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Araştırma Makalesi **Research Article**

Öğretmen Adaylarının Öğretmenlik Uygulaması Dersi Kapsamında Kullandığı Soru Türlerine İlişkin bir Durum Çalışması[1]

A Case Study on Pre-service Teachers' Question Types within the Context of Teaching Practice Course

Büşra Çaylan Ergene[2], Mine Işıksal Bostan[3]

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Anahtar Kelimeler
Soru sorma
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Öğretmenlik uygulaması
Öğretmen adayı

Özet

Bu çalışmanın amacı öğretmen adaylarının öğretmenlik uygulaması dersi kapsamında kullandığı soru türlerini ve bu soru türlerinin nasıl değiştiğini incelemektir. Nitel araştırma yöntemi ile yürütülen bu çalışmanın deseni çoklu durum çalışması olarak belirlenmiştir. Araştırmanın katılımcıları, Türkiye'deki bir devlet üniversitesinde ilköğretim matematik öğretmenliği programına kayıtlı olan, çalışma sırasında Öğretmenlik Uygulaması II dersini alan ve Emel ve Naz olarak isimlendirilen iki öğretmen adayıdır. Araştırmanın verileri derslerin ses kayıtları, yarı yapılandırılmış görüşmeler, Emel ve Naz tarafından hazırlanan ders planları ve araştırmacı gözlem notları aracılığı ile toplanmıştır. Öğretmenlik uygulaması dersi kapsamında öğretmen adaylarının üç ders boyunca sordukları sorular Sahin ve Kulm (2008) tarafından önerilen soru türlerine göre analiz edilmiştir. Çalışmanın bulguları olgusal, yönlendirici ve sorgulayıcı sorulara ek olarak, öğretici sorular, evet/hayır soruları ve genel soruların da öğretmen adayları tarafından kullanıldığını göstermiştir. Ayrıca öğretmen adayları tarafından kullanılan çeşitli soru türlerinde farklılıklar olduğu ve en dikkat çekici farkın da sorgulayıcı sorularda olduğu görülmüştür.

Key Words
Questioning
Question types
Teaching practice
Pre-service teacher

Abstract

The purpose of the present study is to investigate pre-service teachers' question types used during teaching practice course and how the question types have changed during the course. In the study, qualitative method was adopted, and the research design was a multiple case study. The participants of the study are two pre-service teachers Emel and Naz who were taking Teaching Practice II course in elementary mathematics teacher education program in one of the state universities in Turkey. Data were collected through audio records of the lessons, semi-structured interviews, lesson plans prepared by Emel and Naz and observation notes. Questions they asked in three lessons during their teaching practice were analysed according to the question types of Sahin and Kulm (2008) framework. The findings indicated that in addition to factual, guiding and probing questions; self-answered, yes/no and general questions emerged from the data. Furthermore, there were differences in the variety of question types used by the pre-service teachers and the most remarkable difference was in probing questions.

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[2] Sakarya University, bcaylan@sakarya.edu.tr, ORCID: 0000-0002-5567-6791
[3] Middle East Technical University, misiksal@metu.edu.tr, ORCID: 0000-0001-7619-1390

Questioning is a fundamental practice in teaching process (Moyer & Milewicz, 2002), and asking proper questions is viewed as one of the most significant skills that teachers should have (Harrop & Swinson, 2003). Questioning can be used as a teaching method by teachers (Jiang, 2014), and as a formative assessment technique (Ginsburg, 2009) as well as for many purposes such as arousing students' curiosity about topic, checking and challenging students' comprehension, reminding particular facts to students, managing classroom with ease, promoting higher level thinking, and activating students' prior knowledge (Arslan, 2006; Ashlock, 2002; Mason, 2014; Wragg & Brown, 2001). Students' knowledge construction in mathematics lessons is related to teacher's questioning (Moyer & Milewicz, 2002). In addition, teacher's questioning skills have an effect on the development of students' mathematical thinking (Burns, 1985). Teachers can identify students' mathematical error and misconceptions through questioning (Ashlock, 2002). Research showed that teachers' questions that enable students to explain, clarify and justify their mathematical ideas promote student achievement (Metz, 2007). Moreover, Yang (2006) stresses the importance of questioning in the process of classroom discussion as a powerful tool that carries out communication in the classroom. Teacher-generated questions shape the flow of classroom discussion, help students engage in the tasks, and give them cognitive opportunities for higher level mathematical thinking (Boaler & Brodie, 2004; Kazemi & Stipek, 2001; Stein et al., 2007). In this way, questioning facilitates mathematical communication in the classroom (Ramsey & Gabbard, 1990). Being aware of the purposes of questions and being able to use questions that serve these purposes are among the teacher qualifications. Many research studies have investigated in-service mathematics teachers' questioning in the classrooms (Boaler & Brodie, 2004; Franke et al., 2009; Koizumi, 2013; McCarthy et al., 2016; Ong et al., 2010; Paoletti et al., 2018; Piccolo et al., 2008; Sahin & Kulm, 2008; Shahrill & Clarke, 2014; Yılmaz, 2019). These studies revealed that mathematics teachers experience difficulty in asking open-ended or higher-level questions. Hence, they prefer to use closed or lower-level questions by which they expect students to recall facts, procedures or rules. For instance, in a study conducted by Sahin and Kulm (2008), although teachers were aware of the importance of asking higher-level questions for students' learning, they rarely used probing or guiding questions. In a similar vein, Yılmaz (2019) noted that novice teachers tended to ask questions based on their own thinking rather than using student thinking while asking questions. Therefore, learning and practicing different question types by pre-service teachers and improving their questioning skills should be a central part of mathematics teacher education programs (Moyer & Milewicz, 2002).

Regarding pre-service teachers, several research studies have been conducted that investigate questioning strategies used by pre-service teachers during clinical interviews with students (Didis-Kabar & Tataroglu-Tasdan, 2020; Groth et al., 2016; Moyer & Milewicz, 2002); questioning practice of pre-service teachers within the context of formative assessment interviews (Weiland et al., 2014); pre-service teachers' use of open-ended questions while teaching inquiry lessons (Inoue & Buczynski, 2011); the effects of the question types asked by pre-service teachers on student performance (Critelli, 2012); the relationship between algebraic thinking of pre-service teachers' and the types of questions they asked during cognitive interviews conducted with middle school students (van den Kieboom et al., 2010); questioning behaviours of pre-service teachers in the context of lesson study (Cumhur, 2016); the effects of microteaching on pre-service teachers' questioning skills (Saunders et al., 1975); the effects of videotaped mathematics lessons on pre-service teachers' questioning skills (Kreide et al., 2015); the relationship between pre-service teachers' questioning skills and their knowledge about students' mathematical thinking (Tanıslı, 2013); the effects of curriculum and instruction course on pre-service teachers' questioning, listening and responding to the students (Nicol, 1999); pre-service teachers' questioning skills in terms of preparing and posing questions clearly, and waiting students' responses (Ralph, 1999); question types asked by pre-service teachers during whole-class discussions in high school mathematics classes (Bennett, 2010; Gaspard & Gainsburg, 2020); and pre-service teachers' use of purposeful question types during field experience (Crowley, 2021). Similar to in-service teachers, research on pre-service teachers showed an inadequate use of open-ended questions (Weiland et al., 2014). For example, Inoue and Buczynski (2011) found that even though pre-service teachers tried to ask open-ended questions, they could not benefit from students' answers since they could not predict and/or fully grasp these answers.

Bearing those studies in our minds, this research focuses on pre-service mathematics teachers' question types during their teaching practice course. As Moyer and Milewicz (2002) stated that additional research on the question types used by pre-service teachers during teaching and learning interactions in classrooms can contribute to body of knowledge on the question types and their convenience in different mathematical situations. Thus, it is believed that this study may contribute to the literature by revealing what question types pre-service teachers use, why they ask such questions and how the questions change over time when they have teaching practice and experience in middle school mathematics classrooms at schools. In addition, investigating pre-service teachers' question types might give information about how competent pre-service teachers are at understanding students' learning and their own questioning, and more importantly with which questioning skills they will graduate from the teacher education program. Thus, the findings of the study can enlighten teacher educators about teacher education programs and the content of the teacher education courses. Examining what type of questions pre-service teachers use may help to inform inclusion of questioning activities into teacher education programs, preparing pre-service teachers to use their questioning skills when they enter the classroom.
Thus, the purpose of the study is to investigate pre-service teachers' question types used during teaching practice course and how the question types have changed during the course. For this purpose, following research questions were formulated:
•What kind of questions being asked by the pre-service teachers while they were teaching in math classes as a requirement of teaching practice course?
•How the structure of the questions being asked has changed during pre-service teachers' enrolment in a teaching practice course?

Theoretical framework

Teachers should pose different types of questions to stimulate mathematical thinking of students for enhancing conceptual understanding (Kwon et al., 2006). Question types used by the teachers can be affected by both teachers' purposes and their teaching methods (Yei et al., 1998). For example, teacher questioning in inquiry-based instruction can be different from traditional instruction (Gallas, 1995; Roth, 1996). While teachers prefer to ask lower-level questions in traditional instruction, they are inclined to use higher-level questions in order to elicit students' thinking (Chin, 2007).
There are various theoretical frameworks regarding question types in the literature (Blosser, 2000; Boaler & Brodie, 2004; Franke et al., 2009; Moyer & Milewicz, 2002; Orrill, 2013; Piccolo et al., 2008; Sahin & Kulm, 2008; Walsh & Sattes, 2011; Weiland et al., 2014; White, 2001). Although there are no certain types of questions agreed by the researchers, there are similarities among the question types presented by the researchers. For instance, while Blosser (2000) classified questions as rhetorical, closed and open, and managerial, White (2001) suggested procedural, conceptual and management questions. In this respect, management and managerial questions are similar to each other. Framework offered by Moyer and Milewicz (2002) consisting of check listing, instructing rather than assessing, probing and follow-up questions and the framework suggested by Weiland et al. (2014) including problem posing, instructing rather than assessing and follow-up questions are similar to each other. These question types emerged during one-on-one interviews which pre-service teachers made with students.
In this study, the framework offered by Sahin and Kulm (2008) that provide criteria for question types was used to analyse mathematical dialogs in real classroom environments. In the framework, there are three types of questions named as factual, guiding and probing questions. If a specific fact or definition, an answer to an exercise or the next step in a procedure is asked, this type of question is categorized as factual question. If a teacher asks for a specific answer or the next step of solution when students are confused or puzzled, or if a teacher asks students to think about or recall a general heuristic or strategy, or if a teacher scaffolds or leads students to understand a concept or to complete a procedure by asking a sequence of factual questions that provide hints, these questions are named as guiding questions. The questions that are asked for the students to explain or elaborate their thinking, or to use their prior knowledge and then apply it to a current problem or idea, or to justify or prove their ideas are involved in probing questions. Thus, in the present study, it was aimed to investigate pre-service teachers' question types used during teaching practice course and how the question types asked have changed during their enrolment in teaching practice course.

Method

In this study, multiple case study was utilized to examine pre-service teachers' questioning during their teaching practice. In a multiple case study, several cases are examined to understand the similarities and differences within and between cases (Yin, 2003). The cases of the present study were two pre-service teachers. In the present study, the cases were bounded by three teachings in a public middle school within the context of Teaching Practice II course during spring semester of 2018-2019 school year. Ethics Committee Permission for this research, ethical permission was obtained from Middle East Technical University applied Ethics Research Center with the number 28620816/170 dated 26.03.2019.

Participants

The participants of the study are two pre-service teachers Emel and Naz (names are used as pseudonym) who were taking Teaching Practice II course in elementary mathematics teacher education program in one of the state universities in Turkey at the time of the study. It is necessary for teachers to have sufficient content knowledge in order to ask good questions (Schuster & Anderson, 2005). Therefore, as representative of content knowledge, out of the pre-service teachers having low and high grades in mathematics education-related courses, two volunteered to participate in this study. Emel completed such courses (e.g., Methods of Teaching Mathematics, Mathematical Concepts, and Teaching Mathematics with Intelligence Questions) with higher scores than those of Naz. Both participants were senior students, and they were at their last semester at that time. Before the study, they completed the Teaching Practice I course at the autumn semester of 2018-2019 academic year, and they taught four times in a middle school within the context of the course.

At the beginning of the study, interviews were conducted with Emel and Naz to know them better and learn their view about questioning. In this interview, Emel stated that although she did not enter the elementary mathematics education program willingly, now she thinks that teaching profession is right for her because she loves students, spending time together and teaching. Additionally, she expressed that she is willing to teach during teaching practice and she sees it as an opportunity for being experienced and she believes that she can teach in a real sense in future. About questioning she indicated that asking question is important because mathematics is discovered with questions and questioning provides permanent learning and students' learning can be enhanced by using it. Furthermore, she explained that during Teaching Practice I course she preferred to ask questions to motivate students or to help them connect concepts to the real life such as "Have you ever encountered this concept in your life before or have you ever heard this in daily life?" On the other hand, she added that she never asked questions leading to brainstorming or probing as she felt inadequate in asking these types of questions, but she thought that she needs some time to become competent in asking different types of questions.

Naz stated that she entered the elementary mathematics education program willingly and she sees teaching practice as training and preparation for being teacher for the future. About questioning, she expressed that asking right question is important and when questions such as "why, how do you do, is there another way" are asked, students start to think, and their thinking skills improve. In addition, like Emel, Naz emphasized that questioning allows for active participation and active participation provides permanent learning and makes recalling easier. Naz explained that at the beginning of the lessons, she generally asked questions that remind the previous lesson or while she introduced a new concept, she asked questions such as "What do you think about this or what does it implicate to you?" during Teaching Practice I course.

Data collection

In the study, data were collected through audio records of the lessons, semi structured interviews, lesson plans prepared by Emel and Naz and observation notes taken by the first author. At the beginning of the study, interviews were conducted with Emel and Naz to know them better and learn their views about questioning. After that, Emel and Naz taught three times during their teaching practice in one of the public middle schools and their teachings were recorded by using audio recorder to capture everything

they said during their teachings. In addition, the first author was also in the classrooms to make observation and take some notes. After the first teachings of Emel and Naz, the pre-service teachers were informed, by the first author of the present study of some of the question types by providing examples taken from real classroom dialogs. Moreover, the purposes underlying the usage of the question types and their effects on the students' learning and understanding were discussed with

them. Furthermore, after each teaching in the middle school, an interview was conducted with both of them to uncover their reasons for asking the questions through the lesson. During the interviews, transcripts of their own lessons were presented to the pre-service teachers and some questions such as "what was the reason for asking …question, what kind of answers you received, did the question reach its goal, and did the question support student learning" were asked them.

Context

Emel and Naz implemented four lessons during their teaching practice in the same public middle school. In this study, we focused on three lessons which were implemented during the semester. All lessons were organized as individual work rather than group work. In all three lessons of Emel, respectively 6th, 7th and 8th grade students have encountered concepts for the first time. On the other hand, before the first lesson of Naz, the mathematics teacher in the school had taught corresponding angles, alternate angles, alternate interior angles and alternate exterior angles concepts to the 7th grade students. Therefore, they have already known these concepts. The objective of the third lesson was the same as the second lesson of Naz. While in the second lesson, 8th grade students have encountered Pythagorean Theorem concept for the first time, in the third lesson they have solved problems related to Pythagorean Theorem. Objectives for each of three lessons of Emel and Naz are presented in Table 1.

Table 1
Objectives for Each of Three Lessons of Emel and Naz

	Emel Objectives	**Naz Objectives**
First Lesson	Students can calculate and explain the range of the given data set. Students can calculate and explain the mean of the given data set.	Students can examine the properties of corresponding angles, alternate angles, alternate interior angles and alternate exterior angles which are formed between two parallel lines and a secant, determine the congruent and supplementary angles and solve the related problems.
Second Lesson	Students can identify interior and exterior angles, diagonals of polygons; and calculate the sum of the measures of interior angles and exterior angles.	Students can constitute Pythagorean Theorem and solve related problems.
Third Lesson	Students can associate congruence with similarity, and they can determine side and angle relationship of congruent and similar shapes.	Students can constitute Pythagorean Theorem and solve related problems.

Data analysis

Firstly, the questions written by Emel and Naz on the lesson plans were identified before the lessons. Then, all questions asked by them in each of the three lessons were identified by re-listening to the audio records and by using observation notes. After the interviews were conducted with Emel and Naz, they were transcribed as verbatim by taking notes on the transcripts. Lastly, questions in three lessons were analysed according to question types of Sahin and Kulm (2008) framework considering the contexts of the lessons and topics. Yılmaz (2019) used Sahin and Kulm's (2008) framework while examining question types used by two middle school mathematics teachers and the interaction among the tools for questioning and question types. She suggested that this framework can be used and tested while analysing question types used by pre-service teachers in their teaching practice. Hence, in the present study, categorization of questions asked by the pre-service teachers was determined according to the criteria offered in Sahin and Kulm's (2008) framework (see Table 2) by supporting with the interviews.

Table 2
Criteria and Examples for the Question Types Adapted from Sahin and Kulm (2008)

Question Type	Criteria	Example
Factual questions	A teacher asks a specific fact or definition A teacher asks an answer to an exercise A teacher asks the next step in a procedure	First of all, I would like to ask you what the definition of an angle is. What is an angle?
Guiding questions	A teacher asks for a specific answer or the next step of solution when students are confused or puzzled A teacher asks students to think about or recall a general heuristic or strategy A teacher scaffolds or leads students to understand a concept or to complete a procedure by asking a sequence of factual questions that provide hints	If x^2 is 18, what is x? Student: 6 What is the square of 6? Student: 36 So, it is not 6. What can it be? Student: Square root of 18.
Probing questions	A teacher asks students to explain or elaborate their thinking A teacher asks students to use their prior knowledge and then apply it to a current problem or idea A teacher asks students to justify or prove their ideas	(By showing the polygon and non-polygon shapes drawn on the board) While these shapes are polygons, those shapes you see are not polygons. Why is this so?

As can be observed in Table 2, at the beginning of the first lesson, by asking for the definition of an angle, Naz activated students' prior knowledge. In this example, the question asking for the definition of a mathematical concept, namely the angle, was categorized as a factual question. For the second example, instead of telling the student that her response is wrong, Naz asked for the square of 6 in order to help the student realize her mistake. In this way, she enabled the student to find the right answer herself. Therefore, this question was categorized as a guiding question. For the third example, Emel asked the students a probing question about the reason why the given shapes were called either a polygon or a non-polygon. Since the "Why" question asked by Emel required the students to elaborate their thinking and think more deeply about the situation, this question was categorized as a probing question. However, all the questions asked in the lessons were not categorized as one of the three question types in the framework since some of the questions did not fit any category. Therefore, in addition to the framework, open coding was performed, and new categories emerged from the data collected. New categories were named as self-answered questions, yes/no questions and general questions (see Table 3). More detailed explanation was provided in the findings section.

Table 3
Criteria and Examples for the Question Types Emerged from the Data

Question Type	Criteria	Example
Self-answered questions	A teacher asks a question, but she/he answers his/her own question immediately without pausing	What is the range? The difference between the biggest and the smallest number.
Yes/no questions	A teacher asks a question that requires only 'yes' or 'no' as a response	Angle K and angle D are congruent angles, and they are looking in the same direction, aren't they? Students: Yes.
General questions	A teacher asks a question which are not specific to a mathematical concept or procedure	Is there anything you did not understand here?

As can be observed in Table 3, in the first lesson, Emel asked the definition of range, but she answered her own question in order to teach the concept of range. Therefore, this question was categorized as a self-answered question. For the second example, since Naz expected students to give yes or no as an instant response, the "aren't they" question was categorized as a yes/no question. For the third example, Naz asked the general question in order to check whether there was anything that was not understood about angle types. Since the question is not directly related to mathematical concept or procedure, the question was categorized as a general question.

Reliability of the study

Prolonged engagement, triangulation and member checking were used in the study. For triangulation, multiple methods of data collection consist of semi structured interviews, lesson plans and observation notes were used. For member checking, the questions which were categorized were tested with the participants, from whom the data were originally collected. For prolonged engagement, the first author of the study and the participants has been interacting for a term at both at the university campus and in the public middle school. In addition, a researcher who has a PhD degree in mathematics education field examined the lessons of Emel and Naz and analysed the questions asked in order to determine their types. Intercoder reliability measure suggested by Miles and Huberman (1994) was used to calculate the agreement and it was found 90.4%.

Findings

In this section, the question types used by Emel and Naz in the first, second and third lessons will be presented respectively.

The case of Emel

The findings showed that the number of questions written on the lesson plans was low (2, 10 and 5 respectively). Emel accounted for this during the interviews by stating that she cannot think of what questions to ask while preparing her lesson plans, yet during the lessons, questions come to her mind spontaneously at that moment. Emel wrote 1 factual and 1 probing question on the first lesson plan; 5 factual and 5 probing questions on the second lesson plan; and 1 factual, 2 probing and 2 yes/no questions on the third lesson plan. All of the questions written on the lesson plans were asked in the classroom by Emel during the lessons. The total number of questions Emel actually asked in the three lessons was high (62, 60 and 63 respectively). The frequencies of the question types used by Emel in the three lessons are presented in Table 4.

Table 4
The Frequency of the Question Types Used by Emel

	Factual Questions	**Guiding Questions**	**Probing Questions**	**Self-answered Questions**	**Yes/No Questions**	**General Questions**	**Total**
First Lesson	17	2	2	8	10	23	62
Second Lesson	15	4	12	5	15	9	60
Third Lesson	4	-	19	5	20	15	63

As can be observed in Table 4, while she used mostly general questions (23) in the first lesson, in the second lesson, she asked an equal number of factual and yes/no questions (15). In the third lesson, the highest number of question type used by Emel was yes/no questions (20). Although in all three lessons, the lowest number of question type used by her was guiding questions (2, 4 and 0 respectively), the number of probing questions used increased as she proceeded from first lesson to the third lesson (2, 12 and 19 respectively). The details for each question type are presented below.

Factual questions

The number of factual questions used by Emel was close to each other in the first and second lesson. On the other hand, there was a decrease in the number of factual questions in the third lesson. In the first lesson, while students were practicing the concept of range, Emel, asked the class the range of given numbers as presented below.

Emel: What is the range of this (by showing the numbers 3, 5, 6, 7, 7, 14)?
Students: 11.

Since she was asking the class for answers to an exercise, this question was categorized as factual question. In the second lesson, before finding the sum of the measures of the interior angles of quadrilateral, Emel wanted her students to determine the vertices of the quadrilateral drawn by her on the board. Since specific fact (vertices) was asked the students, following question was categorized as factual question.

Emel: Each of the points here is called vertices. In that case, what are the vertices of this quadrilateral?
Student: D, C, A, B.

Emel asked factual questions in order to elicit basic information. As it is mentioned before, "a sequence of factual questions that provides ideas or hints that scaffold or lead toward understanding a concept or completing a procedure" were guiding questions (Sahin & Kulm, 2008, p. 225). In the present study, when the students had a difficulty in responding to factual questions, Emel used guiding questions in order to help them discover the answer as explained below.

Guiding questions

While Emel used a small number of guiding questions in the first and second lessons, in the third lesson she did not ask any guiding question. Data analysis revealed one of the important sub-categories of guiding questions, namely the step-by-step solution questions. These questions require the teacher to ask questions step by step in the solution process, and by means of these questions, he/she tries to lead students towards the answer. In the second lesson, the following questions helped the pre-service teacher to lead the students towards understanding how to find the measure of each interior angle of a square by scaffolding.

Emel: How many triangles can the square be split up into?
Student: 2
Emel: How did you it split up, how did you show it?
Student: I drew a line segment from middle.
Emel: How many? 1 and 2 isn't it?
Student: Yes.
Emel: Well, how did you reach the sum of the measures of the interior angles?
Student: Since the sum of the measures of the interior angles of a triangle is 180 and since there are 2 triangles, it is 360.
Emel: Okay, the measure of one interior angle?
Student: 90 degrees.
Emel: How did you find it?
Student: I divided 360 by 4.

As it is seen that Emel leaded students to complete the procedure by asking step-by-step solution questions that provide hints. In some cases, rather than guiding students, Emel paid attention to the students' thinking and she asked probing questions that push students to examine and articulate their ideas.

Probing questions

The number of probing questions used by Emel increased as she proceeded from the first lesson to the third lesson. These questions were also included on the lesson plans. Following dialogue between Emel and the students from the second lesson exemplifies use of probing questions.

Emel: We classified shapes as regular and irregular. We consider a square as regular but we don't consider a rectangle as regular. What can be the reason for this?
Student A: The lengths of the sides are not equal to each other.
Emel: Good. In this case, can we always call polygons with equal side lengths regular polygons?
Student A: Yes.
Emel: Then is a rhombus also a regular polygon?
Student A: Yes, because all sides have the same length.
Student B: I do not agree.
Emel: Why do you not agree?
Student B: I think that for a polygon to be a regular polygon, both the side lengths and the angle measures must be equal.

Emel: What about a rhombus?
Student B: Rhombus is not a regular polygon because all angles are not equal in measure even though all sides are equal in measure.

In this example, by using probing questions, Emel gave the students a chance to demonstrate understanding by justifying their ideas. In the third lesson, as can be seen in the following dialogue, Emel wanted the student to explain her thoughts about congruence.

Emel: Can we say that two triangles are congruent if their three corresponding measures of angles are equal to each other?
Student: In my opinion, we can't.
Emel: Why Yaren?
Student: The lengths of the sides can be different.
Emel: How can they be different? Can you give an example?
Student: Suppose we have two equilateral triangles. Their measures of angles are equal and 60 degrees. Let the side lengths of one are 4 cm, while the side lengths of the other are 2 cm. In this case, they do not cover each other when we put them on top of each other. That's why we cannot say that they are congruent.

By using a probing question starting with "Why", Emel asked the student to justify her idea. In the following example, the question asked by Emel required the students to elaborate their thinking and to think more deeply about the situation.

Emel: Why don't we multiply the measures of angles by 2 if we want to get a shape which is double size of the original one?
Student: In that case, they won't be similar; they will be different.

In contrast to probing questions, Emel sometimes used self-answered questions in order to not receive an answer from the students but to teach the concepts.

Self-answered questions

A new category of questions emerged from the data; it was named as self-answered questions. The pre-service teachers sometimes left the role of questioner and answered their own questions in order to remind students of the concepts they already knew, or to reinforce what was learned by the students, or to teach students a new concept. While Emel used self-answered questions eight times in the first lesson, she used five self-answered questions in each of the two lessons that followed. In the first lesson, after Emel asked the definition of range, she gave the definition herself.

Emel: What is the range?
Emel: The difference between the biggest and the smallest number.

Following dialogue between Emel and the researcher from the interviews shows why Emel used the self-answered question presented above.

Researcher: Why are you asking a question if you're going to answer it yourself? What was the reason for asking this question? What can you say about that?
Emel: The range is a new concept for the students. I thought that if I repeat it, it will be more permanent for them. That is, the more you hear it, the more it stays in your mind. Therefore, for permanent learning of the students, I emphasized the range by asking and telling the definition of it myself.

In this example, her aim was to teach the concept of range, a new concept for the students, and by telling students the definition, she used a self-answered question. By asking the condition for similarity and explaining this condition in the third lesson, and responding the question herself, Emel tried to remind the students of the concept of similarity, already known concept by the students, as presented below.

Emel: What was the condition for similarity?
Emel: Maintaining the originality of a picture.

In addition to self- answered questions, Emel used yes/no questions that require short answer as yes or no.

Yes/no questions

One of the new categories that emerged from the data was yes/no questions. Yes/no questions are the questions that require only 'yes' or 'no' as a response. The number of yes/no questions used by Emel increased as she proceeded from the first lesson to the third lesson. In addition, one sub-category of

yes/no questions emerged, and it was named as non-reasoning questions with yes/no responses. These types of questions do not require thinking and an instant response can be given to these questions. The pre-service teachers used this type of questions in order to have the students confirm what they had said, check students' understanding, and encourage students to participate in class. The following dialogue exemplifies these types of questions.

> Emel: I add all of them and then I divide the sum by 5. If I want to distribute them to everyone equally, I do it like this. Don't I?
> Students: Yes.

During the interviews, Emel made explanations regarding the non-reasoning questions she asked as follows:

> *Researcher: What was the reason for asking this type of questions like "Don't I" question in this example?*
> *Emel: It was for a confirmation. I wanted students to confirm me by saying yes, which means it is right. I wanted to be sure if everyone finds or think the same thing. Maybe there will be objections from students. Then, I can take an action based on it. In addition, I asked questions in the form of "Isn't it like that?" for the purpose of making a student feel like he knows it, and making him happy by participating him in class when he says yes or no.*

In this example, the question "Don't I" asked by Emel in the first lesson was named as non-reasoning questions with yes/no responses under as a sub-category of yes/no questions because it does not require thinking and by giving the response 'yes', the student gave an instant response. Data analysis revealed another sub-category of the yes/no questions, and it was named as reasoning questions with yes/no responses. In addition to requiring 'yes' or 'no' as an answer like the "nonreasoning questions with yes/no responses", these questions also necessitate thinking about the answer. The following dialogue exemplifies these types of questions used by Emel in the third lesson.

> Emel: When we rotate, reflect and translate a shape, is the new shape congruent to the original shape?
> Students: Yes.

This question was also included on the lesson plan. Although students responded by saying 'yes' to this question, the question required them to think about whether the new shape was congruent to the original shape before replying. In addition to the questions that are part of mathematics teaching and assessment, Emel also used general questions as a part of classroom management.

General questions

Data analysis revealed another important category named as general questions, which are not specific to a mathematical concept or procedure. The highest number of general questions was asked by Emel in the first lesson. In addition, general questions were the most frequently used question type among the other types in the first lesson. While the number of general questions decreased as she proceeded from the first lesson to the second lesson, there was an increase in the number of general questions as she proceeded from the second lesson to the third lesson. In the first lesson, Emel asked the following question in order to check students' progress while they were doing exercises related to mean and range.

> Emel: All of you are doing the exercises, aren't you? Is there anybody who are not able to do them?

In addition, a new category emerged from the data as a sub-category of general questions, and it was named as motivating questions. Motivating questions are the questions that encourage students to participate in the lessons. This type of question is exemplified below. After one of the students said that three triangles could fit inside the pentagon without overlapping, Emel asked the following question.

> Emel: Okay, let's try. Who wants to show it?

By asking a motivating question starting with "Who wants", Emel tried to engage students in class and show their work on the board.

The findings indicated that in all three lessons, the lowest number of question type used by Emel was guiding questions. While there was a decrease in the number of factual questions used as the teacher proceeded from the first lesson to the third lesson, the number of probing questions increased as she proceeded from the first lesson to the third lesson. In addition to the question types in the frameworks, new categories named as yes/no and general questions emerged from the data. It was seen that Emel mostly preferred to use these types of questions in the three lessons. Furthermore, data analysis revealed sub-categories named as step-by-step solution questions as a sub-category of guiding questions,

nonreasoning questions with yes/no responses and reasoning questions with yes/no responses as sub-categories of yes/no questions and motivating questions as a sub-category of general questions.

The case of Naz

The findings showed that the number of questions written on the lesson plans was low (3, 5 and 0 respectively). In the interviews, like Emel, Naz stated that she didn't actually know she was going to ask questions other than the questions on the lesson plans, and she indicated that she produced the questions at that moment during the lessons. She added that she didn't think much about what she was going to ask when she was preparing the lesson plans. Naz wrote 3 factual questions on the first lesson plan; and 1 factual, 1 yes/no and 3 probing questions on the second lesson plan. Referring to the third lesson, she explained the reason for not writing any questions on the lesson plan as follows: *"I didn't know what to ask students because I was going to distribute an activity sheet to the students. I thought they would solve the problems on it, I would tell the answers and I would solve what they couldn't do on the board. So, I couldn't write a question."* All of the questions written on the lesson plans were asked in the classroom by Naz during the first and second lessons. The number of questions asked by Naz in the first and second lessons in the classrooms was higher (90 and 88 respectively) than the number of questions asked by Naz in the third lesson (37). The frequencies of the question types used by Naz in the three lessons are presented in Table 5 below.

Table 5
The Frequency of the Question Types Used by Naz

	Factual Questions	**Guiding Questions**	**Probing Questions**	**Self-Answered Questions**	**Yes/No Questions**	**General Questions**	**Total**
First Lesson	20	6	14	1	29	20	90
Second Lesson	32	2	10	10	19	15	88
Third Lesson	14	2	-	2	5	14	37

As can be observed in Table 5, while she used mostly yes/no questions in the first lesson (29), she used mostly factual questions in the second lesson (32). In the third lesson, she asked an equal number of factual and general questions (14). Naz asked all three types of questions in the first and second lessons while she did not use probing questions in the third lesson. Similar to Emel's findings, the lowest number of question type used by Naz was guiding questions (6, 2 and 2 respectively). Details for each question type are presented below.

Factual questions

During the lessons, Naz mostly preferred to use factual questions and throughout the three lessons, the highest number of question type used by Naz was factual questions. At the beginning of the first lesson, after discussing what an angle is, Naz asked the relative position of two straight lines in order to activate students' prior knowledge. This question was also included on the lesson plan.

> Naz: We have learned the relative position of two straight lines in previous years. What were these positions?
> Students: Parallel, intersecting and coincident.

Since Naz asked for a specific fact of two straight lines, this question was categorized as a factual question. In the third lesson, the following factual question was asked by Naz.

> Naz: Do you remember what a diagonal is?
> Students: Yes
> Naz: What was it?
> Student: Line segment connecting two non-consecutive vertices.

In this example, by asking for the definition of a mathematical concept, namely the diagonal, Naz activated students' prior knowledge. As it is seen that factual questions were used by Naz in order to

enable the students to recall what they have learned before and elicit their prior knowledge. Naz also used series of factual questions as guiding questions, and she scaffolded students to understand the concepts.

Guiding questions

The lowest number of question type used by Naz was guiding questions throughout the three lessons. In the first lesson, the following guiding question helped Naz enable students to understand the procedure that the two angle measures formed between two parallel lines and a secant are equal to each other.

Naz: Now, if I move this line up, does the angle measure change?
Students: No.
Naz: I moved it again; did the angle measure change?
Students: No.
Naz: If I coincide these two lines, does the angle measure change?
Students: No.
Student: When we put lines on top of each other, the angles exactly overlap.

During the interviews, Naz made explanations regarding the guiding question she asked as follows:

Researcher: What was the reason for asking a sequence of these questions?
Naz: There were two intersecting lines, and I put another line parallel to the one of the lines. In this way, I got two parallel lines and one secant. With the help of the concrete material I designed students could easily see the corresponding angles. Each time when I move the parallel line up and down, I asked whether the formed angle between the secant and the parallel line change. In this way, by asking a sequence of these questions, I led students to understand that measures of corresponding angles which are formed between two parallel lines and a secant are equal to each other.
Researcher: Do you think that these questions reached their goals and supported students' learning?
Naz: Yes, I think so. My aim was to visually show the students that two angles are equal. When I coincide two parallel lines the students realized that I moved the same angle measure, and hence two angle measures, namely corresponding angles, are equal.

In addition to asking guiding questions to help students' understanding, probing questions were asked by Naz in order to elaborate students' thinking.

Probing questions

In contrast to Emel, the number of probing questions used by Naz decreased as she proceeded from the first lesson to the third lesson, and in the third lesson she did not ask a probing question. The following dialogue indicates how Naz elaborated students' thinking and enabled them to think more deeply about exterior angles by using a probing question in the first lesson.

Naz: What is the reason for calling it exterior? Why do we call it exterior and not interior?
Student: Both of them look to the exterior and they are outside of the parallelogram.

During the interviews, Naz explained the reason for asking this question as follows:

Researcher: What was the reason for asking this question?
Naz: Because there are alternate interior angles and alternate exterior angles. I did not want students to learn the name of the angles by rote. Rather, I wanted them to think more deeply about the name of the angles and to make a connection the names and the position of the angles. Also, I wanted them to know what the difference between interior and exterior is, in which cases we say interior and in which cases exterior.

In contrast to probing questions, Naz sometimes abandoned questioning and taught the concepts by using self-answered questions.

Self-answered questions

While Naz used self-answered questions once in the first lesson, and twice in the third lesson, in the second lesson she asked this type of question 10 times. At the end of the first lesson, while summarizing the lesson, Naz demonstrated equality of measures of opposite angles by folding and coinciding angles with each other by using a self-answered question in order to reinforce the concept of opposite angles.

Naz: What will I say in this situation?

Naz: The measurements of these opposite angles will be equal.

The following example shows how Naz used self-answered questions while teaching the Pythagorean Theorem in the second lesson.

Naz: What should I do to find a in this triangle?
Naz: I will square the lengths of the legs and add them.
Naz: What do I see just now?
Naz: I see that the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse.

As it is seen that Naz sometimes moved from questioning to teaching the concepts and adopted more directive and explanatory methods. Moreover, in some cases, she only awaited a reply as yes or no by asking yes/no questions.

Yes/no questions

There was a decrease in the number of yes/no questions used by Naz as she proceeded from first lesson to the third lesson. In the following sample dialogues exchanged during the first lesson, the questions asked by Naz were sub-categorized as nonreasoning questions with yes/no responses under the category of yes/no questions because students could respond to the questions as yes or no by merely looking at the figure without thinking about the response very much.

Naz: Angle K and angle D are congruent angles, and they are looking in the same direction, aren't they?
Students: Yes.

Different from the previous example, the following questions were categorized as reasoning questions with yes/no responses because they required students think about whether there is a need for two parallel lines and one secant to form opposite angles all the time.

Naz: For opposite angles, do I need two parallel lines and one secant line?
Students: Yes.
Naz: Are both parallel lines necessary or unnecessary?
Students: No. One of them is not necessary.

Different from the question types mentioned above, general questions which are not specific to a mathematical concept or procedure were also used by Naz during the lessons.

General questions

The number of general questions decreased as Naz proceeded from the first lesson to the third lesson. In the first lesson, Naz asked the following general question in order to check whether there was anything that was not understood about angle types.

Naz: Is there anything you did not understand here?

The following question is an example for motivating questions asked to encourage students to participate in the first lesson.

Naz: Who wants to tell me the corresponding angles here?

The findings indicated that the number of questions asked by Naz in the third lesson was lower than the number of questions asked in the first and second lessons. Naz used all three types of questions in the first and second lessons, while she did not use probing questions in the third lesson. Similar to the findings for Emel, when the total number of question types used in each of the three lessons was compared, it was revealed that the lowest number of question types used by Naz was the guiding questions. Furthermore, in contrast to Emel, there was a decrease in the number of probing questions as she proceeded from the first lesson to the third lesson. As in the data analysis for Emel, the data analysis for Naz also revealed yes/no questions and general questions as two new categories with sub-categories within them.

Discussion and Conclusion

In the present study, the question types that the pre-service teachers used during their teaching practice course and how the questions they asked underwent changes during the mentioned course were examined. The findings of the study indicated that the participants, the pre-service teachers, used factual, guiding and probing types of questions. This finding is consistent with the related literature since several research studies reported the use of these types of questions by pre-service and in-service teachers (Franke et al., 2009; Moyer & Milewicz, 2002; Myhill & Dunkin, 2005; Paoletti et al., 2018; Sahin & Kulm, 2008; Walsh & Sattes, 2011). In this study, guiding questions that exists in the literature as one category of questions (Camenga, 2013; Ong et al., 2010; Piccolo et al., 2008; Sahin & Kulm, 2008) were further elaborated by the researchers by adding step-by-step solution questions as a sub-category.

In addition to factual, guiding and probing questions, self-answered questions emerged from the data. This type of question does not take place in Sahin and Kulm's (2008) framework. In the present study, the pre-service teachers used self-answered questions to remind students of the concepts they already knew, or to reinforce what was learned by the students, or to teach students a new concept as they indicated during the interviews. This finding is consistent with the findings of Inoue and Buczynski (2011)'s study in which pre-service teachers sometimes answered their own questions.

Yes/no questions also emerged from the data confirming previous studies (Kawanaka & Stigler, 1999), and this type of questions was further elaborated as 'non-reasoning questions with yes/no responses' and 'reasoning questions with yes/no responses' in the present study. The pre-service teachers indicated in their interviews that they used non-reasoning questions with yes/no responses in order to have the students confirm what they had said in the lessons. In addition, they tried to check students' understanding, and encourage weaker students to participate in class by using non-reasoning questions with yes/no responses. This finding is consistent with the related literature since in other studies it is stated that yes/no questions are "used to check whether students can follow or agree with teacher's teaching or other students' opinions" (Cao et al., 2018, p. 210).

The other question type that emerged from the data is general questions and this type of questions was also further elaborated by adding a subcategory named as motivating questions. General questions are referred to as 'managerial questions' (Blosser, 2000) or 'management questions' (White, 2001) in the related literature. Pre-service teachers' observations of practice teachers' questioning and ways of managing the class in middle schools might be the reasons underlying their use of general questions.

Based on the second research question, findings indicate that although the pre-service teachers used the same variety of question types, there are differences in the number of question types used by the pre-service teachers in the longitudinal research process. Differences in the number of question types may have stemmed from the differences in the concepts taught in the lessons, grade levels of the students and individual characteristics of the pre-service teachers. One of the most important findings of the present study is small number of questions written on the lesson plans. For both participants, while the total number of questions written on the lesson plans was low, the total number of questions asked during the class was high. This could be attributed to the fact that participants, as they stated in the interviews, could not foresee the questions that would be asked in class while preparing lesson plans.

Among the question types, guiding questions were rarely used by both of the pre-service teachers when compared with other question types. This can be due to the fact that guiding questions "require [a] teacher to have specific knowledge and expectations of student difficulties with particular content" (Sahin & Kulm, 2008, p.238). Since pre-service teachers do not have full pedagogical competence and enough experience in teaching, it is acknowledgeable that the pre-service teachers in this study did not prefer to ask guiding questions in general.

The number of probing questions used by Naz surprisingly declined steadily across the three lessons. This can be due to the fact that Naz previously has not been exposed to probing questions before the study. Also, interviews conducted after each teaching and information regarding question types, the purposes underlying the usage of the question types and their effects on the students' learning and understanding provided by the first author after their first teachings may have been insufficient for Naz to be able to ask probing questions and improve her questioning skills. On the other hand, there is an increase in the number of probing questions used by Emel while the number of factual questions used

by her declined steadily across the three lessons. It can be said that towards the last lesson, Emel started to give more importance to conceptual understanding of students rather than the acquisition of only factual knowledge. In a study conducted by Blanton et al. (2001), while a pre-service teacher asked questions that require students to calculate, remember information or express previously learned procedures early in her field experience, later she started to ask questions in order to explore students' solution strategies later. The researchers emphasized that this improvement was due to pre-service teacher's self-reflecting on her practice and interviews conducted with her, which attracted her attention to her questioning practices. Similarly, in the present study, interviews conducted with Emel after the teachings may have had an effect on the probing questions she used and their intended purposes. She noticed that she had presented concepts to the students directly rather than enabling them to discover the concepts as she stated in the first interview. In addition, with the intervention that the pre-service teachers received after their first teachings, they gained awareness of particularly probing questions, which they had not been familiar with before, and understood the importance of this type of questions. Thus, this intervention may have had an effect on the increase in the number of probing questions used by Emel.

Additionally, the pre-service teachers observed the practice teacher, students and classroom environment in the middle school throughout the semester. In this process, the fact that the practice teacher's questioning strategies and their effects on the students noticed by Emel might have affected probing questions used by her. Furthermore, as pre-service teachers gained experience in teaching by teaching three times in a real classroom environment during teaching practice, they might start to feel confident and competent in asking questions. This situation might have affected Emel's use of probing questions. The decrease in the number of probing questions asked by Naz correlates with the decrease in the number of yes/no questions and the increase in the number of probing questions asked by Emel correlates with the increase in the number of yes/no questions. This could be attributed to the fact that by asking more yes/no questions, Emel gained time to think about and prepare probing questions. In other words, Emel might have used yes/no questions as warm-up for another probing question.

Didis-Kabar and Tataroglu-Tasdan (2020) found that pre-service teachers with higher GPAs tend to ask more probing questions. Hence, they declared that change in pre-service teachers' use of probing questions can be explained by their GPAs which can be considered as indicator of content knowledge and pedagogical content knowledge. In a similar way, in the present study, although both participants had taken the same courses before the study, they might have benefited from the courses differently since Naz completed the mathematics education courses with lower scores than those of Emel. This situation may have caused the difference between Emel and Naz in terms of using probing questions. State differently, Naz could not emphasize the mathematical concepts for students to understand in the lessons as much as Emel did.

Both of the pre-service teachers used general questions less frequently in the third lesson than in the first lesson. As Macías and Sánchez (2015) stated, being in real teaching settings and having opportunities to learn from more experienced teachers might have a positive effect on the improvement of classroom management skills of pre-service teachers. Thus, it can be said that experience in teaching gained by the pre-service teachers throughout the semester and opportunities to observe the practice teacher may have led to an improvement in their classroom management skills and, in turn, to a decrease in the use of general questions.

Recommendations

In conclusion, the present study shows that pre-service teachers' questioning skills can be improved in a longitudinal process. Thus, there could be more content in teacher education courses regarding types of questions and how to use these questions in class. In this way, pre-service teachers can have opportunities to master different questioning techniques and be better questioners (Sahin, 2015; Zhang & Patrick, 2012). Additionally, in the present study, subcategories were added under guiding, yes/no and general questions. For further research studies it is recommended that subcategories can be added under the other main categories by examining the questions in detail as we did in this research. By this way, detailed and comprehensive questioning framework could be obtained to be used in analysing questioning strategies in mathematics classrooms. Moreover, research studies could be conducted in the international educational arena in order to compare pre-service teachers' questioning skills in different

countries. By this way, researchers could have opportunity to compare and contrast their teacher education programs and pre-service teachers' questioning skills. Furthermore, it is recommended to follow pre-service teachers and further examine how their questioning practices develop as they gain experience in teaching profession.

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Genişletilmiş Özet

Giriş

Matematik derslerinde öğrencilerin bilgiyi oluşturması öğretmenlerin soru sormasıyla yakından ilişkilidir (Moyer & Milewicz, 2002). Öğretmenler öğrencilerin matematiksel hatalarını ve kavram yanılgılarını soru sorma aracılığıyla belirleyebilirler (Ashlock, 2002). Öğretmen tarafından sorulan öğrencilerin matematiksel fikirlerini açıklamalarına ve gerekçelendirmelerine imkân veren soruların öğrencilerin matematiksel düşünmelerinin gelişiminde etkili olduğu (Burn, 1985) ve öğrenci başarısını arttırdığı görülmüştür (Metz, 2007). Ancak yapılan araştırmalar öğretmenlerin açık uçlu ya da yüksek seviyede sorular sormada zorluk yaşadıklarını, bu nedenle öğrencilerin kavramları, prosedürleri veya kuralları hatırlamalarını gerektiren kapalı ya da daha düşük seviyede sorular sormayı tercih ettiklerini göstermiştir (Boaler ve Brodie, 2004; Franke vd., 2009; Koizumi, 2013; McCarthy vd., 2016; Ong vd., 2010; Paoletti vd., 2018; Piccolo vd., 2008; Sahin ve Kulm, 2008; Shahrill ve Clarke, 2014; Yılmaz, 2019). Benzer şekilde öğretmen adayları üzerinde yapılan araştırmalar da açık uçlu soruların öğretmen adayları tarafından yeterince kullanılmadığını ortaya koymuştur (Weiland vd., 2014). Öğretmen adaylarının farklı soru türlerini öğrenmeleri, kullanmaları ve soru sorma becerilerinin geliştirilmesi matematik öğretmeni yetiştirme programlarının bir parçası olmalıdır (Moyer ve Milewicz, 2002). Öğretmen adaylarının ne tür sorular kullandığını incelemek, onları mesleğe başladıklarında sorgulama becerilerini kullanmaları için hazırlayacak ve soru sorma etkinliklerinin öğretmen yetiştirme programlarına nasıl dâhil edilmesi konusunda bilgi verecektir. Bu araştırmanın amacı öğretmen adaylarının öğretmenlik uygulaması dersi kapsamında kullandıkları soru türlerini ve ders süresince bu soru türlerinin nasıl değiştiğini incelemektir. Araştırmanın öğretmen adaylarının hangi soru türlerini kullandıklarını, neden bu soruları sorduklarını ve ortaokul matematik sınıflarında deneyim kazandıkça soruların nasıl değiştiğini göstererek alan yazına katkı sağlayacağı düşünülmektedir.

Yöntem

Nitel araştırma yöntemi ile yürütülen bu araştırmada çoklu durum çalışması araştırma deseni olarak benimsenmiştir (Yin, 2003). Araştırmada ele alından durumlar 2018-2019 eğitim-öğretim yılı bahar döneminde Öğretmenlik Uygulaması II dersi kapsamında bir devlet okulunda iki öğretmen adayının ders anlatımları ile sınırlıdır. Araştırmanın katılımcıları, Türkiye'deki bir devlet üniversitesinde ilköğretim matematik öğretmenliği programına kayıtlı olan, araştırma sırasında Öğretmenlik Uygulaması II dersini alan, Emel ve Naz olarak isimlendirilen iki öğretmen adayıdır. Alan bilgisinin temsilcisi olarak matematik eğitimi ile ilgili dersleri yüksek (Emel) ve düşük (Naz) notlarla tamamlayan öğretmen adayları arasından bu iki öğretmen adayı araştırmaya gönüllü olarak katılmışlardır. Araştırmanın verileri öğretmen adayları tarafından yürütülen derslerin ses kayıtları, bu derslere ilişkin ders planları, yarı yapılandırılmış görüşmeler ve araştırmacı gözlem notları aracılığı ile toplanmıştır. Araştırmanın başında öğretmen adayları ile onları daha yakından tanımak ve soru sormaya yönelik düşüncelerini öğrenmek amacıyla görüşmeler yapılmıştır. Ardından Emel ve Naz bir devlet okulunda üç kez ders anlatmış, araştırmacılardan biri de sınıfta bulunarak gözlem notları tutmuştur. İlk ders anlatımlarından sonra gerçek sınıf diyaloglarından alınan örnekler aracılığıyla bazı soru türleri hakkında öğretmen adaylarına bilgi verilmiş, soru türlerinin kullanım amaçları ve bunların öğrencilerin öğrenme ve anlamaları üzerindeki etkileri tartışılmıştır. Ayrıca, her ders anlatımından sonra derste kullandıkları soru türlerinin kullanım amaçlarını ortaya çıkarmak amacıyla her iki öğretmen adayıyla da görüşmeler yapılmıştır. Öğretmen adaylarının anlattıkları üç ders boyunca sordukları sorular Sahin ve Kulm (2008) tarafından önerilen olgusal, yönlendirici ve sorgulayıcı soru türlerine göre analiz edilmiştir. Öğretmen adaylarının sordukları soruların kategorizasyonu bu soru türlerine yönelik sunulan kriterlerin yapılan görüşmelerle desteklenmesi sonucu oluşturulmuştur. Ancak bazı soruların herhangi bir kategoriye uymaması nedeniyle açık kodlama da yapılmış ve yeni kategoriler ortaya çıkmıştır.

Bulgular

Araştırmada, iki öğretmen adayının da ders planlarında az sayıda soruya yer vermesine rağmen, derslerde kullandıkları soru sayısının yüksek olduğu görülmüştür. Öğretmen adayları bu durumun sebebi olarak derste soracakları soruları ders planı hazırlarken öngöremediklerini ve ders sırasında o anda duruma göre sorduklarını belirtmişlerdir. Araştırmanın bulguları olgusal, yönlendirici ve sorgulayıcı sorulara ek olarak, öğretici sorular, evet/hayır soruları ve genel soruların da öğretmen adayları tarafından kullanıldığını göstermiştir. Ayrıca, yönlendirici, evet/hayır ve genel sorular alt kategorilere ayrılmıştır. Bununla birlikte iki öğretmen adayı için de en az tercih edilen soru türü yönlendirici sorular olmuştur (Emel için sırasıyla 2, 4, 0; Naz için sırasıyla 6, 2, 2). Öğretmen adayları tarafından kullanılan soru türleri aynı olmasına rağmen, kullanılan soru türlerinin sayısında farklılıklar olduğu ve en dikkat çekici farkın da sorgulayıcı sorularda olduğu görülmüştür. Emel birinci dersinden başlayarak son dersine kadar sorgulayıcı soruların kullanımını arttırırken (2, 12, 19), Naz'ın kullandığı sorgulayıcı soruların sayısında azalma olmuştur (14, 10, 0).

Tartışma

Yol gösterici sorular sormak öğretmenin belirli bir içeriğe sahip öğrenci zorlukları hakkında belirli bilgiye sahip olmasını gerektirdiğinden (Sahin ve Kulm, 2008), bu araştırmada öğretmen adaylarının tam pedagojik yeterliğe ve yeterli öğretmenlik deneyimine sahip olmamaları yönlendirici sorular sormayı genel olarak tercih etmemelerinde etkili olmuş olabilir. Soru türlerinin sayısındaki farklılıklar derslerde öğretilen kavramlar, öğrencilerin sınıf düzeyleri ve öğretmen adaylarının bireysel özelliklerinden kaynaklanmış olabilir. Naz'ın kullandığı sorgulayıcı soru sayısında azalma olduğu görülmüştür. Bu nedenle, her ders anlatımından sonra yapılan görüşmelerin ve birinci ders anlatımından sonra soru türlerinin kullanım amaçlarına ilişkin yapılan bilgilendirmenin Naz'ın sorgulayıcı sorular sorabilme ve soru sorma becerilerini geliştirmede yetersiz kaldığı söylenebilir. Diğer taraftan, Emel'in kullandığı sorgulayıcı soruların sayısında artış görülmüştür. Öğretmen adaylarının araştırma öncesinde matematik eğitimine ilişkin dersleri farklı notlarla tamamlamaları onların sorgulayıcı soruları kullanmaları açısından farklılığa neden olmuş olabilir. Bu durum yüksek not ortalamasına sahip öğretmen adaylarının daha çok sorgulayıcı soru sorma eğiliminde olduğu bir araştırmanın bulguları ile tutarlılık göstermektedir (Didiş-Kabar ve Tataroğlu-Taşdan, 2020). Ayrıca ders anlatımlarından sonra yapılan görüşmeler ve birinci ders anlatımından sonra soru türlerinin kullanım amaçlarına ilişkin yapılan bilgilendirmenin Emel'in kullandığı sorgulayıcı sorularda etkili olduğu söylenebilir. Bu araştırmada yapıldığı gibi, sorular detaylı incelenerek diğer ana kategorilerin altına alt kategoriler eklenebilir. Böylece matematik derslerindeki soru sorma stratejilerini analiz etmek için kullanılmak üzere daha detaylı ve kapsamlı bir soru sorma çerçevesi elde edilebilir. İleriki araştırmalar için öğretmen adaylarının takip edilerek öğretmenlik mesleğinde deneyim kazandıkça soru sorma becerilerinin nasıl değiştiğinin incelenmesi önerilmektedir.

***** Bu makaleye yazarlar eşit oranda katkı sağladıklarını beyan ederler.

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