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Developing Critical Thinking in Mathematics Lessons for Fourth Graders

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***Abstract*—This study explores the development of critical thinking skills among fourth-grade students within the Lithuanian curriculum, where students are expected not only to perform calculations but also to formulate hypotheses, justify solutions, and explore alternative problem-solving methods (Mathematics General Curriculum, 2022). Despite curricular ambitions, many teachers lack clear strategies for fostering these skills in practice. To address this, a qualitative study using semi-structured interviews with six primary school mathematics teachers was conducted. The interviews were transcribed and analysed through content analysis to uncover common methods and challenges. Findings revealed that teachers encourage critical thinking through interactive tasks, real-life problem analysis, mathematical storytelling, project work, group discussions, and the use of digital applications. Key activities supporting critical reasoning include problem-solving tasks, mathematical modelling, reflective exercises, and structured classroom discussions. However, the study identified a persistent difficulty among teachers in selecting and designing tasks that effectively stimulate analytical thinking. As a result, the research recommends implementing more structured, student-cantered strategies and collaborative learning to better cultivate critical thinking. Furthermore, the integration of inquiry-based learning and digital technologies is emphasized as promising in enhancing students' analytical and problem-solving abilities. The insights gained from this study provide valuable guidance for teachers seeking to align instructional practices with curriculum expectations and promote deeper mathematical reasoning from an early age.**

Keywords*— *critical thinking, mathematics education, logical reasoning, problem-solving.

I. INTRODUCTION

Relevance. Critical thinking prepares students to comprehend and apply mathematical concepts. According to OECD [1], critical thinking assists students in decision-making, observation, and applying knowledge to practical situations. Critical thinking in mathematics involves argument identification and construction, using evidence and reasoning to support or critique claims by assessing the reliability and validity of information sources [2].

The Lithuanian education system intends to form students' cognitive competences, wherein critical thinking is considered one of its constituents. It is assumed by the new mathematics general curriculum [3] that students from the fourth grade will be able to execute mathematical operations, analyse mathematical objects, make hypotheses, argue about the solutions, and even check alternative methods of problem-solving. A study conducted recently emphasized that instructional methods like inquiry-based learning [4] as well as problem-based learning [5] contribute much towards such skill development.

Novelty. What this study found is that critical thinking helps students solve mathematical problems, develop and evaluate mathematical ideas, reason, and explain results. This affects student motivation and achievement positively. However, the factors that influence how critical thinking is acquired and assessed in an educational environment are very complex and under researched. Actual critical thinking mathematics depends much on the approach, method, and task of the teacher. According to the findings from Su et al. [6] and the dynamic approach of critical thinking, it can be enhanced through appropriate pedagogy.

Recent studies indicate that the integration of digital tools, as well as AI applications, may offer effective opportunities for the development of critical thinking as approaches to mathematics education [8]. Nevertheless, many difficulties are experienced in the probability of creating the correct lessons that will consequently improve these skills [7]. Other research has proven that approaches such as STEM-based discovery learning and technology-supported instruction go a long way in enhancing students' analytical thinking and attentiveness.

Research problem. The research problem lies in the fact that the development of critical thinking has become an integral part of modern primary education; however, there

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is much room for improvement in how it is integrated into mathematics lessons. In the updated mathematics program expected in 2022, it is expected that a fourth-grade student will be able not only to operate with mathematical procedures, but also to research mathematical objects, form hypotheses, argue the decisions made, and compare alternative strategies [3]. Developing critical thinking includes the following key areas: deep understanding and reasoning, mathematical communication, and problem solving. For the student to understand and reason deeply, it is necessary to introduce him to the study of mathematical objects and properties to hypothesize the place of these objects in the system of some previous objects; the latter process involves inductive reasoning. Mathematical communication will include the ability to analyse and interpret mathematical ideas in a variety of ways and to be able to see the logical connections on which they are based. Problem solving will involve evaluating the results of their actions and making informed decisions about them. However, in practice, very often there is no clear methodological base that allows for the effective development of these abilities, and, most importantly, teachers experience certain difficulties in choosing tasks suitable for stimulating critical thinking. Considering what has been revealed, the research problem can be formulated as follows: how to develop critical thinking of fourth-grade students in mathematics lessons. The research question focuses on the development of critical thinking in fourth-grade mathematics lessons.

The aim of the study is to investigate the process of developing critical thinking of fourth grade students during mathematics lessons and to determine the most effective strategies and methods that promote the formation of those abilities.

Study objectives:

1. To describe the importance and achievement of critical thinking in the mathematics general curriculum.
2. To present methods for the development of critical thinking in mathematics lessons.
3. To investigate how primary school teachers, develop critical thinking in mathematics lessons for fourth grade pupils.

Research methods: Scientific and methodological literature review, semi-structured interviews, and content analysis.

Importance of research. The results will help to understand and support the methods of developing critical thinking in students' mathematics lessons in the fourth grade, the most effective methodological tools and the problems faced by teachers. Thus, teachers can be given recommendations on how best to encourage students' critical thinking through assignments and discussions.

II. Materials And Methods

A. Literature review

A1. Critical thinking achievement in mathematics lessons

Mathematics is one of the subjects in which critical thinking skills can be developed and applied. In mathematics lessons, pupils are exposed to a variety of tasks that require them to analyse information, find patterns and relationships, apply mathematical procedures and principles, reason and evaluate their own and others' judgements, and model and interpret situations [3]. The mathematics achievement areas include problem solving, which includes elements of critical thinking. Problem solving in mathematics involves the ability to 'model situations that are comprehensible and meaningful in different contexts: decompose a problem into its parts, determine the relationship between them, formulate a mathematical question/task; propose and evaluate alternative strategies for solving a problem, make a plan for solving the problem, and implement the plan; evaluate the results of mathematical activities, draw conclusions, and interpret them in the context of the problem under consideration' [3, p. 17].

The mathematics outcomes that require critical thinking include performing and reasoning mathematical procedures, investigating mathematical objects and formulating hypotheses, making and proving the logicality of a sequence of statements or a solution to a problem, analysing and interpreting the logical relationships between the elements of a mathematical message, proposing and evaluating alternative strategies for solving the problem, designing and implementing a plan for solving the problem, evaluating the results of the mathematical activity and drawing conclusions (see Table 1).

Table 1 Mathematics Achievement In Critical Thinking

Achievement area	Mathematics achievement
Deep understanding and reasoning	Explores mathematical objects, formulates hypotheses about their general properties and their place in a system of previously studied objects (Inductive reasoning).
	Develops a coherent, logically sound sequence of statements or solution to a problem, evaluates the logicality of the reasoning, and proves mathematical statements (Deductive Reasoning).
Mathematical Communication	Analyses and interprets the logical relationships between the elements of a mathematical message presented in different forms (text, figure, diagram, formula, table, drawing, graph, chart).
Problem solving	Evaluates the results of mathematical activities, draws valid conclusions and interprets them.

Compiled according to Framework for Mathematics, 2022

A2. Deep understanding and reasoning

The ability to investigate mathematical objects and to formulate conjectures is a core aspect of mathematical thinking. The Framework for Mathematics (2022) states that pupils should be able to provide a coherent argument for their statements and judgments, justifying them with both inductive and deductive reasoning [3]. According to Maulana et al. [14], students can understand structure and pattern better through the practice of making and testing conjectures. This fact is also underlined by Nugraheni et al. [15], who argue that mastery of reasoning, particularly the core concept behind it, will greatly support students in applying their knowledge of mathematics to many problems. Thus, it should be taught explicitly at school. Nevertheless, many students face challenges in assessing the logical validity of statements, and therefore the development of mathematical reasoning needs to be actively encouraged.

A3. Mathematical communication

The ability to express mathematical reasoning accurately in different forms is important for the development of logical reasoning. The Mathematics General Curriculum (2022) specifies that pupils should be able to interpret mathematical statements presented in text, diagrams, tables, or other visual methods [3]. Results found in a study conducted by Jannah et al. [9] show that a well-explained presentation of mathematical content aids students in knowledge assimilation and makes them more adept at analysing the data given. Tashtoush et al. [8] noted that interactive discussions help students understand the details of problem-solving techniques and how they can be used to assess different arguments. However, not all students are easily able to express their mathematical reasoning accurately, so active communication skills training is needed.

A4. Solving problem

The process of mathematical problem-solving entails the formulation, assessment, and implementation of a plan of solution. The Framework for Mathematics (2022) insists on the need for the pupils to critically appraise the results from mathematical activities, draw valid conclusions, and make an interpretation of the results. Harahap et al. [7] observe that students who learn to analyse and compare different problem-solving strategies have a better understanding of the structure of mathematical reasoning. Active involvement in the process of solving the problem, as argued by Sukardi et al., [16] will help the students visualize and decide for themselves the appropriateness of strategies in reaching a solution. However, challenges remain in terms of students' ability to systematically apply critical thinking techniques in real mathematical situations.

Critical thinking skills developed in mathematics classes are the most important teaching process that allows students not only to understand mathematical concepts but also to apply them to solve real-world problems. Mathematical reasoning, communication, and problem-solving are higher-order thinking skills that allow students to flexibly apply knowledge in a variety of contexts [10], [11]. However, there are certain problems with the application of critical thinking skills, so there is a need to further improve teaching methods, as well as methods that promote the assimilation of theoretical knowledge through their critical analysis and reflection.

A5. Methods for Developing the Critical Thinking

The development of critical thinking abilities in mathematical lessons plays an intrinsic part in facilitating students not only in acquiring knowledge but also in applying, analysing, and even justifying the same. The Mathematics Curriculum (2022) states that students can explore mathematical objects, hypothesize, and evaluate alternative solution strategies [3]. According to Zhou et al. [4], mathematics instruction supported by critical thinking presents students with an opportunity to explore various approaches to solving problems; this will help to enhance their logical reasoning and the use of mathematics in different real-world situations. This view is also supported by a study by Maryani et al. [5], which suggests that students who participate actively in analytical activities generally have better abilities to apply different arguments for the application of motivation and involvement in learning. This view is very different from the view of traditional teaching since it very often makes use of the passive critical thinking of the learners; hence, it is not applicable to this context of instructional innovation.

A6. Methods Based on Problem-Solving

One of the best ways to enhance critical thinking in mathematics classes is to apply problem-based teaching and learning. Sukardi et al. [16] stated that this method encourages students not only to search for solutions but also to check their validity, look for alternative approaches, and analyse the logic of solutions. The views of Harahap et al. [7] support the idea that working with problem-solving activities enables students to apply theoretical mathematical knowledge to real-life situations, thus improving their practical problem-solving skills. This approach fosters self-reliance and builds confidence, as pointed out by Maulana et al. [14]. But this way needs strong teacher help to aid students not just get but also build the problem-solving process, mainly for those who miss analytical thinking.

A7. Methods of Mathematical Argument and Discussion

The talk should be a big part that helps well to show students prove their math thoughts and choices with smart arguments. According to Jannah et al. [9], mathematical discussions are highly beneficial, giving students the opportunity not only to express their opinions but also to learn to listen to others, evaluate their arguments, and compare different points of view. The same collaboration supports the students' critical thinking techniques in communicating their thoughts—a factor directly related to academic achievement and successful problem resolution, as emphasized by Tashtoush et al. [8]. This finding is supported by Er [17] in that discussion and argumentation cultivates the capability of students to logically structure their ideas and, therefore, the audience can be answered

with solutions that are more precise and with sound conclusions. Some students are not willing to participate in the discussion because of knowledge; therefore, it should be an environment where learning can be very supportive, not about getting the right answer but about developing a thought process to get the right answer.

A8. Methods for Mathematical Modelling and Reflection

Contemporary approach that allows learners to understand rules in mathematics and apply them in real-life situations. As described by Jamil et al. [18] it gives the students a chance to experiment with different methods of problem-solving, compare different approaches, and explain the results obtained. This view is also supported by Yu et al. [19] who argue that reflective practice, for example learning journals for students or self-evaluation tasks that will enable students to critically assess their learning in developing how their reasoning has emerged with time. Therefore, Nugraheni et al. [15] argue that such students become more independent and aware of their own progress. However, this assumption does not always hold in real conditions. Sometimes, students are not naturally inclined to reflect on their learning; thus, it becomes the responsibility of the teacher to systematically incorporate reflective questions into daily teaching.

Improving critical thinking during mathematics courses helps raise the academic performance of students due to better-informed decision-making capabilities and proper application of mathematical knowledge to real-life situations. Among the effective approaches are problem-solving-based instruction, discussion and argumentation strategies, mathematical modelling, and reflection. Best practices support this claim [10], [11]. The effectiveness of these methods depends on the delivery mechanism of the content by instructors and the student's level of involvement in the learning process. Critical thinking tasks should cease to be separate extra tasks and should be an integral part of the teaching of mathematics so that students will not only memorize formulas but also learn to analyse, evaluate, and justify decisions.

B. Methodology of the research

B1. Research Instrument

A qualitative research approach was applied, allowing the researcher to pose pre-prepared questions while also giving participants the freedom to express their thoughts. This approach facilitates the discovery of new, unexpected aspects of the research topic [13].

A semi-structured interview was chosen as the primary data collection method, enabling a deeper understanding of the critical thinking development methods used by primary school teachers in mathematics lessons. In the semi-structured interviews, the researcher used open-ended questions determined prior to studying the reviewed literature. The study was intended to find out how the teachers included techniques in their lesson plans to develop critical thinking in mathematics and the type of tasks selected to encourage students to think critically. It also seeks to determine how teachers assess the effectiveness of these methods. Additionally, the semi-structured interview format allowed the researchers to capture teachers' opinions on the importance of critical thinking development and the challenges they face in implementing these methods in their lessons [12], [11].

B2. Research Sample

The study included six primary school teachers selected based on their professional experience and participation in training programs related to the implementation of the updated mathematics curriculum. The participants' ages ranged from 25 to 35 years, with teaching experience varying between 2.5 and 10 years. All participants were women working in primary schools (see Table 2).

TABLE 2 CHARACTERISTICS OF RESEARCH PARTICIPANTS

Participant Code	Age	Teaching Experience (Years)
M1	25	2,5
M2	27	6
M3	34	10
M4	26	5
M5	28	7
M6	35	11

B3. Research Process

Interviews with primary school teachers were conducted between February and March 2024. All informants were professional acquaintances of the researcher. The interviews were scheduled in advance, and the questions were not disclosed to the informants beforehand. Four interviews were conducted remotely via the ZOOM platform, recorded both on ZOOM and using a voice recorder, while two interviews were conducted in person at the workplace of one of the researchers and recorded using a voice recorder.

Before each interview, participants were informed about the study and consented to the recording. The duration of the interviews varied: 22, 33, 35, 40, 45, and 46 minutes. Over time, interviews became longer as the researcher refined the questions based on transcriptions from previous interviews to ensure the research objectives were met. Initially, the sample size was set at five participants; however, one additional participant was included to achieve data saturation (Jannah et al., 2025). Participants were encouraged to provide detailed responses, and follow-up questions were used to clarify their perspectives.

After all interviews were conducted, the recorded data was transcribed verbatim, separating participants' responses from the researchers' questions, with the latter highlighted to facilitate distinction. Data analysis was performed using content analysis, identifying meaningful units—categories and subcategories—from the collected responses. The data were first grouped into subcategories using an inductive approach and then categorized

accordingly. The research findings are illustrated with direct participant quotes.

B4. Ensuring Ethical Research Principles

The study adhered to ethical principles of voluntary participation, privacy, and confidentiality [13]. Participation was entirely voluntary, and respondents had the freedom to decide which questions they wished to answer and to choose the interview format and location that suited them best. Participants were informed about the research purpose, and their consent was obtained before recording the interviews. Confidentiality was ensured, and personal data was not disclosed. The interview questions did not contain any information that could compromise participant privacy. The researchers ensured full confidentiality of the interviews, assigning participant codes during transcription. The demographic data of participants was presented in a fully anonymized format [16].

III. Results And Discussion

C. Encouraging students to explore mathematical objects and formulate hypotheses

The first question aimed to find out how primary school teachers encourage pupils to explore mathematical objects, to formulate hypotheses about their general properties and their place in the system of previously studied objects. Teachers' responses reveal the variety of teaching methods used, which can be grouped into several main categories: interactive tasks, virtual mathematics programmes, analysis of real-life problems, mathematical tales and stories, project work, mathematics laboratories (see Table 3).

Table 3 Teachers' Methods For Encouraging Students To Explore Mathematical Objects And To Formulate Hypotheses About Their General Properties And Their Place In A System Of Previously Studied Objects (Inductive Reasoning)

Category	**Subcategory**
Interactive tasks	Geometric constructors
	Group discussions
	Hypothesis generation
Virtual maths apps	Experimenting with objects
	Formulating hypotheses
	Testing
Analysis of real-life problems	Geometric planning
	Putting hypotheses into practice
Mathematical tales and stories	Search for hidden objects
	Discussion of links to known objects
Project work	Setting object properties
	Comparing hypotheses with theory
	Delving deeper into the world of maths
Mathematics laboratories	Manipulators for object perception
	Developing hypotheses based on observations

Teachers' responses to the question of how they encourage students to explore mathematical objects and formulate conjectures reveal their teaching methods using interactive tasks and virtual mathematics software: "I encourage students to explore mathematical objects using interactive tasks <...>" (M1) emphasising the use of interactive tasks, allowing students to use geometric constructors to understand the properties of shapes and encouraging them to develop their own hypotheses and to discuss in groups, "In my lessons, fourth grade students work with virtual mathematics applications <...>" (M2) highlighting the benefits of virtual mathematics applications by giving students the opportunity to experiment and to formulate hypotheses based on the results obtained. Teachers use methods related to the analysis of real-life problems, mathematical stories and tales, project work and the mathematics laboratory: "I present real-life problems to students <...>" (M2) by having students analyse mathematical objects in a practical way, for example by planning a soda, "I use mathematical stories and tales <...>" (M4) using mathematical fairy tales and stories as a tool for exploration, encouraging pupils to look for hidden mathematical objects and properties, "I give pupils the opportunity to work in projects and mathematics laboratories <...>" (M5) and (M6) give examples of projects and mathematics laboratories where pupils go deeper into the investigation of mathematical objects and the formulation of conjectures. The findings align with the work of other researchers who highlight the importance of active learning, exploration, and problem-solving in developing students' mathematical reasoning [10], [12].

D. Encouraging pupils to construct a coherent, logical sequence of statements or a solution to a problem, to evaluate the logicality of reasoning, to prove mathematical statements

The second question aimed to find out how primary school teachers encourage pupils to construct a coherent, logical sequence of statements or solutions to a problem, to evaluate the logicality of their reasoning, and to prove mathematical statements. Teachers' responses reveal a variety of teaching methods used, which can be grouped into several main categories: problem-solving activities, proof of mathematical statements, classroom discussions, group activities, mathematical diaries, and mathematics laboratories (see Table 4).

Table 4 Teachers' Methods For Encouraging Students To Construct A Coherent, Logical Sequence Of Propositions Or A Solution To A Problem, To Evaluate The Logicality Of Reasoning, To Prove Mathematical Statements (Deductive Reasoning)

Category	**Subcategory**
Problem-solving tasks	Application to real-life situations
	Critical and logical thinking
Proofs of mathematical statements	Making calculations
	Logical explanation of decisions
Classroom discussions	Communication and sharing of arguments
	Critical evaluation and requirement for logical explanations

Group activities	Constructing and defending arguments
	Developing structured and logical arguments
Mathematical diaries	Capturing thinking progress
	Improving logic skills
Mathematics laboratories	Experimenting with methods
	Practical application and finding the most logical solutions

Teachers use a variety of methods to promote the ability of Year 4 pupils to construct coherent and logical sequences of statements: 'To encourage pupils to construct coherent and logical sequences of statements, I use problem-solving activities <...>' (M1) emphasising problem-solving activities that require the application of mathematical concepts to real-life situations, 'In my lessons I emphasise the importance of proofs of mathematical statements <...>" (M2) emphasising the importance of proving mathematical statements by asking students not only to perform calculations but also to explain their correctness, "I use classroom discussions to allow students to share and evaluate each other's arguments <...>" (M3) using classroom discussions to allow students to share and evaluate each other's arguments, helping them to understand the specificity of logical argumentation, "In order to promote logical thinking, I organise activities <....>" (M4) by organising group activities in which pupils construct and defend arguments to develop structured and logical thinking, "I encourage pupils to write mathematical diaries <...>" (M5) by encouraging pupils to write mathematical diaries that allow them to record their thinking and develop their logical skills, "In my classes, I often use 'maths labs' <...>" (M6), emphasising the use of maths labs where students experiment and search for proofs by applying mathematics in practice These methods show that teachers value critical thinking, logical reasoning and the practical application of mathematics as important skills to be developed at school. The findings align with the work of other researchers who highlight the importance of problem-solving, discussion, group work, and reasoning in developing students' critical thinking and mathematical understanding [10], [12], [14].

E. Encouraging students to analyse and interpret a mathematical message

The third question aimed to find out how primary school teachers encourage pupils to analyse and interpret the logical relationships between the elements of a mathematical message presented in different forms (text, picture, diagram, formula, table, drawing, graph, chart). Teachers' responses reveal the variety of teaching methods used, which can be grouped into several main categories: text analysis and interpretation, mathematical concepts, visual aids, mathematical shapes and formulae, group activities, data collection and analysis, and the integration of different forms (see Table 5).

TABLE 5 TEACHERS' METHODS FOR ENCOURAGING STUDENTS TO ANALYSE AND INTERPRET A MATHEMATICAL MESSAGE

Category	**Subcategory**
Text analysis and interpretation	Text tasks: students analyse and explain mathematical relationships using text examples
Mathematical concepts	A description of how the area of a figure changes with the length of its sides.
Visual aids	Tables and graphs: used to explain and represent mathematical relationships
	Drawings and diagrams: help you understand and interpret functions and their properties
Mathematical forms and formulae	Diagrams: pupils learn to recognise relationships between mathematical elements
	Formulas: used to explain mathematical models such as geometric progression
Group activities	Group discussion: students analyse and interpret mathematical data presented in different forms
	Presentations: students share their findings with the class
Data collection and analysis	Collecting data: students create tables and graphs based on the data they collect
	Interpreting data: students learn to understand the importance of data analysis
Integration in its various forms	Text, drawings, formulae: Pupils use different forms to analyse mathematical relationships
	Comparison: students compare the areas of different shapes using visual and mathematical expressions

The study reveals a variety of teaching methods used by primary school teachers to encourage fourth-graders to analyse and interpret a mathematical message: for example, <...To promote fourth-graders' analysis and interpretation skills, I use text tasks in which students have to find and explain mathematical relationships...> (M1) assessing the students' ability to not only perform calculations, but to express themselves clearly in writing, which is an important aspect of critical thinking, <....In my lessons, students often work with diagrams and formulas...> (M2), suggesting that the teacher encourages students to see mathematics as a system in which each element is related to the next...<...I encourage students to use drawings and diagrams to understand mathematical relationships...> (M3) in order to teach them how to visually represent and analyse information, which is especially useful for problem-solving and data analysis, <...Interpretive skills are developed through group discussions...> (M4) emphasising that group activities encourage students to share ideas and deepen their understanding of mathematical concepts, <...I encourage my students to create their own tables and graphs...> (M5) valuing students' ability not only to follow instructions but also to use mathematics creatively in their work, <...In my lessons, my students learn to analyse mathematical relationships using different forms...> (M6) emphasising the importance of analysis by encouraging students to look for connections between different aspects of mathematics and to apply them in practice. Both teachers emphasise the importance of practical work with data, encouraging students not only to learn theory but also to apply their knowledge in real situations, which is essential for understanding the meaning and importance of

mathematics. The results of the study align with the work of other researchers who emphasize the importance of text tasks, diagrams, formulae, drawings, group discussions, and working with data in developing students' abilities to analyse and interpret mathematical messages [9], [10], [12].

F. Encouraging pupils to evaluate the results of mathematical activities, to draw valid conclusions and to interpret them

The fourth question asked how primary school teachers encourage pupils to evaluate their mathematical performance, draw valid conclusions and interpret them. Teachers' responses reveal a variety of teaching methods used, which can be grouped into several main categories: individual choice and independence, group work and collaboration, process relevance and exposing thinking, self-testing methods, and the use of technology and interactive tools (see Table 6).

TABLE 6 TEACHERS' METHODS FOR ENCOURAGING PUPILS TO EVALUATE MATHEMATICAL PERFORMANCE, MAKE VALID INFERENCES AND INTERPRET THEM

Category	**Subcategory**
Individual choice and autonomy	Allowing students to choose tasks according to their personal abilities
	Encouraging self-assessment of work done
Working in groups and collaboration	Using group work to complete tasks and present results
	Learning from your own and others' mistakes and achievements
The importance of process and uncovering thinking	Emphasising not only the importance of the right answer but also the process by which it was arrived at
	Promoting the ability to explain thinking processes and problem solving
Self-testing methods	Use of various self-testing methods such as checklists or reflective diaries
	Critical thinking and error analysis
	Encouraging critical thinking by analysing mistakes and finding their causes
	Use of interactive learning tools that allow students to see their progress in real time

The study reveals a variety of teaching methods used by primary school teachers to encourage pupils to evaluate their mathematical performance, draw reasonable inferences and interpret them. The teacher stresses the importance of students' choice, allowing them to choose tasks that are appropriate to their abilities and then discussing their decisions: "I encourage students to evaluate their mathematical performance by letting them choose the tasks according to their abilities. Afterwards, we discuss together how it went and what could be done differently." (M1). Such lessons require that the students are made to work in groups, where they must execute tasks and present the outcomes to others as well. This will enable them not just to draw conclusions but also learn from their errors and through the achievements of their friends. (M2) which encourages students not only to complete the tasks but also to share the results and learn from their mistakes and their friends' successes. The teacher also identifies the importance of process thinking: "I always emphasise the importance not only of the right answer, but also of the process by which it was arrived at. Students need to be able to explain their thinking process and how they solved problems." (M3) encouraging pupils to analyse and explain their thinking process. The teacher suggests self-assessment methods as a way of: "I encourage pupils to self-assess their work using a variety of self-assessment methods such as checklists or reflective diaries." (M4) for students to assess their own progress. The teacher emphasises the importance of critical thinking: "I think it is important to teach students not only mathematics but also critical thinking. That is why I encourage them to analyse mistakes and look for reasons why something didn't work as it should have...>" (M5) not only to complete the tasks but also understand the process of doing them. The benefits of technology are also noted by this teacher "I use various interactive technologies, such as learning apps, which allow students to see their progress in real time and encourage them to improve...>" by actively involving students in the learning process and showing them their own achievements. These teachers' approaches denote multi-fadedness in teaching, calling for reflection not just on one's math performance but on critical thinking, self-efficacy, and collaborative skills.

IV. CONCLUSIONS

The acquisition of critical thinking involves justifying one's knowledge and literacy in mathematics, as well as being a problem solver. All these will enable the students to apply mathematics not only in performing mathematical procedures but in analysing and interpreting information from various forms and applying it successfully outside the classroom.

Discussions, projects, teamwork, and problem-solving activities fit very well into mathematics lessons because they help not only deepen knowledge but also give the ability to explore and discuss. These methods, combined with modelling and feedback, create an active learning environment that motivates students and helps them to make meaningful connections between new and existing knowledge.

To develop critical thinking in mathematics lessons, a variety of methods must be used to promote active participation and deep understanding of mathematics among fourth-grade pupils: Group discussions, interactive tasks, project work and mathematical diaries help pupils to formulate hypotheses, argue their ideas, solve problems and reflect on their learning process. A variety of tasks that encourage deductive reasoning and the search for creative solutions develop students' analytical and problem-solving skills. The use of such learning tools, texts, visual aids and most importantly allows the students to effectively analyse and interpret information of a mathematical nature. Due to the above it is also important to better understand the significance of collaboration and teamwork which will consequently help them learn through each other and improve their communication skills. The teacher should give challenges that include but are not limited to fear of

making mistakes, habitual dependence on direct instruction, and scarcity of resources when designing problem-solving activities for the students at the fourth-grade level. The development and improvement of the methods of work based on individual characteristics of students are required for effective mastering of the skills of critical analysis.

V. RECOMMENDATIONS

- The primary school teachers should use the following methods to develop critical thinking among their students in mathematics lessons:
- Problem solving and proving mathematical statements or engaging in discussions and group activities would promote students to develop deductive reasoning.
- It will give students an opportunity to reflect and deepen their knowledge of mathematics through mathematical journals and laboratory work.
- Different forms of presentation can be integrated to allow students to analyse and interpret a mathematical message.
- This will discuss and bring out the fact that group discussion and collaboration bring out deeper understanding and, on top of that, gives the students a chance to argue their ideas
- Interactive tasks, virtual applications, mathematical tales and project work encourage critical thinking, group discussion and conjecture.
- Discussions, projects, authentic and problem-solving tasks, and group work help students to deepen their mathematical knowledge and logical thinking, and allow them to explore, question and discuss.
- Simulation and feedback provide an active learning environment that allows students to effectively link prior knowledge with new knowledge.
- Creativity skills and teamwork encourage pupils to propose and evaluate alternative strategies for solving a mathematical problem
- Interactive activities, autonomy and reflection help students not only to find solutions but also to make sense of them, to learn from others and to improve collaboration skills
- Group work and collaboration allow learning from peers and improving communication skills.
- The use of technology helps students to see their progress and allows them to visualise mathematical processes.

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