional strategies were also identified as key implementation axes. The themes in these categories included immediate feedback, verbal encouragement, diverse response opportunities, short and frequent sessions, conditioned reinforcement, error reduction, response-time reduction, staged activities, and targeted intervention. These findings are consistent with the literature showing that students with learning disorders benefit from feedback-rich instruction that enables them to identify mistakes, evaluate performance, and make corrective adjustments. Research on metacognitive learning strategies has shown positive effects on decision-making and cognitive dissonance, suggesting that reflective feedback can help students manage conflict between prior understanding and new information (26). Similarly, studies on academic mediators, cognitive-metacognitive strategies, and motivational beliefs indicate that feedback and strategy use are related to students' academic adaptation (25). Therefore, feedback in this curriculum should not be limited to correction of right and wrong answers; it should function as a metacognitive tool for helping students understand how they learn, why errors occur, and what strategies can be used next.

The findings further showed the importance of cognition-oriented and phonological strategies. Cognition-oriented strategies included alternative problem-solving methods, mental representation of problems, cognitive instruction, strategy selection, and strengthening positive capacities. Phonological strategies included phoneme identification, blending, deletion, decoding, spelling, and phonological-awareness training. This result is especially important because learning disorders often involve domain-specific deficits that must be addressed alongside general metacognitive training. For students with reading and spelling disorders, phonological awareness and decoding instruction remain essential components of remediation (2, 17). For students with mathematics learning disorders, cognitive and metacognitive approaches are needed to improve mathematical reasoning, problem representation, and task management (12, 14). Therefore, the present curriculum model appropriately integrates domain-specific remediation with broader metacognitive and cognitive regulation.

Mindful teaching strategies emerged as another important implementation dimension. This axis included attention to higher psychological processes, concentration, nonjudgmental observation, goal recall during mind wandering, adaptation to new conditions, cognitive flexibility, decision-making, and self-regulation. This finding can be interpreted in relation to the overlap between mindfulness and metacognition, both of which involve awareness, monitoring, attentional control, and regulation of internal experiences. Students with learning disorders often experience frustration, anxiety, avoidance, and negative self-evaluation; therefore, mindful teaching may help them observe errors and difficulties without excessive emotional reactivity. This interpretation is consistent with evidence that learning disorders can affect students' mental health (4), and with research emphasizing the role of metacognition, affect, and motivation in regulation of learning (21). Accordingly, mindful teaching may provide an emotional-regulatory foundation for more effective metacognitive learning.

Finally, the identification of participatory strategies shows that successful curriculum implementation requires collaboration among students, peers, families, teachers, counselors, and psychologists. The themes included active student participation, family participation, peer-mediated instruction, verbal exchange, information exchange, guidance for parents and teachers, and the development of specialized programs by counselors and psychologists. This result is consistent with the socially situated view of learning regulation, which emphasizes that metacognitive development is supported by interaction, dialogue, modeling, and shared regulation (21, 22). It also aligns with studies showing that cognitive and metacognitive strategy training can improve school quality of life and academic engagement, outcomes that are closely related to social participation in learning (20). Overall, the findings suggest that a metacognition-based curriculum for reducing learning disorders should be implemented as a comprehensive, interactive, and developmentally sensitive model that integrates direct teaching, self-regulation, environmental adaptation, feedback, cognitive and phonological remediation, mindfulness, technology, and family-school collaboration.

This study was conducted using a qualitative thematic-analysis design based on documents, scientific texts, and prior research; therefore, the findings reflect conceptual and thematic synthesis rather than direct experimental testing of the proposed curriculum model. Although efforts were made to use relevant and credible sources, the analysis may still be influenced by the availability, quality, and scope of the reviewed literature. In addition, because the study focused on elementary-school students and metacognition-based learning-disorder reduction, the findings may not be fully generalizable to preschool learners, secondary-school students, or learners with more severe neurodevelopmental, sensory, or emotional disorders. Another limitation is that the study did not include direct interviews with teachers, parents, counselors, or students, and therefore the practical feasibility of each implementation method in real classroom contexts requires further empirical examination.

Future studies should empirically test the proposed curriculum model through experimental, quasi-experimental, and mixed-method designs in elementary-school settings. It is recommended that researchers examine the effectiveness of each implementation axis separately and in combination, especially direct instruction, metacognitive training, multisensory methods,

mindfulness-based teaching, feedback-oriented strategies, and participatory family-school methods. Future research may also compare the effects of this curriculum model across different types of learning disorders, including reading disorder, writing disorder, mathematics disorder, and combined learning difficulties. Longitudinal studies are needed to determine whether improvements in metacognitive awareness, self-regulation, academic performance, and motivation remain stable over time. In addition, future studies should include the perspectives of teachers, parents, students, and school counselors to evaluate the feasibility, acceptability, and contextual adaptability of the curriculum in diverse educational environments.

For practical implementation, teachers and school counselors should use a structured but flexible approach that combines explicit instruction with opportunities for student participation, reflection, and self-regulation. Classroom activities should be short, staged, feedback-rich, and adapted to the student's learning profile, with attention to attention span, working memory, emotional readiness, and task difficulty. Teachers should model metacognitive strategies such as planning, monitoring, questioning, error checking, and evaluation, and then gradually transfer responsibility to students. Families should also be involved through simple home-based guidance so that students receive consistent support across school and home environments. Schools should provide teacher training, appropriate educational materials, reduced-distraction learning spaces, and collaboration between teachers, counselors, psychologists, and parents to ensure that the curriculum is implemented continuously and effectively.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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