Journal of Educational Studies in
Mathematics and Computer Science

Questions in Mathematics Teaching: Teachers' Perspectives in Serbia

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Received: 28 November 2025; **Accepted:** 29 December 2025

Abstract

Questions play a central role in mathematics teaching, shaping classroom interaction, students' thinking, and learning opportunities. This study examines how mathematics teachers in Serbia perceive and use questions in their teaching practice, with particular focus on three complementary aspects: how teachers explain the nature of mathematics to students, the types of questions they report asking during lessons, and how they perceive and remember students' questions.

The study was conducted as an exploratory mixed-methods investigation. Data were collected through an online questionnaire administered to 209 in-service mathematics teachers during a national professional development seminar. The instrument included closed questions and three open-ended questions addressing: (1) teachers' responses to a ten-year-old student's question, "What is mathematics?"; (2) examples of questions teachers had recently asked their students; and (3) examples of students' questions that teachers perceived as interesting or significant. Quantitative data were analyzed descriptively, while open responses were examined using qualitative content analysis. Coding was conducted in multiple phases, including independent coding by the author, AI-assisted checks of coding consistency, and verification by a second human coder.

The results show that teachers most frequently conceptualize mathematics as a tool for developing thinking and logical reasoning, followed by references to everyday applications. Although teachers report asking questions very often during lessons, qualitative analysis reveals that these questions are predominantly content-focused and procedural, with relatively few reflective or metacognitive questions. Notably, fewer than half of the teachers provided examples of memorable student questions, despite reporting frequent student questioning. This discrepancy suggests a tension between perceived classroom interaction and the depth of professional reflection on students' inquiry.

The findings highlight the need for targeted professional development focused on the quality of questions and their role within the teaching process, as well as on fostering students' capacity to formulate meaningful questions as a foundation for students' lifelong learning.

Keywords: teacher questioning, student questions, mathematics teaching, qualitative content analysis.

MSC2020: 97D30, 97D40, 97C70

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1. Introduction

Questions represent one of the fundamental mechanisms through which people explore the world, develop understanding, and generate new knowledge. From early childhood, when children spontaneously ask questions to explain surrounding phenomena, to scientific inquiry, where questions drive theoretical and empirical progress, questioning occupies a central place in learning and thinking. Although often perceived as a natural and spontaneous activity, a substantial body of research suggests that high-quality questioning is a complex skill that develops through education and social interaction, particularly within the school context (Chin, 2007; Shahrill, 2013).

In mathematics education, questions serve multiple didactic functions: they may be used to assess understanding, guide students toward particular conclusions, stimulate thinking, and create opportunities for discussion, argumentation, and reflection. However, existing research indicates that questions in mathematics classrooms often remain at the level of knowledge reproduction and procedural understanding, while questions that promote deeper conceptual thinking, justification, and metacognitive processes are considerably less frequent (Dong et al., 2019; Martino & Maher, 1999). At the same time, students' questions, although widely recognized as important indicators of curiosity and engagement, are often insufficiently and unsystematically analyzed and only rarely become part of teachers' professional reflection (Shahrill & Clarke, 2014).

Drawing on these insights, this paper focuses on three interconnected aspects of teaching practice in mathematics education: (1) how mathematics teachers conceptualize mathematics when responding to a student's question, (2) the types of questions teachers themselves report asking during teaching, and (3) students' questions that teachers perceive as interesting or significant. Rather than directly eliciting formal definitions of mathematics from teachers, the study deliberately adopts a situational approach through the question: How would you answer a ten-year-old child who asks, "What is mathematics?" This approach provides insight into teachers' implicit conceptions of mathematics as they emerge in classroom discourse, that is, in how teachers adapt their understanding of the discipline to younger learners (Harel, 2008; Ziegler & Loos, 2017).

The choice of this particular question is further motivated by the specific educational context of fifth grade in primary school in Serbia (at the beginning of fifth grade, students are aged 10.5 to 11.5). At this age, students encounter the natural and social sciences for the first time as distinct school subjects, with new content often introduced through clear, concise definitions (e.g., biology as the science of living organisms or geography as the science of the Earth). Within this context, the question "What is mathematics?" becomes both natural and didactically challenging, as mathematics does not easily lend itself to unambiguous descriptive definitions. The way teachers respond to this question may therefore reveal which aspects of mathematics they consider essential and worth conveying to students.

The remaining two research questions focus on concrete classroom interaction and everyday teaching practice. Teachers were asked to provide an example of a question they had recently asked their students, as well as an example of a student question that had remained in their memory as particularly interesting or significant. In this way, the study moves from the level of general conceptions to the level of teaching practice and professional reflection. Examining students' questions is especially important, as they may indicate depth of understanding, curiosity, and the extent to which teaching creates space for dialogue, inquiry, and students' intellectual initiative (Vrikki & Evagorou, 2023). From this perspective, the teacher's role is not limited to didactic mediation of content but also includes a moral responsibility for shaping the culture of teaching, dialogue, and attitudes toward knowledge, positioning the teacher as a moral exemplar whose views and actions influence students' intellectual and ethical development (Jelovac, 2025).

This study aims to provide insight, through a combination of quantitative and qualitative analysis, into how mathematics teachers in Serbia understand and use questions in the teaching process, as well as how they value students' questions. By examining teachers' perspectives from multiple angles, conceptions of mathematics, teaching practice, and classroom interaction, the study

seeks to contribute to a deeper understanding of the role of questioning as a key didactic tool in contemporary mathematics education and to provide a foundation for the research design presented in the following section.

2. Methodology

2.1. Research Design

The study was designed as an exploratory–descriptive investigation employing a combination of quantitative and qualitative data analysis. This design was chosen in order to capture both general patterns in teachers' responses and the meanings, didactic emphases, and implicit beliefs expressed in teachers' open-ended statements.

The aim of the study was to examine how mathematics teachers conceptualize mathematics, what kinds of questions they ask students while teaching, and how they perceive the questions students ask them, with particular attention to how these conceptions and practices are reflected in everyday classroom interaction.

2.2. Research Questions

In accordance with the research aim, the following research questions were formulated:

RQ1: How do teachers formulate an answer to the question "What is mathematics?" when addressing a ten-year-old student?

RQ2: What types of questions do teachers report having recently asked students during mathematics lessons?

RQ3: What kinds of questions do students ask teachers that teachers recognize as particularly interesting, significant, or memorable?

Together, these questions enable an examination of teachers' perspectives from three complementary angles: conceptions of the nature of mathematics, teaching practice, and interaction with students.

2.3. Sample and Research Context

Data were collected through an online questionnaire administered during the National Seminar of the Mathematical Society of Serbia, held on 11–12 October 2025. The seminar is intended for mathematics and computer science teachers in primary and secondary schools, with the questionnaire primarily targeting mathematics teachers.

The analysis included responses from 209 teachers who teach mathematics in primary and secondary schools. The sample comprises teachers from different genders, age groups, school types, and working environments, providing a more comprehensive insight into diverse aspects of teaching practice.

Women accounted for approximately four-fifths of the sample (79.9%). The majority of participants (62.2%) were between 30 and 50 years of age, 31.6% were older than 50, and 6.2% were younger teachers aged 30 or younger. Most respondents were employed in primary schools (96), followed by grammar schools (68) and vocational secondary schools (41), while four teachers worked simultaneously in a primary school and a vocational secondary school. Ninety-five teachers were employed in Belgrade (the capital city of Serbia), 85 in other cities, and 29 in rural areas.

2.4. Instrument

The study employed an author-designed questionnaire consisting of two interconnected sections. The first section focused on basic socio-demographic characteristics of the participants and included questions on gender, age, school type, and the size of the community in which the school is located.

The second section addressed teachers' views and experiences in mathematics teaching and included a combination of three closed-ended and three open-ended questions. The three closed-ended questions were designed to assess respondents' perceptions of how frequently they ask

questions in class, how often students ask questions, and the level of students' motivation to learn mathematics.The open-ended questions referred to:

(1) how teachers explain mathematics to students ("How would you answer the question posed by a ten-year-old child: 'What is mathematics?'"),

(2) questions teachers ask students during the teaching process ("Please state the most recent or one question you have recently asked students during a lesson."), and

(3) students' questions that teachers remembered as particularly interesting or significant ("Please state one student question that has remained in your memory as interesting or significant and briefly explain why.").

The open-ended questions were intentionally left without restrictions on response length to allow participants to express themselves freely and provide content-rich answers. Participants were also allowed to respond only to the questions they wished to answer, which reduced response pressure and increased the authenticity of the collected data.

2.5. Data Analysis

The collected data were analyzed using a combination of quantitative and qualitative approaches, in line with the nature of the research questions. Closed-ended questions and descriptive data were analyzed using basic descriptive statistics, with frequencies and percentages used to present the distribution of responses.

Open-ended responses were analyzed using qualitative content analysis. The coding process followed an inductive–deductive approach: initial analytical categories were developed based on the theoretical framework and research aims and were subsequently refined and operationalized during the analysis of empirical responses. A separate coding scheme was developed for each open-ended question, tailored to its specific research function. The categories, their descriptions, and illustrative examples are presented in Tables 1, 3, and 4.

Responses to the question "What is mathematics?" were coded according to the dominant meaning emphasized in each response, with each response assigned a single code reflecting its prevailing focus (see Table 1). This procedure enabled the identification of different ways in which teachers conceptualize mathematics when addressing students.

Responses concerning teachers' questions were analyzed in relation to their function within the teaching process, including questions focused on mathematical content, connections to real-life contexts, the promotion of reflection and self-assessment, as well as organizational or general questions (Table 3).

Students' questions were coded according to the type of cognitive and content-related demands they expressed, including those aimed at understanding concepts and procedures, deepening meaning, applying knowledge in real-world contexts, and reflecting curiosity, critical thinking, or broader student interests (Table 4).

2.6. Coding Reliability and the Use of AI Tools

To enhance the reliability of the qualitative analysis, the coding of open-ended responses was conducted in multiple phases. In the first phase, responses were coded by the first author of the study. In parallel, the same material was independently coded with the support of an AI tool (ChatGPT, version 5.2), which was used exclusively to check the consistency of the application of the predefined codes.

After comparing the two sets of codes, discrepancies were examined through analytical discussion, and the categories were further refined and operationalized. Based on this agreed-upon coding system, the second author independently coded the responses. The level of agreement between the two human coders ranged from 90% to 95%, depending on the question. In the rare cases of disagreement, final decisions were reached through joint discussion and consensus.

The use of the AI tool was strictly analytical and supportive and was not employed to generate, supplement, or modify empirical data, thereby preserving research control and procedural transparency.

2.7. Ethical Considerations

Participation in the study was voluntary and anonymous. The collected data contained no personal identifiers and were used exclusively for research purposes. Participants were informed about the study's purpose and the use of their data. Particular attention was paid to the ethical use of AI tools, which did not have access to participants' personal data and were not used to draw research conclusions without the authors' expert oversight.

3. Results

3.1. The Question "What Is Mathematics?"

Out of the 209 teachers included in the analytical sample, 131 responded to the open-ended question "How would you answer the question posed by a ten-year-old child: 'What is mathematics?'", representing 62.7% of the respondents. A similar response pattern was observed for the other two open-ended questions, indicating that a substantial proportion of teachers did not respond to questions requiring spontaneous, reflective, or conceptual answers. This finding suggests that open-ended questions, particularly those that deviate from conventional survey formats, pose a certain challenge for respondents.

Table 1. Categories, Examples, and Frequencies of Teachers' Responses to "What Is Mathematics?"

Code	Category	Category description	Example response	Share of responses (%)
C	**Creativity**	Mathematics as solving puzzles or games	"It is solving puzzles."	**4.6**
E	**Everyday applications**	Mathematics as a tool for navigating everyday life and real-life situations	"Mathematics is all around us, in the shop, on the phone…"	**32.1**
N	**Nature of mathematics**	Mathematics as a science dealing with numbers, shapes, and relations	"A science that deals with numbers and shapes."	**12.2**
O	**Other**	General, vague, or tautological responses	"Everything."	**4.6**
S	**Science**	Mathematics as a foundational or universal science language	"The queen of all sciences."	**11.5**
T	**Thinking skills**	Mathematics as a means of developing thinking and logical reasoning	"Mathematics teaches you how to think."	**35.1**

The analysis shows that teachers most frequently conceptualize mathematics as a means of developing thinking skills, logical reasoning, and intellectual effort, accounting for 35.1% of the responses (Table 1). This category includes formulations describing mathematics as "brain training," "mental gymnastics," or a tool that "teaches how to think," often using metaphors accessible to students.

The second most prevalent category links mathematics to everyday life and real-world contexts (32.1% of responses), emphasizing its practical usefulness, omnipresence, and role in solving concrete life situations.

A smaller but still notable proportion of responses conceptualize mathematics as a formal science dealing with numbers, shapes, and relations, as well as a foundational or "royal" science, with these two categories represented in approximately equal proportions. The smallest share consists of general or vague statements that do not provide a substantively elaborated explanation of mathematics.

3.2. Teachers Ask Questions

Using a five-point Likert scale, teachers reported how frequently they ask questions during lessons and how often students do so. The distribution of responses is presented in Table 2.

Table 2. Distribution of responses to questions about the frequency of asking questions.

Frequency of asking questions	Teachers ask questions (%)	Students ask questions (%)
In every lesson	83.3	51.7
In most lessons	13.9	33.5
In about half of the lessons	1.4	10.5
In fewer lessons	1.0	4.3
Do not ask questions	0.5	0.0

The results indicate that teachers largely perceive questioning as an integral component of their teaching practice. As many as 83.3% of teachers report asking questions in every lesson, while an additional 13.9% indicate doing so in most lessons. Only a very small proportion report asking questions occasionally, and a negligible number state that they do not ask questions during the teaching process.

Although the quantitative data suggest a high frequency of questioning, the qualitative analysis of responses to the open-ended question, in which teachers were asked to provide a concrete example of a question they had recently asked students, reveals a more complex picture. More than 30% of teachers did not provide any specific example, despite indicating in the closed-ended question that they ask questions very frequently or in every lesson. This finding points to a discrepancy between teachers' self-assessment of their teaching practice and their willingness or ability to illustrate it with concrete classroom examples.

Table 3. Categories, Examples, and Frequencies of Questions Teachers Ask in Mathematics Lessons

Code	Category	Description	Example of teachers' questions	Share of responses (%)
S	**Subject-matter questions**	Questions focused on mathematical content, definitions, procedures, or problem-solving within the subject itself	"What is a one-to-one function?"; "Why is √x a bijection?"	**53.5**
P	**Practical/real-life application**	Questions connecting mathematical content to everyday contexts or practical situations	"Where do we use the coordinate system in real life?"; "Give an example of direct proportionality."	**20.2**
R	**Reflection / metacognitive questions**	Questions aimed at checking understanding, encouraging reflection or self-assessment	"Do you understand this?"; "How difficult do you find this task?"	**16.3**
O	**Other/organizational**	Organizational, procedural, or non-teaching questions not directly related to mathematical learning	"Have you all submitted your homework?"	**10.1**

A total of 129 out of 209 teachers responded to the open-ended question asking for an example of a question they had recently asked during a mathematics lesson. As shown in Table 3, the most prevalent questions are subject-matter oriented, focusing on mathematical content, conceptual

understanding, and procedures within the discipline (53.5%). These include requests to define concepts, explain procedures, or solve specific problems.

The second most frequent category comprises questions linking mathematical content to real-life or practical contexts (20.2%). Reflective and metacognitive questions aimed at checking understanding and promoting self-assessment appear in 16.3% of responses, while the smallest proportion consists of organizational or general questions (10.1%) that do not directly contribute to the development of mathematical understanding.

3.3. Students Ask Questions

The results reveal a clear difference in teachers' perceptions of how frequently they themselves ask questions compared to how often students do so (Table 2). While 83.3% of teachers report asking questions in every lesson, only 51.7% attribute the same level of frequency to students. At the same time, no teacher assessed students as never asking questions, although this option was available in the questionnaire. Most teachers believe that students ask questions in most lessons (33.5%) or in about half of the lessons (10.5%), while a smaller proportion reports that this occurs in fewer lessons (4.3%).

Table 4. Categories, Examples, and Frequencies of Students' Questions Identified as Interesting or Significant

Code	Category	Description	Example of students' questions	Share of responses (%)
U	**Understanding / procedural questions**	Questions focused on understanding mathematical concepts, definitions, or procedures, usually within the currently taught content	"Why does dividing by zero not make sense?"; "Can we solve this task without using proportion?"	**27.2**
G	**Generalization / deeper reasoning**	Questions indicating deeper conceptual thinking, generalization, or exploration beyond immediate procedures	"Is there more numbers between 0 and 1 or between 1 and infinity?"; "Why does the implication truth table look like this?"	**25.0**
P	**Practical application (including technology-related questions)**	Questions connecting mathematics to real-life situations, practical use, or questioning the role of manual procedures in the presence of technology	"Where do we use this in real life?"; "Why do we calculate integrals by hand if software can do it?"	**22.8**
I	**Interest-driven / curiosity questions**	Questions reflecting curiosity, interest, historical context, or personal engagement with mathematics	"Did Pythagoras and Thales know each other?"; "Why was the circle invented?"	**10.9**
O	**Other / non-teaching**	Organizational, off-topic, or vague questions not directly related to mathematical learning	"When will the bell ring?"	**14.1**

Ninety-two out of 209 teachers (44.0%) responded to the open-ended question "Please state one student question that has remained in your memory as interesting or significant." Compared with the previous two open-ended questions, this question yielded the lowest response rate, suggesting that a considerable number of teachers did not identify or recall a student question they perceived as particularly noteworthy.

The analysis of student questions reported by teachers indicates that the largest proportion concerns understanding mathematical concepts and procedures (27.2%), followed closely by questions that reflect deeper reasoning and generalization (25.0%). A substantial share of responses refers to questions connecting mathematics to practical applications and technology (22.8%). Interest-driven questions reflecting curiosity or broader engagement with mathematics are less frequent (10.9%), while a notable proportion falls into the 'other' or 'non-teaching' category (14.1%).

In the closed-ended question assessing students' interest in mathematics lessons, most teachers rated student interest as good (53.1%). At the same time, nearly half of the teachers (44.0%) assessed student interest as poor, while only a very small proportion rated it as excellent (1.9%) or very poor (1.0%). These results indicate a pronounced polarization in teachers' perceptions of students' interest in mathematics.

Overall, the findings reveal consistent patterns in teachers' conceptions of mathematics, teaching practices, and perceptions of student activity. Responses to the open-ended questions indicate that teachers most frequently conceptualize mathematics as a means of developing thinking and logical reasoning, while the questions they ask students are predominantly focused on mathematical content and on assessing understanding. Although most teachers report asking questions in every or almost every lesson, qualitative analysis suggests limited diversity and reflectiveness in these questions, as well as a marked discrepancy between reported frequency and the ability to provide concrete classroom examples.

A similar pattern emerges regarding students' questions. Although teachers reported that students ask questions relatively frequently, the lowest response rate was observed for the question requiring recall and evaluation of interesting or significant student questions. The structure of the reported questions shows that they are most often focused on understanding and procedures, while questions that indicate deeper reasoning, generalization, or sustained interest are less prevalent. These findings should also be considered in light of the fact that nearly half of the teachers assess students' interest in mathematics as low.

Additional analyses did not reveal statistically significant differences in teachers' responses with respect to school type, size of the community in which they work, gender, or age, suggesting that the observed patterns transcend individual characteristics and may be viewed as a more general phenomenon in mathematics teaching practice.

4. Discussion

This study aimed to examine teachers' perspectives on mathematics, teaching practices related to questioning, and the role of students' questions in mathematics teaching. The results indicate relatively stable patterns across all analyzed segments, with quantitative and qualitative findings complementing one another. In this discussion, the findings are interpreted in light of contemporary didactic approaches, the emphasis on mathematical literacy and competencies, and teachers' professional reflection on their own practice.

4.1. What Is Mathematics?

The dominance of responses describing mathematics as a means of developing thinking and logical reasoning suggests that teachers essentially recognize its cognitive and formative dimensions. Such conceptions are consistent with contemporary educational perspectives on the role of mathematics in fostering thinking and competencies, which emphasize that teachers and mathematicians often view mathematics as a vehicle for broader cognitive and educational development rather than merely as a formal system (Hoffmann & Even, 2023; Ziegler & Loos, 2017).

At the same time, mathematical content, understood as a formal structure of concepts, relations, and procedures, is less frequently explicitly articulated in teachers' responses. This finding may indicate an implicit assumption that content is "self-evident," particularly when teachers address younger students. As a result, the formal structure of mathematics recedes into the background of educational discourse, even though it constitutes the foundation for the very thinking processes that teachers identify as central.

The substantial number of responses linking mathematics to everyday life and practical contexts further confirms teachers' orientation toward applicability. While this emphasis aligns with contemporary demands for functional knowledge and realistic approaches to mathematics

education, it raises the questions of how effectively practice balances the development of thinking processes, understanding of the internal structure of mathematics, and meaningful connections to real-world contexts, a tension explicitly addressed in theoretical discussions of the nature of mathematics and its teaching (Harel, 2008; Hoffmann & Even, 2024).

The findings of this study are broadly consistent with previous research. In the study by Colić et al. (2025), pre-service primary teachers and pre-service mathematics teachers in Serbia also most frequently associated mathematics with the development of thinking and logical reasoning, while formal and structural aspects of the discipline were less often explicitly named. The similarity of patterns across students and experienced teachers suggests the stability of these conceptions across different stages of professional development, but also points to a possible lack of systematic reflection on the nature of mathematics in both initial and continuing teacher education.

4.2. Teachers' Questions

Quantitative findings indicate that teachers largely perceive questioning as an integral part of their teaching practice, with the vast majority reporting that they ask questions in every or almost every lesson. However, qualitative analysis of concrete examples of questions reveals a much narrower range of didactic functions.

Most reported questions focus on mathematical content, primarily aimed at checking knowledge, understanding concepts, and applying familiar procedures. Questions that encourage reflection, self-assessment, argumentation, or connections to broader contexts are considerably less frequent. This pattern is consistent with previous studies showing that teacher questioning in mathematics often serves a controlling and guiding function, while its potential to foster deeper understanding and reflection remains underutilized (Dong et al., 2018; Martino & Maher, 1999; Shahrill, 2013).

The discrepancy between the reported frequency of questioning and the limited qualitative diversity of questions suggests that questions are often instrumentalized to manage the lesson rather than as a starting point for inquiry-based or problem-oriented approaches to mathematics teaching. In this way, questions are reduced to a technical tool for content delivery, rather than becoming vehicles for dialogue, argumentation, and metacognitive reflection. Similar tensions between the organizational and cognitive functions of questions have been noted by Dong et al. (2019), highlighting the complexity of teachers' decisions in real classroom conditions, particularly in balancing managerial and cognitive demands.

4.3. Students' Questions

Findings related to students' questions further enrich the picture of classroom interaction. Although teachers estimate that students ask questions relatively frequently during lessons, the lowest response rate was observed for the question requiring recall and evaluation of interesting or significant student questions. This result suggests that, while students' questions are present in classroom practice, they do not occupy a stable or salient place in teachers' professional awareness. Given that teachers' autobiographical experiences with mathematics, particularly experiences of failure, influence how they interpret students' errors, uncertainty, and success, it is possible that teachers' professional attention is selectively directed toward aspects of teaching that align with their own experiential patterns (Lutovac & Kaasila, 2022).

The structure of the reported student questions shows that they are most often focused on understanding concepts and procedures or clarifying specific tasks, while questions that indicate deeper conceptual reasoning, generalization, or exploratory curiosity are less frequent. These findings are consistent with research indicating that dialogic and inquiry-oriented classroom cultures do not emerge spontaneously but require deliberate planning and sustained support (Chin, 2007; Vrikki & Evagorou, 2023). Interventions focused solely on increasing interest may be insufficient, as mathematical self-confidence is a key factor in the later development of students' attitudes and achievement (Ganley & Lubienski, 2016).

Particularly indicative are questions in which students problematize the relationship between manual calculation and the use of digital tools. Such questions do not represent resistance to learning mathematics, but rather a demand for its meaningful didactic positioning within a contemporary technological context. Research suggests that these questions can serve as powerful resources for developing metacognition and a more profound understanding when appropriately integrated into classroom interaction (Kinnear et al., 2024; Morris & Chi, 2020).

The relationship between teachers' assessments of students' interest in mathematics and the limited recall of student questions further illuminates these findings. Although more than half of the teachers rate students' interest as good or at least moderate, student questions are rarely remembered as relevant or intellectually challenging. This discrepancy may indicate that student engagement is assessed primarily through visible activity and participation, rather than through the quality of cognitive contributions. Previous research confirms that the quality of students' questions depends largely on the types of questions teachers pose and on the space students are given to think, make mistakes, and engage in dialogue (Chin, 2007; Vrikki & Evagorou, 2023).

Overall, the findings point to stable yet limited patterns in teachers' conceptions of mathematics and in the culture of questioning in mathematics classrooms. Although teachers largely recognize mathematics as a means of developing thinking, this orientation is not equally reflected in the structure of the questions they predominantly ask during teaching. Questions are most often directed toward content and procedural understanding, while reflective, inquiry-based, and metacognitive questions are less common. These findings may also be viewed in light of research showing that teachers often hold highly idealized images of the teaching role, particularly regarding personal characteristics and relationships with students, while operational strategies for empowering students are less frequently concretized in practice (Nissim & Simon, 2019).

An important finding is the absence of differences in teachers' responses across school type, the size of the community in which they teach, gender, or age. This result suggests that the observed patterns are not tied to individual teacher characteristics but may have a systemic character. This interpretation aligns with research indicating that teachers' professional beliefs and practices are deeply embedded in sociocultural and institutional contexts rather than being solely a function of individual traits (Xenofontos, 2018). When teaching practice and questioning culture are viewed as part of teachers' professional and moral identity, the observed patterns do not represent individual shortcomings but rather reflect a broader normative framework in which the teaching role is primarily understood as knowledge transmission rather than as moral and dialogic guidance of students (Jelovac, 2025). Research on relationship formation in school contexts further confirms that institutional systems and pedagogical practices can either enable or constrain the development of productive learning relationships, regardless of teachers' individual intentions (Tobbell & O'Donnell, 2013). Without institutional support, even highly motivated students may develop lower mathematical self-confidence and weaker attitudes toward the subject (Kaur et al., 2022).

From the perspective of implications for practice, the results highlight the need for a stronger integration of topics related to question quality, reflection on student questions, and the development of metacognitive strategies in both initial teacher education and professional development programs for mathematics teachers. In this regard, reflection on one's own experiences of failure in mathematics may represent an important resource, as it contributes to greater sensitivity to students' errors, questions, and affective dimensions of learning, as well as to an understanding of failure as an integral part of the learning process rather than solely as a negative outcome (Lutovac & Kaasila, 2022). Special attention should also be paid to the contemporary context in which students problematize the relationship between manual calculation and digital tools, which requires a thoughtful didactic positioning of technology in mathematics education.

The limitations of this study primarily relate to its reliance on teachers' self-reports and self-assessments, as well as the absence of direct analysis of actual classroom interactions. Future research could combine analyses of teachers' beliefs with classroom observations, lesson transcript

analyses, and students' perspectives in order to provide a more comprehensive understanding of the role of questioning in mathematics learning.

5. Conclusion

This study provides insight into teachers' perspectives on the nature of mathematics, questioning practices, and the role of students' questions in mathematics teaching. The findings indicate that teachers most often conceptualize mathematics as a means of developing thinking and logical reasoning, which is consistent with contemporary educational goals and relevant educational frameworks. However, this general orientation is not reflected to the same extent in everyday classroom practice, particularly in the structure and function of the questions that dominate classroom interaction.

Although most teachers report that they ask questions very frequently during teaching, qualitative analysis shows that these questions are predominantly aimed at checking knowledge and procedural understanding of mathematical content. Questions that foster reflection, argumentation, inquiry, and metacognitive thinking are considerably less frequent. A similar pattern is observed regarding students' questions: while teachers estimate that students ask questions relatively often, only a few recall examples of student questions that remained memorable as particularly interesting or significant. This discrepancy suggests that student questions, although present in classroom practice, do not stand out in teachers' professional perception.

A particularly indicative finding is that nearly half of the teachers assess students' interest in mathematics lessons as good, while examples of more profound, inquiry-oriented, or conceptually demanding student questions are largely absent. This gap suggests that students' motivation may manifest in ways that are not necessarily recognized through questioning, but also that the structure of classroom interaction may not sufficiently encourage students to articulate their curiosity through questions that go beyond the procedural level.

The absence of differences in teachers' responses across socio-demographic characteristics, school type, or community size indicates that the observed patterns do not reflect individual teacher characteristics but rather reflect broader professional and institutional frameworks of mathematics teaching. This finding further emphasizes the need to consider questioning and the culture of dialogue in mathematics classrooms as an important didactic and professional issue, rather than as a matter of individual teaching style. In this sense, improving the quality of teachers' questions and strengthening students' questioning cannot be viewed solely as a didactic concern, but also as part of teachers' broader ethical responsibility. Teachers who foster dialogue, curiosity, and argumentation assume the role of moral exemplars, guiding students toward the development not only of mathematical understanding but also of a responsible and reflective relationship toward knowledge (Jelovac, 2025).

From the perspective of implications for teaching practice, the results point to the need for a more systematic integration of the topic of question quality into both initial teacher education and continuous professional development for mathematics teachers. Particular emphasis should be placed on developing competencies for designing questions that promote deeper understanding, argumentation, and reflection, as well as on deliberately creating classroom spaces in which students' questions are recognized, valued, and productively used. The findings confirm the need to more strongly integrate content that connects personal characteristics, professional values, and concrete teaching strategies into teacher education, in order to develop teacher leadership as a practical rather than merely declarative competence (Nissim & Simon, 2019).

The methodological contribution of this study lies in the combination of quantitative and qualitative analyses, a multi-phase coding procedure, and the controlled use of AI tools as support for checking the consistency of qualitative analysis. Such an approach highlights possibilities to enhance research reliability in mathematics education and opens avenues for future studies that

would include direct classroom observation, analysis of classroom discourse, and inclusion of students' perspectives.

Acknowledgment

The authors gratefully acknowledge the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant Nos. 451-03-137/2025-03/200125, 451-03-136/2025-03/200125 and 451-03-137/2025-03/ 200122)

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