Journal of Computer and Education Research
March 2025 Volume 13 Issue 25
(ISSN:2148-2896)
http://dergipark.org.tr/jcer

Research Article

# An Analysis of Primary School Teacher's Questioning in Mathematics: A Focus on Fractions

Figen BOZKUŞ [1,*] Zeynep ARSLAN [2]

[1] Istanbul Medipol University, İstanbul, Türkiye, figen.bozkus@medipol.edu.tr
[2] Istanbul Medipol University, İstanbul, Türkiye, zeynep.arslan1@medipol.edu.tr
[*] Corresponding Author: figen.bozkus@medipol.edu.tr

**Article Info**

***Received:*** *15 October 2024*
***Accepted:*** *18 February 2025*

**Keywords:** Mathematics instruction, fractions, lesson analysis, primary school teacher, teacher question

**10.18009/jcer.1567459**

**Publication Language:** English

**Abstract**

Examining teachers' questioning approaches in the classroom is critically important for effectively developing students' mathematical thinking. In this context, the purpose of this study was to analyze the types of questions used by a fourth-grade teacher at a public middle school, focusing on the concept of fractions in mathematics instruction. To this end, ten lesson videos capturing the teacher's instruction on fractions were analyzed according to a predetermined questioning framework. The findings indicate that the teacher predominantly used checklists and guiding questions during the lessons, while questions aimed at deepening student thinking, such as those for probing and extending thinking questions, were used less frequently. Additionally, it was found that the teacher mainly focused on procedural questions, using questions that encourage higher-order thinking in a limited manner. It was observed that the types of questions and the approach to questioning varied depending on the content of the lessons.



**To cite this article:** Bozkuş, F. & Arslan, Z. (2025). An analysis of primary school teacher's questioning in mathematics: A focus on fractions. *Journal of Computer and Education Research, 13* (25), 133-155. https://doi.org/10.18009/jcer.1567459

## Introduction

Questioning is a crucial strategy for teachers to engage with students and is one of the fundamental components that shape the learning process. Specifically, questions posed in the classroom help foster the development of students' mathematical thinking, thereby supporting the learning process (Chin, 2007). In an inquiry-focused environment, questioning is considered an effective method for diagnosing students' ideas, initiating productive discussions, and assessing their learning and development (Dunphy, 2010; Heng & Sudarshan, 2013). When students actively participate in discussions where they are encouraged to explore, articulate, and justify their mathematical ideas, they have the opportunity to develop a strong mathematical understanding (Boerst et al., 2011).

Additionally, discussions in which students actively engage support critical thinking skills and contribute to a deeper understanding within the classroom (Caram & Davis, 2005). Indeed, the NCTM (2014) emphasizes critical thinking, reasoning, and the interpretation of mathematical ideas when evaluating student understanding. Similarly, the High School Entrance Exam, implemented in 2018, aims to develop students' competencies in reading comprehension, making interpretations, drawing conclusions, solving encountered problems, and critical thinking (Ministry of National Education [MNE], 2018a). Therefore, it is crucial for teachers to use effective questioning to help students develop these skills.

Teacher questioning behaviors, particularly from the primary level onward, have the potential to shape students' ideas and observations (Boaler & Brodie, 2004). Through the questions they ask, teachers make the learned information meaningful, guide the discussion process, and encourage the development of various perspectives by allowing students to follow their own thoughts (Chin, 2007). Additionally, student responses provide teachers with insights into students' thinking processes and enable them to monitor the development of these thoughts. This process can offer teachers a pathway for asking questions that support students' cognitive development (NCTM, 2000). Thus, teachers have the opportunity to develop questioning skills that more effectively elicit mathematical thinking during instruction (Heng & Sudarshan, 2013). Consequently, examining teachers' questioning approaches in the classroom is of critical importance for fostering the more efficient development of students' mathematical ideas (Shahrill & Clarke, 2014).

*Teachers' Questioning*

Teachers can use various types of questions during instruction for different purposes, such as recall, supporting learning, guiding students, raising awareness, and assessing understanding. In the literature, various categories have been established based on the purposes for which teachers use questions and the types of questions they prefer (Chin, 2007; Cumhur & Güven, 2018; Dong et al., 2015; Franke et al., 2009; Kabar & Taşdan, 2020; Özpınar, 2023; Şahin & Kulm, 2008; Way, 2008). Studies on question types have classified questions into general, specific, probing, and guiding questions (Franke et al., 2009); initial and follow-up questions (Dong et al., 2015); guiding, checklist, and student-specific questions (McCarty et al., 2016); open-ended and closed-ended questions (Yee, 2002); and next-step, guiding, yes-no, probing, and general questions (Kabar & Taşdan, 2020). In addition, teachers' questioning strategies serve various purposes. These include focusing

questions used to increase students' interest in the lesson and capture their attention (Way, 2008); questions that assess students' prior knowledge (White, 2001); guiding questions that provide support in areas where students struggle (Şahin & Kulm, 2008); probing questions that encourage students to explain, justify, and elaborate their ideas (Boaler & Brodie, 2004; Soysal & Soysal, 2022; Şahin & Kulm, 2008) and assessment questions used to evaluate learning (Dong et al., 2015). Some of these questions are noted for their high cognitive demand in terms of supporting student thinking, while others are considered to have lower cognitive demand. These types of questions are used with varying frequency throughout teaching depending on different purposes. However, not all questions equally prompt students to engage in deep thinking. Low-level cognitive questions tend to lead students to provide quick and short responses, whereas high-level cognitive questions require students to engage in deeper thinking and analysis. In particular, probing questions not only encourage students to present their knowledge but also require them to justify it, fostering deep thinking and the development of their conceptual and procedural knowledge. For this reason, these are considered high-level cognitive questions. However, research shows that teachers often prefer to ask lower-level cognitive questions, such as guiding or recall questions, rather than those that probe student understanding (McComas & Abraham, 2004).

Although the studies provide significant insights into teachers' questioning practices, these findings are generally limited to mathematics teachers or preservice teachers. In this context, it appears that research on the types of questions used by primary school teachers in mathematics lessons is quite limited. Questioning in primary mathematics lessons plays a critical role in developing students' mathematical thinking skills, deepening their understanding, and promoting active learning. In this regard, questioning in primary mathematics lessons stands out as an indispensable instructional tool for enhancing students' learning motivation and deepening their mathematical comprehension. Existing research has shown that primary school teachers typically use lower-level questions that are knowledge-based, practice-oriented, or directive in nature during mathematics lessons (Baysen, 2006; Desli & Galanopoulou, 2015). This situation increases the likelihood that students who do not encounter higher-level questions during primary school will struggle with such questions in middle school. Indeed, a study on reading comprehension found that students who struggled to answer higher-level questions in the fourth grade continued to experience similar difficulties in the sixth grade (Özdemir & Kıroğlu, 2019). This finding

highlights the importance of exposing students to higher-level questions, particularly those that probe student understanding and encourage the development of alternative solutions, at an early age. Higher-level questions support students' thinking skills, allowing them to defend their ideas and develop various problem-solving strategies. In this context, identifying the types of questions used by teachers in primary mathematics lessons could inform decisions related to teacher education and offer recommendations for improving the quality of instruction. Additionally, this study focuses on consecutive lessons on the topic of fractions. Examining the questions used by primary school teachers specifically in the context of fractions could provide valuable contributions to the literature.

*The Importance of the Concept of Fractions*

The concept of fractions is one of the fundamental components of mathematics education, playing a critical role both in everyday life and in the teaching of various mathematical concepts (Koç Deniz, 2019). In this context, the importance of fraction knowledge as a foundational element in developing students' mathematical thinking skills is emphasized. Lamon (2007) notes that fractions provide a fundamental structure not only for arithmetic calculations but also for understanding more complex mathematical concepts such as proportion, ratio, percentage, and probability. Given that fraction knowledge is considered a strong predictor of advanced mathematical success (Siegler et al., 2011), acquiring this knowledge at an early age is viewed as a critical step toward relating it to abstract mathematical concepts in later stages (Behr et al., 1983). Additionally, a strong understanding of fractions is necessary for modeling real-life situations, solving mathematical problems effectively, and gaining a deep comprehension of the number system (NCTM, 2000). These findings clearly highlight the importance of students deeply understanding the concept of fractions to enhance their mathematical thinking skills.

Many studies have been conducted with primary and middle school students, teachers, and preservice teachers to deeply examine the understanding of fractions. These studies aim to reveal how students learn the concept of fractions, the difficulties they encounter, and effective teaching strategies (Biber et al., 2013; Karaağaç & Köse, 2005). For example, a study by Biber et al. (2013) identified misconceptions among 5th-grade students in ordering, addition-subtraction, and multiplication of fractions through eight open-ended questions related to fractions. The study also emphasized that modeling strategies in problem-solving yielded effective results in teaching the concept of fractions. Similarly, in a

study conducted by Çakmak Gurel and Okur (2016) aimed at identifying misconceptions related to fractions, it was found that the most common misconception was regarding the part-whole relationship, while misconceptions related to the addition of fractions were less prevalent. In another study by Karaağaç and Köse (2005), misconceptions among 7th-grade students regarding the variability of numerical expressions in a fraction depending on the referenced whole were highlighted. Given the challenges students face, it is crucial for teachers to diversify their instructional strategies. Indeed, effective questioning is one of the strategies that help students develop their thinking and gain a deep understanding of the concept of fractions. In this context, a study by So (2015) explored the impact of questions used during the teaching of fractions in 4th-grade mathematics lessons on students' understanding of the part-whole relationship and their use of comparison models. The teacher asked questions that allowed students to share their own thoughts and encouraged discussion through mutual feedback. It was noted that questions posed at critical moments significantly accelerated the development of students' understanding of fractions. The findings underscore the importance of teacher questions in the development of the concept of fractions. Therefore, the present study aims to provide a detailed examination of the questions used by a primary teacher during the teaching of fractions, considering the importance of the concept of fractions and limitations in teachers' questioning approaches in the literature.

## Method

In this study, the case study design, one of the qualitative research methods, was chosen to analyze the types of questions used by a primary school teacher in mathematics lessons. In this context, the data for the study consists of video recordings of the teacher's lessons.

*Participants*

This study was conducted with Lucy, a primary school teacher at a public school in Türkiye, and her 4th-grade students. Lucy, who is 35 years old, has 10 years of teaching experience. During her undergraduate education, she took courses in pedagogy, assessment, and evaluation, and throughout her career, she has participated in various in-service training programs. However, she mentioned that she has not received any specialized training in teacher questioning and effective questioning skills. The class involved in the study consists

of 26 students, including 14 girls and 12 boys. The school where Lucy works is located in a community with a moderate socio-economic income level, and the student's academic performance is average compared to other schools in the area. Before the research process began, the teacher and students were provided with detailed information about the study's purpose and process, and their voluntary participation was considered.

*Data Collection*

The data for this study were collected through video recordings of 10 hours of mathematics lessons. Each video recorded a single class period (40 minutes), resulting in a total of 400 minutes of recorded instruction. To enable an in-depth analysis of the teachers' questioning approaches, the study focused on a single topic, which was fractions. The video recordings cover consecutive lessons on this topic, and detailed information about the lesson content is presented in Table 1.

**Table 1.** Overview of the content of the lessons

| Observation | The content of the lesson |
|---|---|
| 1st observation | Description subject about whole, half, numerator, denominator, unit fraction concepts, reading, and example solution of fractions |
| 2nd observation | Description subject including showing unit fractions and proper fractions with the help of figures, associating proper fractions with unit fractions, example solution |
| 3rd observation | Explanation and sample solution about showing combined and integer fractions with the help of shapes |
| 4th observation | Explanation and example solution about the representation of unit fraction on the number line |
| 5th observation | Explanation and example solution about the representation of proper fractions on the number line |
| 6th observation | Explanation and sample solution about the representation of composite fractions and integer fractions on the number line; association between composite fraction and integer fraction |
| 7th observation | Description of subject and sample solution about ordering in fractions with equal denominators |
| 8th observation | Description of subject and sample solution about ordering in fractions with the same numerator and different denominators |
| 9th observation | Problem-solving exercises related to fractions |
| 10th observation | Problem-solving exercises related to fractions |

As shown in Table 1, the first two lessons focus on the conceptual explanation of fractions, while the third, fourth, and fifth lessons address the representation of fractions with different models and provide example solutions for these representations. The sixth lesson is centered on the relationships between fractions, and the seventh and eighth lessons

focus on the ordering of fractions. In the final two lessons, the teacher incorporates problem-solving activities related to fractions.

Both the teacher and students were informed in advance that the lessons would be recorded, ensuring that students participated naturally in the class. The video recordings were conducted by the first author of the study, who remained a passive observer throughout the lessons. The researcher did not intervene in the lesson process beyond the video recording and did not interact with students or the teacher.

*Data analysis*

In the study, qualitative content analysis techniques were employed to analyze the data obtained from the lesson videos. Before the data analysis, coding schemes defined by various researchers concerning teachers' questioning were reviewed in the relevant literature (Cumhur, 2016; Dong et al., 2019; Franke et al., 2009; Kabar & Taşdan, 2020; Lim, 2020; McCarty et al., 2016) to construct a framework. In the first phase of the analysis, three researchers simultaneously analyzed a randomly selected lesson video according to the established framework. New codes that emerged were added to the framework, and the final version of the framework was presented (see Appendix 1). The questioning framework was categorized into nine categories: question types used by the teacher, checking of prior knowledge, focusing, procedural-next-step questions, making connections, guiding, probing, extending thinking, assessment, and checklist questions. For each category, the purpose of the relevant question and indicators defining the question were identified. The categories are detailed with examples in Appendix 1. For example, questions in the category of uncovering prior knowledge aim to prompt students to recall their prior knowledge and experiences related to the topic. In this context, the teacher is expected to ask questions to remind students of what they learned in the previous lesson, elicit information, ideas, and experiences related to the topic, and probe the student's knowledge about related topics. Consequently, questions such as *"What was a unit fraction?"* and *"What type of fraction is ¾?"* were categorized under this framework. Each question was thus coded according to its intended purpose and the corresponding indicators.

In the second phase of the analysis, each lesson video was independently coded by researchers according to the developed questioning framework, and the codings were compared. During this process, similarities and differences between the codings were discussed. Some challenges were encountered in determining the appropriate category for

certain questions. For instance, some questions, when assessed within context, were categorized as guiding questions, while when considered in isolation, they were categorized as procedural questions. To address such ambiguities, relevant questions were examined as a whole, including the discussions before and after the question, to more accurately determine the purpose of the question and ensure proper coding. The results were presented in tables showing the frequency (f) and percentage (%) distribution of the types of questions used by the teacher, reflecting the findings.

## Finding

This study examined the types of questions used by a fourth-grade primary school teacher in mathematics lessons at the fourth-grade level. In this section, the types of questions used by the teacher are presented with supporting examples and explanations. Table 2 provides a detailed distribution of the types of questions used by the teacher during the lessons.

Table 2 shows that the teacher asked a total of 560 questions across the ten lessons. Among these questions, the most frequently used were checklist questions, with 155 instances (28%), and guiding questions, with 108 instances (19%). Conversely, the least preferred types of questions were making connection questions, with 10 instances (2%), and focusing questions, with 21 instances (4%). Checklist questions typically require short answers and include questions aimed at ensuring students' understanding, seeking confirmation, or organizing the class, such as *"Does everyone understand?"*, *"Are we ready?"*, *"Did you write it down?"*, and *"It's ¾ right?"*. The teacher used these types of questions intensively and with similar frequency across all lessons.

Journal of Computer and Education Research
March 2025 Volume 13 Issue 25
(ISSN:2148-2896)
http://dergipark.org.tr/jcer

**Table 2.** Distribution of question types used by the teacher across lessons

| Question Types | | L1 | | L2 | | L3 | | L4 | | L5 | | L6 | | L7 | | L8 | | L9 | | L10 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | f | % | f | % | f | % | f | % | f | % | f | % | f | % | f | % | f | % | f | % | f | % |
| Checking of prior knowledge | | 10 | 15 | 15 | 29 | 12 | 17 | 16 | 19 | 7 | 11 | 4 | 8 | 2 | 4 | 3 | 6 | 0 | 0 | 1 | 3 | 70 | 13 |
| Focusing | | 7 | 10 | 0 | 0 | 4 | 6 | 4 | 5 | 1 | 2 | 0 | 0 | 3 | 5 | 1 | 2 | 1 | 3 | 0 | 0 | 21 | 4 |
| Procedural-next step questions | | 10 | 15 | 10 | 19 | 12 | 18 | 18 | 22 | 10 | 16 | 3 | 6 | 10 | 18 | 2 | 4 | 7 | 17 | 3 | 10 | 85 | 15 |
| Making connections | | 0 | 0 | 0 | 0 | 4 | 6 | 3 | 4 | 0 | 0 | 2 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 2 |
| Guiding | | 8 | 12 | 8 | 16 | 10 | 15 | 13 | 16 | 20 | 32 | 23 | 46 | 11 | 19 | 7 | 14 | 6 | 15 | 2 | 6 | 108 | 19 |
| Probing | Elaboration | 1 | 1 | 3 | 6 | 2 | 3 | 4 | 5 | 3 | 5 | 2 | 4 | 1 | 2 | 4 | 8 | 5 | 12 | 5 | 17 | 30 | 5 |
| | Justification | 3 | 4 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 2 | 4 | 3 | 5 | 5 | 10 | 2 | 5 | 4 | 13 | 22 | 4 |
| | Interpretation | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 1 | 3 | 2 | 6 | 8 | 1 |
| Extending thinking | | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 4 | 0 | 0 | 0 | 0 | 4 | 7 | 12 | 24 | 4 | 10 | 2 | 6 | 26 | 5 |
| Assessment | | 5 | 8 | 5 | 10 | 3 | 4 | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 5 | 4 | 8 | 1 | 3 | 0 | 0 | 25 | 4 |
| Checklist questions | | 23 | 34 | 10 | 20 | 21 | 30 | 16 | 19 | 18 | 29 | 13 | 26 | 18 | 31 | 11 | 22 | 13 | 32 | 12 | 39 | 155 | 28 |
| Total | | 68 | 100 | 51 | 100 | 69 | 100 | 82 | 100 | 62 | 100 | 50 | 100 | 57 | 100 | 50 | 100 | 40 | 100 | 31 | 100 | 560 | 100 |

Journal of Computer and Education Research
March 2025 Volume 13 Issue 25
(ISSN:2148-2896)
http://dergipark.org.tr/jcer

Guidance questions, the second most frequently used type, serve two primary purposes: context-focused and student error-focused questions. In context-focused questions, the teacher aims to provide small parts to help students better understand a context or problem. In error-focused questions, the teacher asks questions to help students notice their mistakes and reconsider their answers, thereby encouraging them to think again. It can be stated that such questions were present in all lessons. In this context, an example of a dialogue between the teacher and students is provided below;

*Teacher:* Write the fraction in your notebook once. Draw the number line. After drawing the number line, the first step is to identify the zero point, the starting point. Then identify one and then two. Now look at the denominator of the fraction. What is the denominator here? ***(Guiding Question – Question focused)***

*Eric:* Two.

*Teacher:* What do we do when the denominator is two? Eric***? (Guiding Question – Question focused)***

*Eric:* We divide it by two.

*Teacher:* What are we dividing by two? ***(Probing - Elaboration)***

*Eric:* The denominator, that is, three.

*Teacher:* Three? Think again. What are we dividing by two? ***(Guiding - Error focused)***

*Eric:* The space between zero and one.

*Teacher:* We are dividing the space between zero and one, or the space between one and two, which we consider as the whole, into two parts. I've divided it. One, two. How many pieces do I need? (***Guiding Question – Question focused***)

*Eric:* The third piece...

Examining the dialogue above, it is evident that the teacher asks guiding questions to students regarding the representation of a specific fraction on the number line. Questions such as "*What is the denominator here?"* and "*What do we do when the denominator is two?"* are designed to focus the students' attention on particular aspects and encourage them to think critically about the topic. The question "*Think again. What are we dividing by two?"* asked in response to an incorrect answer provides the student with an opportunity to reassess their response. This approach reveals that the teacher adopts a supportive role in the students' thinking processes, rather than directly providing answers or re-explaining the topic.

Reviewing Table 2, it is observed that the teacher utilized procedural questions 85 times (15%), checking prior knowledge 70 times (13%), and probing questioning 60 times (10%), indicating similar frequencies for these types of questions. Procedural questions are typically aimed at determining the next step in a given context and require a single correct answer or a brief response. For example, the teacher used questions such as *"How many milliliters of milk are left?", "What was the number of passengers?", "What did we find for the denominator?"*, and *"What is the result of dividing 24 by 3?"* to elicit responses that require only calculations from the students. The frequency of these questions indicates that the teacher employed them more intensively during the first six lessons, with a notable decrease in subsequent lessons. Questions to check prior knowledge are designed to elicit students' existing knowledge and experiences related to the topic. Consequently, these questions are generally used at the beginning of the lesson and involve recalling information. In this context, a dialogue from the second lesson between the teacher and students is presented:

*Teacher:* What were the names of the above and below numbers? Let's recall, what was the name of the top number? ***(Checking of prior knowledge)***

*Daniel:* Numerator

*Teacher:* Very good. As your classmates say them, you remember. What about the below number? ***(Checking of prior knowledge)***

*Micheal:* Denominator

*Teacher:* Yes, the number below or above the fraction bar is the denominator. The above number is the numerator, and the line in the middle is called the fraction line. Emily, what does the below number show us? ***(Checking of prior knowledge)***

*Emily:* Denominator

*Teacher:* Yes, it's the denominator, but why is the below number two? Why did we write two***?*** ***(Probing - Justification)***

*Emily:* We will divide two things into two parts.

*Teacher:* So? What does that mean? ***(Probing - Elaboration)***

*Emily:* We divided two things.

*Teacher:* Is it the opposite, perhaps? Think carefully. I have two things. ***(Guiding - Error focused)***

*Emily*: We divided one part into two.

*Teacher:* Exactly. We divided the whole into two parts, which is why we wrote 2.

In the dialogue above, it is evident that the students have previously learned the concepts of numerator and denominator. The teacher asks questions aimed at eliciting the

students' existing prior knowledge about numerator and denominator. These questions are at a reminder level, helping students focus on the lesson and establishing the starting point of the lesson for the teacher. Throughout the lessons, it was observed that such questions were used more intensively by the teacher in the first five lessons, with a decrease in frequency in the subsequent lessons.

It was found that 10% of the questions used by the teacher were probing questions. Probing questions are categorized into three subtypes: elaboration, justification, and interpretation. Elaboration questions help students articulate their responses in more detail and clarity, thereby aiding in revealing their thinking processes. In this context, it was determined that the teacher asked a total of 30 (5%) elaboration questions. For example, in the dialogue above, the student's statement *"We will divide two things into two parts"* indicates that the student considered the denominator to be 2 and thought about dividing it into two parts. However, when the teacher asked for clarification, the student's response *"We divided two things"* revealed a misunderstanding or misinterpretation of the context. Thus, by asking the question again, the teacher prompted the student to re-evaluate and arrive at the correct understanding. This example highlights that students' responses may not always fully reflect their thinking, necessitating further elaboration and clarification. Justification questions require students to provide evidence supporting their answers. It was determined that the teacher asked a total of 22 (4%) justification questions across all lessons. As observed in the dialogue above, questions such as *"Why is the bottom number two?"*, *"Why did we write two?"*, and *"Why are we dividing?"* prompt students to provide evidence for their thoughts. Such questions assist students in explaining their reasoning and reaching correct conclusions. However, the limited number of justification questions and the sole use of *"why"* questions, although constraining effective probing, can be said to support encouraging students to think beyond basic information levels. Another type of question in the elaboration category aims to elicit students' interpretations. The teacher used a total of 8 (1%) interpretation questions, indicating that this was the least employed type of question. Interpretation questions require students to explain outcomes with their own reasoning. In this context, questions *like "What does our result tell us?"*, *"What does it mean to be whole?"*, and *"What does the 1800 milliliters represent here?"* demonstrate that the teacher aimed to have students interpret the situations. Overall, it can be said that while the teacher employed probing questions in every lesson, their quantity was relatively limited.

On the other hand, it was observed that the teacher used 26 (5%) *extending thinking questions*, 25 (4%) *assessment questions,* and 21 (4%) *focusing questions.* Extending thinking questions are intended to guide students to use different representations, question how specific rules apply in various contexts, and reach generalizations. For instance, in the fourth lesson, the teacher asked students to represent a given fraction both on a shape and on a number line and to compare these representations. This approach helped students recognize that fractions have numerical values on the number line and develop their understanding of the magnitude of fractions. Another example can be given from the eighth lesson, where after ordering proper fractions, students were asked to order mixed fractions, thereby encouraging them to think about ordering fractions. During this activity, the teacher attempted to deepen students' responses with questions such as, *"Why did you consider this fraction larger?", "What did you take into account when ordering?"*, and *"How did you arrive at this result?"* In this context, although the teacher asked effective questions, their use was relatively limited in terms of frequency and was not consistently applied across all lessons. It was noted that the teacher did not use this type of question in four of the lessons. This finding indicates that the teacher's use of extending thinking questions was relatively weak.

It was observed that the teacher effectively used assessment questions to review students' learning processes. The teacher employed such questions a total of 25 times across all lessons. These questions typically involved summarizing information at the end of lessons or facilitating peer assessments among students. For example, at the end of the second lesson, where unit fractions and proper fractions were covered, the teacher provided students with a worksheet containing various shapes and fractions. Students were asked to shade the portions of the shapes corresponding to the given fractions. The dialogue between the teacher and students proceeded as follows:

*Teacher:* Look at the fractions and shade them on the shape. Exchange your paper with your partner. Everyone should check their partner's paper. Did your partner do it correctly? ***(Assessment )***

*Teacher:* (Takes a student's paper and shows it to the class) Did your partner shade it correctly? ***(Assessment)***

*Class:* Yes.

*Teacher:* Now, which types of fractions do these shaded fractions belong to? What kind of fraction are they? ***(Assessment)***

*Caroline:* Unit fraction.

*Teacher:* A unit fraction? Think again. ***(Probing -Error focused)***

*Caroline:* Proper fraction.

In the dialogue above, it is evident that the teacher provided students with the opportunity to review their own learning by evaluating each other's work. The teacher monitored the students' shading activities while circulating around the class and gathered information about their learning levels. Additionally, it was found that the teacher primarily used assessment questions at the end of the lessons and did not incorporate such questions adequately throughout teaching. Considering that student learning should be monitored throughout the lesson, it can be concluded that the teacher was insufficient in distributing these questions throughout the entire lesson.

Another type of question used by the teacher is *focusing questions*, which aim to direct students' attention to a specific topic and encourage them to think about the context. Throughout the observed lessons, it was noted that the teacher posed a total of 21 focus questions across seven different classes, accounting for 4% of all questions asked. An examination of the teacher's questions reveals that these inquiries also served to establish a starting point for the lesson. For example, the teacher asked, *"In this lesson, we will sort fractions. Can you give me an example of a proper fraction?"* and *"In the diagram, we are dividing our whole into 4 equal parts. What else does this represent? (pointing to one part)?"* These questions are designed to help students focus on a specific context. By breaking the content into smaller parts, the teacher aims to build the lesson's content more effectively. Moreover, the teacher's use of focus questions at various stages of the lesson, particularly when transitioning to a new context, demonstrates an intention to revisit topics as a natural part of the lesson flow. This approach encourages students to connect their existing knowledge with new concepts.

Among all the types of questions used throughout the lessons, the least utilized type by the teacher was questions *making connections* between different contexts. The teacher used this type of question only in four lessons, a total of 10(2%) instances. These questions require the explanation of relationships between mathematical concepts and the identification of similarities or differences between concepts. For instance, the teacher directed students to make connections between concepts with questions such as, *"How can we express this fraction (a proper fraction) using unit fractions?" "Can you express this fraction as a mixed number?"* and *"What is the common feature of a proper fraction and a mixed number?"* Questions requiring

connections between contexts are intended to develop students' relational thinking skills and help them construct a more robust mental framework of concepts. However, the fact that the teacher used this type of question in only four lessons indicates a weakness in employing this question type and a general underutilization in the lessons.

## Discussion and Conclusion

In this study, the types of questions used by a fourth-grade teacher during mathematics lessons were examined. The primary findings indicate that the teacher predominantly employed checklist and guiding questions, while questions aimed at deepening student thinking, such as probing and extending questions, were used less frequently. The use of other question types by the teacher was identified in the following order: procedural-next step questions, checking of prior knowledge, assessment questions, focusing questions, and making connections questions. Overall, it can be concluded that the teacher's preferred questions were generally those requiring validation or a single correct answer. This situation, as observed in other studies (Kabar & Taşdan, 2020; Şahin & Kulm, 2004), suggests a limited use of questions that encourage higher-order thinking among students.

A detailed examination of the types of questions used by the teacher reveals a pronounced preference for checklist questions. These questions are typically employed to obtain confirmation from students or to organize the class and are consistently used with similar frequency across all lessons. Similar studies in the literature (Kabar & Taşdan, 2020; Şahin & Kulm, 2004) have also found that teachers frequently use checklist questions that require confirmation. However, these types of questions are often characterized as low-cognitive questions because they typically require short answers and are inadequate in supporting student thinking. Another frequently used question type by the teacher is guiding questions. These questions are defined as those used to facilitate students' understanding of the question or to help them recognize their errors, thereby guiding them toward finding the correct solutions. Understanding the question is a critical step for students to reach a correct solution, and similarly, recognizing their own mistakes is crucial for restructuring their current ideas with accurate information. Student errors can be valuable learning opportunities, as they provide important insights into where students may need support in understanding mathematical concepts and in which areas they struggle (Bray, 2011). Reaching this information effectively requires skillful questioning by teachers

and ensuring that students elaborate on their responses. Guiding questions, in this sense, can be considered as questions that help students structure their own knowledge. However, findings from the current study and other research suggest that teachers are not sufficiently effective in using these questions during the instructional process and tend to directly provide the information to students themselves (Bozkurt & Polat, 2018; Cumhur & Güven, 2018; Kabar & Taşdan, 2020; Şahin & Kulm, 2004).

Procedural-next step questions, which aim to prompt students to determine the next step within a specific mathematical context, are frequently used by the teacher during lessons. These questions typically require brief, one-sentence answers and serve to advance the progression of mathematical operations, thus not encouraging deep thinking among students. Studies have indicated that procedural questions are commonly employed by teachers during lessons but fall short in fostering students' higher-order thinking skills (Ellis, 1993; Kabar & Taşdan, 2020). While such questions can play a valuable role in supporting students' procedural and conceptual knowledge, the development of students' thinking necessitates exposure to questions that demand higher cognitive levels. Therefore, the combined use of various types of questions is critical for deepening students' thinking (Cengiz et al., 2011). On the other hand, questions aimed at assessing prior knowledge are designed to uncover students' existing knowledge and experiences related to the topic. It was observed that the teacher frequently used these questions at the beginning of lessons, but their usage declined as the lessons progressed. In the initial lessons, the teacher's priority was likely to ensure that students understood the topic, especially considering that students might have some prior knowledge and experience with fractions from previous years. Ellis (1993) noted that such questions are often used to facilitate the quick progression of the lesson and to maintain classroom control. In this context, it can be inferred that the teacher was particularly attentive to classroom management in the early lessons where they primarily delivered the information themselves. Additionally, given that these types of questions play an important role in helping students connect their existing knowledge with new topics, the teacher's frequent use of them can be regarded as a positive approach.

Probing questions, which consist of subcomponents such as elaboration, justification, and interpretation, aim to prompt students to explain their responses more deeply, provide justifications supported by evidence, and interpret the findings. These types of questions are crucial for developing students' higher-order thinking skills. Through probing questions,

students are encouraged to articulate their ideas and examine mathematical concepts in detail, which positively contributes to their learning (Bozkurt & Polat, 2018). However, the findings of this study reveal that the teacher used elaboration questions very sparingly in lessons and, in some cases, did not incorporate justification and interpretation questions at all. When justification questions were posed by the teacher, they were typically limited to phrases like "why" and “how”. Kreide et al. (2015) also emphasized that although teachers frequently use "why" and "how" questions, these questions often fail to deepen students’ thinking or provide sufficient opportunities for justification. Studies in the related literature have similarly found that teachers use probing questions far less frequently compared to other types of questions (Cayton, 2017; Van de Kieboom et al., 2014). Likewise, it was observed that thinking extension questions, which support higher-order thinking, were not used at all in half of the lessons analyzed and were employed very sparingly in the remaining lessons. Cayton (2017) highlighted that teachers often focus on procedural and factual questions, thereby limiting opportunities for students to articulate and elaborate on their ideas. Van de Kieboom et al. (2014) related this situation to teachers’ content knowledge, noting that preservice teachers who used more probing questions demonstrated a higher level of algebraic knowledge. These findings suggest that a teacher’s content knowledge, ability to understand student thinking, and flexibility in pedagogical approaches significantly shape their inquiry skills (Boaler & Brodie, 2004; Cumhur et al., 2015). In the present study, the teacher’s limited use of a probing approach to deepen and develop students’ thinking may indicate that these deficiencies are linked to content knowledge and pedagogical understanding.

Another type of question, assessment questions, is used to evaluate students’ understanding of concepts through summarizing questions and by allowing students to evaluate each others’ work. When examining the frequency and timing of the teacher’s use of these questions, it was found that they were predominantly employed at the end of the lesson. However, the assessment should span the entire lesson to effectively monitor student learning and take appropriate actions. Continuous assessment and feedback are critical for supporting student learning (Black & William, 1998). While end of lesson evaluations are important, they are insufficient on their own. Therefore, the teacher’s limited use of assessment questions and failure to integrate them throughout the instruction may negatively impact student learning. Similarly, it was found that the teacher used focus

questions and connection-making questions only sparingly. Focus questions are intended to direct students' attention to a specific topic and encourage them to consider a particular situation. Making connections questions, on the other hand, aim to establish relationships between mathematical concepts and ideas. Both types of questions support higher-order thinking by encouraging students to move beyond merely recalling basic information (Şahin & Kulm, 2008). Mason and Johnston Wilder (2004) emphasized that such questions help deepen mathematical thinking and strengthen connections between concepts. However, the limited use of these questions in the classroom, and their near absence in many lessons, can result in restricted student learning. Particularly when teachers fail to incorporate these types of questions into their classroom practices, opportunities for students to engage in deep thinking and to make connections between concepts are missed (Black & Wiliam, 1998).

One significant finding of the study is that the teacher's frequency of questioning increased during the third and fourth lessons and then decreased again, with variations depending on the type of questions used. For instance, the frequency of probing questions, initially low in the early lessons, showed an increase in subsequent lessons. While the focus in the initial lessons was on introducing fundamental concepts such as proper fractions, unit fractions, compound fractions, and mixed numbers, and their representation in shapes and on the number line, later lessons concentrated on the representation and ordering of compound fractions and mixed numbers on the number line. Similarly, it was observed that questions aimed at expanding thinking were used more intensively in the later lessons. This pattern may be associated with the teacher's greater focus on content delivery in the initial lessons. As the lessons progressed, addressing different representations of the fraction concept may have provided opportunities for deeper student thinking and encouraged more inquiry. This situation demonstrates that the types of questions and inquiry approaches used by the teacher can vary depending on the content of the lesson. The relevant literature also emphasizes that teachers' questioning strategies and inquiry approaches change according to the lesson content. Smith and Johnson (2010) noted in their research that teachers adopt various types of questions and strategies tailored to the lesson content to enhance students' thinking skills. Similarly, Hattie and Timperley (2007) found that teachers enrich students' learning experiences and deepen their understanding by varying question types and inquiry approaches based on the lesson content.

## Limitation and Recommendation

This study examined the types of questions used by a fourth-grade teacher in mathematics lessons focusing on the concept of fractions. The findings indicate that the teacher predominantly asked questions focusing on simple and procedural knowledge and used questions that encouraged higher-order thinking in a limited manner. Furthermore, it was observed that the types of questions and the inquiry approach used by the teacher varied according to the content of the lesson. However, as these findings are limited to a single teacher and their students, further research involving multiple teachers and different topics could enhance the generalizability of the study. Additionally, exploring how the teacher perceives the concept of questioning and how this perception shapes their questioning approaches could be suggested as another area of research. Studies in the literature and the current research demonstrate that teacher knowledge plays a decisive role in shaping the teacher's questioning approach. Therefore, it is recommended that studies be conducted to examine teachers' subject knowledge, pedagogical skills, and understanding of student thinking in relation to their questioning approaches.

For effective mathematics education, teachers need to use inquiry methods to assess students' knowledge levels and needs and provide learning opportunities that promote mathematical thinking (NCTM, 2000). The primary school mathematics curriculum (MNE, 2018b) suggests that beyond procedural and knowledge-focused teaching, concepts should be constructed through discussions and that procedural and conceptual knowledge should be presented in a balanced manner. In this context, the questioning competence of primary teachers is critically important. To support this, professional development training could be provided, introducing teachers to various types of questions and demonstrating their effects in the classroom through example lesson videos. Following such training, monitoring and evaluating the teachers' classroom practices could further support their professional development.

*Ethical Committee Permission Information*

*Name of the board that carries out ethical assessment: İstanbul Medipol University Social and Humanities Scientific Research and Publication Ethics Board*

*The date and number of the ethical assessment decision: 01.10.2024 -79171*

*Author Contribution Statement*

***Figen BOZKUŞ:*** *Conceptualization, methodology, formal analysis, investigation, resources, writing - original draft, writing - review & editing.*

***Zeynep ARSLAN:*** *Conceptualization, methodology, formal analysis, data curation, writing - original draft, writing - review & editing.*

## References


Baysen, E. (2006). The levels of teacher questions and student answers. *Kastamonu Education Journal, 14*(1), 21-28.

Behr, M. J., Lesh, R., Post, T., & Silver, E. A. (1983). Rational number concepts. *Acquisition of mathematics concepts and processes, 91*, 126

Biber, A., Tuna, A. & Aktaş, O. (2013). Students' misconceptions of fractions and its effect on solving fractions problems. *Trakya University Journal of Education 3*(2), 152-162. https://dergipark.org.tr/tr/pub/trkefd/issue/21474/230175

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7-74. 02 http://dx.doi.org/10.1080/0969595980050102

Bray, W. S. (2011). A collective case study of the influence of teachers' beliefs and knowledge on error-handling practices during class discussion of mathematics. *Journal for Research in Mathematics Education, 42*(1), 2–38.

Boaler, J., & Brodie, K. (2004). The importance, nature and impact of teacher questions. In D. E. McDougall, & J. A. Ross (Eds.), *Proceedings of the 26th Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 774–782).

Boerst, T., Sleep, L., Ball, D., & Bass, H. (2011). Preparing teachers to lead mathematics discussions. *Teachers College Record, 113*(12), 2844-2877.

Bozkurt, A., & Polat, S. (2018). An examination of teacher's questions for revealing students' mathematical thinking. *Turkish Journal of Computer and Mathematics Education (TURCOMAT) 9*(1), 72-96.

Caram, C.A. & Davis, P.B. (2005). Inviting student engagement with questioning. *Kappa Delta Pi Record, 42* (1), 19-23. https://doi.org/10.1080/00228958.2005.10532080

Cayton, C., Hollebrands, K., Okumus, S., & Boehm, E. (2017). Pivotal teaching moments in technology-intensive secondary geometry classrooms. *Journal of Mathematics Teacher Education, 20*(1), 75–100. https://doi.org/10.1007/s10857-015-9314-y

Cengiz, N., Kline, K., & Grant, T. J. (2011). Extending students' mathematical thinking during whole-group discussions. *Journal of Mathematics Teacher Education, 14,* 355–374. https://doi.org/10.1007/s10857-011-9179-7

Chin, C. (2007). Teacher questioning in science classrooms: Approaches that stimulate productive thinking. *Journal of Research in Science Teaching, 44*(6), 815-843. https://doi.org/10.1002/tea.20171

Cumhur, F. & Güven, B. (2018). Investigating of pre-service mathematics teachers' questioning: The reflections from teaching practice course. *Journal of Computer and Education Research, 6* (12), 195-221. https://doi.org/10.18009/jcer.432559

Cumhur, F., Şahin, A., & Matteson, S. S. (2015). Questioning skills of mathematics and science teacher candidates and the ways acquiring these skills. *Proceedings of the III. International Symposium on Instructional Technology and Teacher Education*, 98-107.

Çakmak Gürel, Z., Okur, M. (2016). 6th and 7th grade secondary school students' misconceptions about fractions. *Erzincan University Journal of Education Faculty 18*(2), 922-952. https://doi.org/10.17556/jef.30116

Dong, L., Clarke, D., Cao, Y., Wang, L., & Seah, W. T. (2018). Teacher questioning practices over a sequence of consecutive lessons: A case study of two mathematics teachers. *Sustainability, 11*(1), 139. https://doi.org/10.3390/su11010139

Dong, L., Seah, W. T., & Clarke, D. (2015). A case study of the pedagogical tensions in teacher's questioning practices when implementing reform-based mathematics curriculum in China. *Mathematics Education Research Group of Australasia.*

Dunphy, E. (2010). Exploring young children's (mathematical) thinking: Preservice teachers reflect on the use of the one-to-one interview. *International Journal of Early Years Education, 18*(4), 331-347. https://doi.org/10.1080/09669760.2010.528830

Ellis, K. (1993). Teacher questioning behavior and student learning: What research says to teachers. Retrieved from ERIC database. (ED 359572).

Franke, M. L., Webb, N. M., Chan, A. G., Ing, M., Freund, D., & Battey, D. (2009). Teacher questioning to elicit students' mathematical thinking in elementary school classrooms. *Journal of Teacher Education, 60*(4), 380-392.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112. https://doi.org/10.3102/003465430298487

Heng, M. A., & Sudarshan, A. (2013). "Bigger number means you plus!"—Teachers learning to use clinical interviews to understand students' mathematical thinking. *Educational Studies in Mathematics, 83*, 471-485. https://doi.org/10.1007/s10649-012-9418-6

Kabar, M. G. D., & Tasdan, B. T. (2020). Examining the change of pre-service middle school mathematics teachers' questioning approaches through clinical interviews. *Mathematics Teacher Education and Development, 22*(1), 115-138.

Karaağaç, M.K., Köse, L. (2015). Examination of pre-service and in-service teachers' knowledge of students' misconceptions on the topic of fractions. *Sakarya University Journal of Education Faculty* (30), 72-92.

Kreide, A., Turner, C. E., & Tomlinson, A. (2015). Pre-service teachers' development of questioning skills through common core aligned exemplar videotaped math lessons. *Proceedings of the Hawaii University International Conferences: S.T.E.A.M. & Education,* Honolulu, HI, United States, June 13-15, 2015.

Koç Deniz, H. (2019). *The effect of game and activity supported flipped classroom model on students` achievement in problem solving skill and reflective thinking skill based on problem solving in mathematics course.* (Publication no: 606454) [Doctoral Thesis, Fırat University]

Lamon, S. (2007). Rational numbers and proportional reasoning: Toward a theoretical framework for research. FK Lester (Ecl.), *Second handbook of research on mathematics teaching and learning A project oft/we national council of teachers of mathematics*, 629-667.

Lim, W., Lee, J. E., Tyson, K., Kim, H. J., & Kim, J. (2020). An integral part of facilitating mathematical discussions: Follow-up questioning. *International Journal of Science and Mathematics Education, 18,* 377-398. https://doi.org/10.1007/s10763-019-09966-3

Mason, J., & Johnston-Wilder, S. (2004). Developing thinking in geometry. *Teaching Mathematics and Its Applications, 23*(2), 66-76.

McCarthy, P., Sithole, A., McCarthy, P., Cho, J., & Gyan, E. (2016). Teacher questioning strategies in mathematical classroom discourse: A case study of two grade eight teachers in Tennessee, USA. *Journal of Education and Practice, 7*(21), 80–89.

McComas, W. F., & Abraham, L. (2004). Asking more effective questions. *Rossier School of Education*, 1-16.

Ministry of National Education (2018a). *Performance of students placed by central examination in the transition system to high schools [Educational analysis and evaluation reports series, no. 3].* Ministry of National Education.

Ministry of National Education (2018b). *Mathematics course curriculum (primary and secondary school grades 1, 2, 3, 4, 5, 6, 7, and 8).* Ministry of National Education Publications.

National Council of Teacher of Mathematics [NCTM]. (2000). Principles and standards for school mathematics. The Council.

National Council of Teachers of Mathematics. (2014). Principles to actions: Ensuring mathematics success for all. National Council of Teachers of Mathematics.

Özdemir, Y., & Kıroğlu, K. (2019). A spatial perspective on the development of reading comprehension skills. *Amasya University Journal of Faculty of Education, 8*(1), 85-124.

Özpınar, İ. (2023). Secondary school students' attitudes and teacher-student views on questioning in mathematics course. *International e-Journal of Educational Studies,* 7 (14), 359-380. https://doi.org/10.31458/iejes.1238226

Shahrill, M., & Clarke, D. J. (2014). Brunei teachers' perspectives on questioning: Investigating the opportunities to "Talk" in mathematics lessons. *International Education Studies, 7*(7), 1-18. http://dx.doi.org/10.5539/ies.v7n7p1

Siegler, R. S., Thompson, C. A., & Schneider, M. (2011). An integrated theory of whole number and fractions development. *Cognitive Psychology, 62*(4), 273-296.

Smith, M. S., & Johnson, A. (2010). Teacher questioning techniques and their impact on student learning. *Journal of Educational Psychology, 102*(3), 789-802.

So, J. (2015). *The impact of the teacher's questions on the learning of part-whole relations and a benchmark model in fractions* (Doctoral dissertation)

Soysal, Y., & Soysal, S. (2022). Exploring prospective classroom teacher question types for productive classroom dialogue. *ECNU Review of Education, 0*(0).

Şahin, A., & Kulm, G. (2008). Sixth grade mathematics teachers' intentions and use of probing, guiding, and factual questions. *Journal of Mathematics Teacher Education, 11*(3), 221-241. https://doi.org/10.1007/s10857-008-9071-2

Van den Kieboom, L.A., Magiera, M.T. & Moyer, J.C. (2014). Exploring the relationship between K-8 prospective teachers' algebraic thinking proficiency and the questions they pose during diagnostic algebraic thinking interviews. *J Math Teacher Educ*, 17, 429–461. https://doi.org/10.1007/s10857-013-9264-1

Way, J. (2008). Using questioning to stimulate mathematical thinking. *Australian Primary Mathematics Classroom, 13*(3), 22-27.

White, P. B. (2001). *Conceptual questioning in the mathematics classroom.* Master of Education, BEd, Universite de Moncton.

Yee, F. P. (2002). *Using short open-ended mathematics questions to promote thinking and understanding.* In Proceedings of the 4th International Conference on The Humanistic Renaissance in Mathematics Education, Palermo, Italy (pp. 135-140).

## Appendix-1: Questioning Framework

| Question type | Objectives | | Indicators | Examples |
|---|---|---|---|---|
| Checking of prior knowledge | It aims to reveal students' prior knowledge and experience on the current topic. | ✓ | Recalling information learned in the previous (lesson) | What was a unit fraction? |
| | | ✓ | Eliciting knowledge, thoughts, and experiences on the topic | What kind of fraction was ¾? |
| | | ✓ | Query student's knowledge between previous knowledge linked to the new topic | Can we show this fraction on a number line? |
| Focusing | It aims to draw students' attention to the topic and encourage them to think deeply about a particular situation. | ✓ | Create a starting point for the topic to be learned and build the content | What do you understand when I say whole? |
| | | ✓ | Drawing thought to a more specific situation | Where is this fraction close to on the number line? |
| Procedural-next step questions | In a given context, it aims to obtain a mathematical answer for the next step. | ✓<br>✓<br>✓ | Questions requiring a one-sentence answer.<br>Questions with one correct answer<br>Questions for further processing | What did you find as the result<br>How many parts will we divide the whole? |
| Making connections | It aims to help students make connections between mathematical concepts and ideas. | ✓ | Explaining the relationship between concepts | How do you express a proper fraction with a unit fraction? |
| | | ✓ | Identify similarities between mathematical concepts | What do a compound fraction and an integer fraction have in common? |
| | | ✓ | Identify the differences between mathematical concepts | How is a proper fraction different from a compound fraction? |
| Guiding | Aims to facilitate comprehension of the question and appropriate response (Question-oriented | ✓<br>✓ | Helping to better understand the problem<br>Giving tips | What is the question asking of us?<br>What do you think about the denominator? |
| | Aims to help the learner realize his/her mistake (learner error-oriented). | ✓ | Encouraging students to review and rethink their answers | Four out of seven? Can you reconsider the answer? |
| Probing | Elaboration | ✓ | Enabling the learner to elaborate on their answer (long answer) | Can you tell me in detail how you did it? |
| | | ✓ | Enabling the student to express a closed answer in more detail (short answer) | What do you mean, five shapes? Can you show me? |
| | | ✓ | Revealing the learner's way of thinking | How did you know you divided them into equal parts? |
| | Justification | ✓ | Ask the student to justify their answer | Why split it into two? |
| | | ✓ | Asking the student to provide evidence to support his/her opinion | Which one makes more sense? Why is that? |
| | Interpretation | ✓ | Student's interpretation of the findings obtained | What does it mean that there are no pieces left on the paper you cut? |
| | | ✓ | Explaining the result with the student's own thoughts | What does it mean it's whole? |
| Extending thinking Assessment | It aims to expand students' thinking by directing them to different ways of thinking. | ✓ | Directing the student to use different representations | Can you show the fraction ¾ with a figure? |
| | | ✓ | Expanding the correct answers by making the student think about different situations | What would it look like if it was .....? |
| | | ✓ | Directing students to different ways of thinking | Any other ideas? |
| Extending thinking Assessment | It aims to determine whether students understand the subject matter. | ✓ | Asking summarizing questions about the related concept | How would you define a unit fraction? |
| | | ✓ | Opportunity for students to evaluate each other | What do you think about your friend's solution? |
| Checklist questions | It aims to get feedback from students or to maintain order in the classroom. | ✓ | Questions requiring a confirmation response | Everybody got it? |
| | | ✓ | Yes/no questions | Are we ready? Have we seen it? |
| | | ✓ | Questions for organizing the class | Who doesn't have a ruler? |
| | | ✓ | Reviewing students' solutions and getting confirmation from students that they understand the solution | Are you saying that this fraction is smaller? Are you asking if we should have drawn it with a figure? |
| | | ✓ | Repeating students' answers (questions, etc.) to make sure they understand correctly | |