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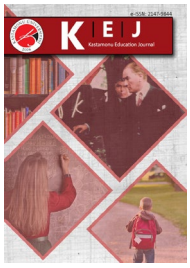

| Research Article / Araştırma Makalesi |

An Investigation of the Knowledge of Teaching Mathematics of Novice Primary School Teachers[1]

Mesleğe Yeni Başlayan Sınıf Öğretmenlerinin Matematiği Öğretme Bilgisinin İncelenmesi

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Keywords

1. Knowledge for teaching math
2. Primary school teachers
3. Data processing learning area
4. Pedagogical content knowledge
5. Teacher qualifications

Anahtar Kelimeler

1. Matematiği öğretme bilgisi
2. Sınıf öğretmeni
3. Veri işleme öğrenme alanı
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Abstract

Purpose: This study, it is aimed to examine the knowledge of classroom teachers who are just starting out in the profession to teach mathematics in the field of data processing learning.

Design/Methodology/Approach: The research was carried out for the purpose of specific case study from qualitative research methods. The data was obtained from 100 classroom teachers who have not completed 5 years in their professional life. The data were obtained with the data collection tool developed for the data processing learning area. The researchers used the rubric they developed for data analysis. All questions were evaluated and scored within the scope of "correct", "partially correct", "wrong" and "irrelevant" answers, and the frequency of answering each question was kept. Subsequently, the proficiency levels of the teachers were determined and the teaching knowledge was examined within the framework of these levels.

Findings: It has been revealed that primary school teachers who have just started their profession have deficiencies in teaching mathematics and its sub-components, content knowledge, student and content knowledge, teaching and content knowledge, and curriculum knowledge. In the topics determined within the framework of the knowledge of teaching mathematics, it was observed that the field knowledge of the classroom teachers is sufficient but close to the lower limit of the specified level, the student, teaching and content knowledge is of moderate proficiency and the curriculum knowledge is the lowest compared to other components. In line with the results, it has been determined that classroom teachers have deficiencies in teaching knowledge of data processing learning area.

Highlights: It has been determined that there are deficiencies in the knowledge of classroom teachers who are just starting out in the profession to teach mathematics. It has been observed that the deficiencies in the curriculum knowledge of the classroom teachers are greater than in other components. It has been observed that classroom teachers have misconceptions about table and graphic concepts.

Öz

Çalışmanın amacı: Bu çalışmada mesleğe yeni başlayan sınıf öğretmenlerinin veri işleme öğrenme alanına ilişkin matematiği öğretme bilgisinin incelenmesi amaçlanmıştır.

Materyal ve Yöntem: Araştırma, betimsel amaçlı olup nitel araştırma yöntemlerinden özel durum çalışması yöntemi ile yürütülmüştür. Veriler, meslek hayatında 5 yılını doldurmamış 100 sınıf öğretmeninden elde edilmiştir. Veriler, veri işleme öğrenme alanına ilişkin geliştirilen veri toplama aracı ile elde edilmiştir. Araştırmacılar, veri analizi için kendi geliştirdikleri rubrikten yararlanmışlardır. Tüm sorular "doğru", "kısmen doğru", "yanlış" ve "alakasız" cevap kapsamında incelenerek puanlandırılmış, her sorunun cevaplanma frekansı tutulmuştur. Devamında öğretmenlere ait yeterlilik düzeyleri belirlenmiş ve öğretme bilgisi bu düzeyler çerçevesinde incelenmiştir.

Bulgular: Mesleğe yeni başlayan sınıf öğretmenlerinin matematiği öğretme bilgisi ve alt bileşenleri olan alan bilgisi, öğrenci ve içerik bilgisi, öğretim ve içerik bilgisi, müfredat bilgisindeki eksikliklerinin olduğunu ortaya çıkarmıştır. Matematiği öğretme bilgisi çerçevesinde belirlenen başlıklarda sınıf öğretmenlerinin alan bilgisinin yeterli düzeyde ancak belirlenen düzeyin alt sınırına yakın, öğrenci, öğretim ve içerik bilgisi orta yeterlilikte ve müfredat bilgisinin ise diğer bileşenlere oranla en düşük yeterlilikte olduğu görülmüştür. Ortaya çıkan sonuçlar doğrultusunda sınıf öğretmenlerinin veri işleme öğrenme alanı öğretme bilgisinde eksiklikleri olduğu belirlenmiştir.

Önemli Vurgular: Mesleğe yeni başlayan sınıf öğretmenlerinin matematiği öğretme bilgilerinde eksikliklerin olduğu belirlenmiştir. Sınıf öğretmenlerinin müfredat bilgilerindeki eksikliklerin diğer bileşenlere oranla daha fazla olduğu görülmüştür. Sınıf öğretmenlerinin tablo ve grafik kavramları hakkında kavram yanılgıları olduğu gözlenmiştir.

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INTRODUCTION

The number of qualified individuals in a society is measured by the quality of the level of education in that society. One of the most basic elements that will increase the quality in education is the quality of the teacher. For professional competence, a teacher must have field knowledge and knowledge of teaching the field within the scope of professional knowledge. As a matter of fact, the Ministry of National Education (MEB, 2017) also announced "Teaching Professional Qualifications" and "Teaching Special Field Qualifications" in its report. The report emphasized the need for teachers to have professional knowledge (content knowledge, content education knowledge, regulatory knowledge), professional skills (planning for education, developing a learning environment, managing, measuring and evaluating the learning process) and professional values (national, spiritual and universal values) within general qualifications. In the special field qualifications of MEB classroom teaching, it is important to adopt 'learning-teaching environment and development', 'monitoring and evaluation', individual and professional development – social relations, art and aesthetics, developing language skills, scientific and technological development, individual responsibilities and socialization, physical education and safety qualifications. The fact that teachers develop and equipp themselves with these qualities will allow them to educate individuals who can express themselves, question themselves and produce different solutions. Considering that the success of teachers in education and training reflects positively on the achievements of the students (Hill, Rowan & Ball, 2005), it is obvious that the qualified teacher will train qualified students.

Considering the important role of educators in the training of students, their success and preparation for life, teachers should have field knowledge, field education knowledge and legislative knowledge, as stated in the report of the Ministry of National Education (2017), in order to provide qualified education. By many researchers (An, Kulm and Wu 2004; Ball, Thames & Phelps, 2008; Bluff, Gustafsson &Shavelson 2015; Fennema & Franke, 1992; Shulman, 1986, 1987) explained these types of information with various models. Information that the teacher must have in the model of Shulman (1986), which describes the qualifications of the teacher; field knowledge, field teaching knowledge and curriculum information. Shulman (1987), who explained his pedagogical field knowledge as determining the preliminary knowledge of the students before the lesson, making different educational explanations, using effective materials, and correcting the misconceptions of the students, continued his studies in this regard.

Studies on the teacher's teaching knowledge gained momentum after Shulman's (1987) work and guided other researchers. Hawkins (2012) studied mathematics education, Park &Oliver (2008) studied science, and Ball et al. (2008) studied classroom education. Some researchers also emphasized that teachers' beliefs influenced teaching knowledge in math teaching in An and his colleagues (2004), Baki (2018) and Fennema and Franke (1992). In addition, teaching knowledge was at the heart of all of these studies and teaching knowledge was supported by components such as technology, curriculum, pedagogy, cognitive comprehension, content, mathematics knowledge. Bluömeke and his colleagues (2015) also stated that teachers should see the sensory characteristics of the students in addition to seeing, feeling and correcting the mistakes of the students in the name of teaching.

Ball et al. (2008) created a model in his study that would appeal more to classroom teachers. While drafting teaching knowledge, they focused on what teachers should know and how to apply for effective mathematics teaching. At the end of the study, they revealed the "Mathematical Knowledge for Teaching" model. This model is shown in Table 1.

Table 1. Mathematical knowledge model for teaching (Ball et al., 2008)

Mathematical Information Model for Teaching	
Content Knowledge	**Pedagogical Content Knowledge**
• Common Content Knowledge	• Knowledge of Content and Students
• Horizontal Content Knowledge	• Knowledge of Content and Teaching
• Specialized Content Knowledge	• Curriculum Information

When the model is examined in Table 1, teaching knowledge, content knowledge and pedagogical content information are divided into two sections. It has also divided content knowledge and pedagogical content knowledge into subcomponents. content knowledge includes the teacher's knowledge of mathematical subjects, finding and resolving the points where students have difficulty solving problems, and connecting lower and upper grade subjects (Ball et al., 2008). Researchers agree on the need for robust and comprehensive field knowledge for qualified mathematics teaching (Ball, 1990; Maa, 1999; Shulman 1986,1987). Student and content knowledge, which is a component of pedagogical content knowledge, refers to getting to know students, predicting at what points when students are asked a question, predicting which students will have difficulties, and predicting how students will respond to homework they do at home. Teaching and content knowledge requires knowing the most effective teaching method for teaching any subject, knowing which impressions will be more useful at which stage of the course. Curriculum knowledge includes knowing the objectives of the applied curriculums (Ball et al., 2008). When studies on teaching knowledge are examined, the researchers (An et al,2004; Ball et al., 2008; Park and Oliver, 2008; Shulman, 1986) is to know the field in which the teacher will teach expectations, to know the students, to know different method techniques related to the subject he will teach, to be able to keep the course flow and to be aware of the curriculum he teaches. Teaching knowledge is also expressed as a mixture of all these types of knowledge, in other words, the most effective and practical way to teach. In addition, Ball et al. (2008) developed some questions to measure teachers' teaching knowledge. The Teacher Education

and Development Study in Mathematics (TEDS-M) project examines the teaching knowledge of primary and secondary school math teachers in 60 countries. During this examination, questions are asked about the knowledge, interpretation and application of all learning areas in mathematics. The TEDS-M project also used the questions in the work of Ball et al. (2008) while preparing these questions (TEDS-M, 2008). In this study for classroom teachers, Ball et al. was evaluated within the scope of the teaching knowledge model developed. Although many researchers have considered and evaluated teaching knowledge in different ways, the common idea of researchers is that teachers must have a comprehensive teaching knowledge in order to teach a qualified mathematics.

The majority of the studies carried out within the scope of mathematics teaching were carried out with teacher candidates (Aksu, 2013; Aydın, 2015; Baki, 2012; Gökbulut, 2010; Hacıömeroglu, 2013; Pırasa, 2009; Yıldırım ve Boz, 2015). However, it is known that examining teachers' teaching knowledge or even identifying their shortcomings in this subject will contribute positively to teaching knowledge (Lee, Brown, Luft and Roehrig, 2007). Especially when the domestic literature is examined, the researches mostly investigate the feelings, thoughts and attitudes of the candidates of the class teachers regarding mathematics teaching (Arseven, Arseven & Tepehan, 2015; Çağırtan-Gülten, 2011; Hacıömeroglu & Şahin-Taskın, 2010; Cesur, 2008), investigating the concerns of class teacher candidates about math teaching (Elmas, 2010; Küçük-Demir, Cansız, Deniz, Çevik-Kansu and, 2016) studies have been observed. It has been noted that studies investigating the pedagogical and mathematical knowledge of the classroom teacher and explanations of mathematics teaching (Aksu & Konyalıoğlu, 2014; Baki, 2013; Işık & Baran-Kaya, 2017; Toluk-Uçar, 2011) were generally conducted with teacher candidates. It was observed that the studies in which the pedagogical field knowledge of the incumbent classroom teachers were investigated were carried out in limited numbers in the fields of Mathematics Education (Şen, 2019), Science Education (Aydın, 2015) and Social Sciences Education (Kılınç, 2012).

In the international project "Teacher Education and Development Study in Mathematics" (Project TEDS-M), scenario type questions were used in the Teaching Content Knowledge exams applied in our country. In addition, some domestic studies (Bütün, 2005; Hacıömeroğlu, 2013) tried to examine the mathematics teaching knowledge of teachers or prospective teachers with scenario-type open-ended questions. The current research with classroom teachers will be an original study in this context with scenario-type open-ended questions. In addition, scripted open-ended questions offer the opportunity to examine teachers within the framework of a single scenario, by placing the components of mathematics teaching knowledge, which cannot be examined directly during the course of the course, or which will not be easy to examine (Bütün, 2005, 2011).

When the studies on mathematics teaching knowledge in our country are examined (Aksu, 2013; Baki, 2013; Bütün, 2005; Hacıömeroğlu, 2013; Pırasa, 2009), it is seen that the researches are generally on areas such as fractions, four-operation skills and numbers. However, in this study, data processing learning was studied within the scope of the subject of graphics that are used a lot in science, life information and social studies courses, which form the basis of visual reading that students will use frequently in all educational life in their daily life. The field of data processing learning provides students with analytical thinking, interpretation and cognitive reading skills in primary schools for the purposes of creating tables, charting and reading, and achieving results by examining data (MEB, 2017). In addition, learning graphic reading and interpretation will create a preliminary preparation for other courses (Life Knowledge, Science) on behalf of students, as well as improving students' visual intelligence and accelerating their conceptual learning, making the field of data processing learning valuable. Considering the value of the designated learning area, the teaching information of the classroom teachers who will organize teaching activities in this field is also very important (Beyazit, 2011). Within the scope of the research, only data processing learning studies have been carried out, giving the opportunity to examine in detail and providing the opportunity to put a realistic framework in the middle.

Another benefit of the research to the literature is that it will provide a self-evaluation opportunity about the pedagogical field education of the classroom teachers trained in the education faculties of our country. From another point of view, the research is necessary and important in that it will benefit the professional development of classroom teachers and fill an important place in the field of data processing learning in the literature.

Teacher's Professional Development

Teachers are one of the most important factors in the education life where students learn by doing, question life, and aim for good and beauty. The role of teachers in education increases as they equip themselves. The importance of pre-service and in-service training is quite high in the training of a competent teacher. In addition, pre-service education is primarily important in the upbringing of a qualified teacher. Teachers' professional development studies (Huberman, 1989; Bakioglu, 1996) and it was seen that the studies were usually examined by breaking down into certain years of service. Bakioglu (1996) divided the developmental stages of teachers into 5 periods into their professional years and determined as follows: Career Entry Phase /1-5 years, Rinsing Phase / 6-10 years, Experimentalism/Activism Phase / 11-15 years, Specialization Phase / 16-20 years, Calmness Phase / 21 years and above.

Huberman (1989) named the professional development stages of teachers as apprenticeships, middle career stages and late career stages in his work. In addition, it has included teachers with less than 10 years of professional seniority in the apprenticeship phase. He described the teachers who had just started their careers as candidate teachers in meb and removed the teachers who had completed one year in their professional life from the status of candidate teachers (MEB, 2017). When we

look at the studies, the first 5 years of teachers' professional lives are considered as the rookie years of the profession. In addition, it is known that teachers lack more knowledge during their novice years. For this reason, the knowledge of teachers in the first 5 years of their professional life to teach mathematics in the field of data processing was examined.

Data Processing Learning Area

Data Processing learning field is included in the curriculum published by MEB (MEB, 2009, 2015, 2017) from the 1st grade. Data processing is also associated with learning areas such as learning area (Numbers and Operations, Geometry, Measurement) and courses such as (Science, Social Studies, Life Knowledge). Data Processing learning area; It consists of four main topics: "creating researchable questions", "data collection", "processing and analyzing data", "interpreting results". When these stages are taken into account in data processing teaching, it is aimed to read tables with few data groups from the first grade, collect and make this data about a researchable question in the second grade, read overdates tables in the third grade, and draw and interpret column charts in the fourth grade. In addition, it is aimed to design problems related to daily life using the information obtained from the graphs and to search for answers to these problems (MEB, 2017).

In the name of effective education, teachers need to know the stages determined for data teaching and transfer these stages to their lessons. According to the primary school mathematics curriculum, the field knowledge of the classroom teachers should be sufficient in relation to table and graphic reading and interpretation from the 1st grade. In addition, it is very important for teachers to associate examples of the process of collecting data, presenting data with tables or graphs with the student's life, i.e. using pedagogical field knowledge during the teaching process. Within the scope of "General and Special Competence Fields" published by the Ministry of National Education (2017), it is necessary for classroom teachers to make students who encounter data teaching for the first time like this field, to make them look at mathematics positively, to understand and guide students by speaking their language. In order to increase qualified education, it is necessary to know and implement the curriculum related to the field of "Data processing" learning as another equipment. In addition to these duties and responsibilities of the classroom teachers, the teachers who teach this course should be equipped in terms of scientific literacy, considering that the field of data processing learning improves the statistical literacy and scientific thinking skills of the students (MEB, 2017).

Within the scope of the specified reasons and qualifications, it is aimed to examine the knowledge of classroom teachers who have just started the profession to teach mathematics in the field of "Data Processing" learning. Within the scope of this purpose, the following questions were sought. These:

1. What level of field knowledge is the field information regarding the data processing learning area of classroom teachers who have just started their profession?
2. What level of student and content information about the data processing learning area of the classroom teachers who have just started their profession?
3. What level of teaching and content information about the data processing learning area of classroom teachers who have just started their profession?
4. What level of curriculum information about the data processing learning area of classroom teachers who have just started their profession?

METHOD

Research Methodology

In this study, the case study method, one of the qualitative research methods, was used. The main thing in the case study is to examine an event in depth through a person or persons (Yin, 2003; Ekiz, 2009). Thanks to the data obtained through detailed examination, the smallest details about the examined situation and the relationships between the variables are easily reached (Çepni, 2009). In this study, a special case was examined for descriptive purposes and an existing situation was revealed. This special case covers the teaching knowledge of mathematics and the learning area of data processing of primary school teachers who have just started their profession. Mathematics teaching knowledge of primary school teachers related to data processing learning area has been examined in detail in this study.

Participants

100 classroom teachers (77 women and 23 men) who are working in a province in the Eastern Anatolia Region, where a lot of appointments were made as the first place of duty, constitute the participants of this study. The fact that one of the researchers worked as a classroom teacher in this region, the high number of classroom teachers assigned to this region, and the fact that the teachers working in the region were in the first years of their professional life were instrumental in selecting the participants from this district. While choosing the classroom teachers, attention was paid to the fact that they did not complete 5 years in their professional life and that they were volunteers. When we look at the schools where the participants work, 82 of them teach in full-time and 15 of them half-day schools, and 3 participants teach in multigrade classes. The classes that the participants taught; 1st grade is 33, 2nd grade is 26, 3rd grade is 27, 4th grade is 14. The majority of participants are 1 and 2 year teachers. When the universities where the teachers attended the faculty of education were examined, many different university graduate participants took part in the research. In the 2017-2018 academic year, the measurement of math teaching knowledge

with classroom teachers who have not completed 5 years in their profession is also limited to the field of Data Processing learning.

Data Collection Tools

The data in the research were collected with the "Test on the Data Processing Learning Area". In the personal information part of the data collection tool, personal information such as gender, professional experience, the university they graduated from, the school they work in and the class they teach were asked to be answered. This information is interpreted in the discussion section within the scope of teaching mathematics knowledge. It is also used to describe the participants.

Test for Data Processing Learning Area

In the process of creating this test, studies related to teaching knowledge were scanned (An et al., 2004; Ball, 1988; Bütün,2005, 2012; Hacıömeroglu, 2013) questions measuring teachers' teaching knowledge were examined. Then, the questions in the TEDS-M project, which measures the teaching knowledge of teachers internationally, and meb books and auxiliary source books were examined by the researcher. In addition, some questions adapted to Turkish were used by TEDS-M project questions (Ertaş, 2014). Within the scope of all this literature, field information questions, scenario-type open-ended questions were developed by the researchers and a pool was created with appropriate questions from the TEDS-M project. In the continuation of the study, all these questions are categorized within the scope of the teaching steps of the data processing learning field and the "Mathematical Information for Teaching" model. The question distribution in accordance with the specified model is presented in Table 2.

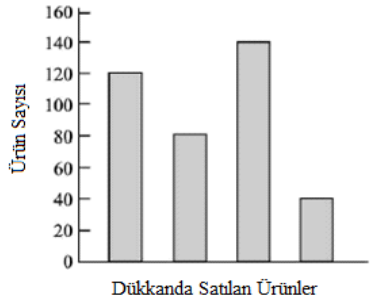
Table 2. Distribution of questions in accordance with the mathematical knowledge model for teaching

Content Knowledge	Knowledge of Content and Students	Knowledge of Content and Teaching	Curriculum Information
1a		1b	
2a,2b		3	
	4a		4b
5			
6a	6b		
	7		
		8	
9a,9c		9b	
10a			10b
11			
	12a	12b	
13a			13a,13b
	14		

The prepared questions were submitted to 3 expert mathematics educators, taking into account the opinions of the expert, the expression deficiencies in some questions (explain by associating them with the question), the narrative disorders were eliminated. Some scenario questions have been added. For example, if you want to use In question 12, Zeynep teacher's 4. The expression 'using the type of chart you want' is added to the graphic drawing question of the class students. One of the questions within the scope of the curriculum information is organized by adding a sub-article as 'What stage comes in data teaching after the step of creating researchable questions'. After the feedback of the experts, some questions in the question pool were eliminated. In the continuation of the study, the opinions of a classroom teacher who had a master's degree in mathematics education were taken about the questions. In addition, for scenario type open-ended questions, the opinions of an expert mathematics educator were taken again. After all stages, expert opinions were reflected in the questions and the data collection tool was prepared and the pilot study was applied with 17 questions and sub-articles. ith the pilot study, it was tried to determine whether teachers understood the questions, narrative disorders in the questions, spelling mistakes, lack of expression, and the time to answer them. For these purposes, the pilot work was carried out with 5 classroom teachers. After the study, a question to read a column chart similar to article a of question 6 from the questions measuring the same information was removed from the data collection tool, and visual arrangements were made by adding sub-articles to the 9th question. After the feedback from the teachers, some questions were edited in terms of grammar and narrative disorder and sub-articles were added. For example, if you want to use "In article 9 of the measuring tool, teachers were asked to find the number of boys and girls in the shape chart. In item b of the question, it was stated that the students had difficulty in converting

the figure graph to the scoreboard and the teachers asked the students, “How would you help? “The question has been asked. After the feedback, item c was added to the 9th question and the teachers were asked to draw a scoreboard table for the question. Following the feedback, statements such as “explain, why” were added to a few questions (4,7,10) in the measurement tool. After the teachers' feedback, the data of some questions were reduced to small numbers. With the pilot study, the response time of the measurement tool was determined as 1 hour. In the continuation of the study, the distribution of questions covering all subjects (Table 2) was provided, and the scope of the study was increased, and the data collection tool was finalized with the feedbacks from the teachers. Since the research has no generalization purpose, validity requirements have been provided (Ekiz, 2009; Yin, 2003). The reliability of the study was increased by specifying the characteristics of the participants, the environment in which the study was carried out and scoring twice. The data collection tool was prepared as 14 questions and sub-item questions and scripted teaching questions, questions measuring field and curriculum knowledge, and a total of 23 questions in a single test. The sample question for the data collection tool is shown in Figure 1.

6- The following problem is given to primary school students. The chart below shows the number of pencils, ballpoint pens, rulers, and erasers sold in a store in a week.



The names of the products are not included in the chart. The shop sold the most ballpoint pens. Eraser was the least sold product compared to the others. And the pencil sales were more than the ruler sales.

a- a- How many pencils have been sold?
A) 40 B) 80 C) 120 D) 140

b- Some elementary school students had difficulty solving this question. What could be the reason why students have a hard time with this question? Explain by associating it with the question.

Figure 1. Question 6 in the test

The question shown in Figure 1 is taken from the TEDS-M project. Item a of the question was prepared to measure teachers' content knowledge on the Data Processing learning field. With item b of the question, it was prepared to measure teachers' student and content knowledge.

Data Collection Process

The data collection process of the research was planned in November 2017. In the specified planning, the number of participants to be applied to the research, data collection tools and how to examine the collected data are regulated. While collecting the data of the study, the Primary School Mathematics Curriculum published in 2017 was taken into consideration and the questions of the data collection tool were prepared in this context. The data collection tool was applied to the classroom teachers who did not complete 5 years of age, who volunteered at the teacher seminars at the beginning of the semester in the district where one of the researchers worked as a classroom teacher, by obtaining the necessary permission from the national education and informing the responsible persons, on the day and time determined. It has been observed that teachers who have just started their profession are both volunteers and willing. The continuation of the study was carried out in another seminar held in the district in the middle of the semester, with the same permissions. Both applications were carried out in the same hall under the observation of the researcher, and the teachers were provided with distance to avoid being affected by each other. In the second application, it was noted that the same teachers were not tested twice. Teachers have been given an hour to answer the test with the experience gained from the pilot application.

Analysis of Data

Qualitative and quantitative data were obtained from the "Data Processing Learning Area Test", the data collection tool of the research. The quantitative data of the study were analyzed using analytical scoring rubrics inspired by the TEDS-M project. The rubric prepared by the researchers was used in the analysis of the qualitative data obtained from the scripted questions and open-ended questions. The teachers who were participants in the study were "Ö1, Ö2, Ö3..." is encoded in the form of. While preparing the rubric, assistance was obtained from an expert teacher who had a postgraduate education in the field of mathematics education for the detailed analysis of the answers of the teachers, and the opinions of 3 academicians who were experts in the field of mathematics education were consulted to finalize the rubric.

With these measures taken to increase the validity and reliability of the research, the data was reviewed twice and scoring was performed twice to ensure scoring reliability. After the first scoring was done by the researcher, it was expected for three months and then the second scoring was performed. By looking at these analyses and comparing, scoring reliability was ensured. In cases where undecided, the opinion of the second researcher was applied and a joint decision was reached. In the analysis of some of the questions in the test, the correct answers were scored as 1, and the wrong, empty and irrelevant answers were scored as 0 points. When analyzing scenario open-ended questions, the exact correct answer to the questions such as "why" and "explain" is scored as 2 points, partly as the correct answer as 1 point, and the wrong, empty and irrelevant answers as 0 points.

Table 3 shows the scoring used for the analysis of item a of the question in Figure 2 in the data collection tool, and Table 4 shows the scoring prepared for item b of the same question as an example. Scoring in item a, which measures teachers' content knowledge, and item b, which is used to test higher-level skills, are similar for other questions.

Table 3. The rubric for item a of question 6 in the test

1 Point	Correct answers	(C option 120)
0 Point	Wrong answers	(a option 40, b option 80)
0 Point	Empty answers	

Table 4. The rubric of item b of question 6 in the test

2 Point	The answers that the concepts such as 'at least' and 'most' used in the question are not understood by the children and that the children's association skills do not develop. • For example (E.g); The language used in the question is quite heavy Example; The complexity of concepts such as “less than others”, “most” and “less” made it difficult for students to understand the question. • They have difficulties because they have to edit the chart, interpret it, and re-correlate the data.
1 Point	Answers that express the points that children have difficulty in the question in general and do not specify why they have difficulties • E.g; They have difficulty reading the graph. • They have difficulty in the language used in the question.
0 Point	Wrong answers, Irrelevant answers • The chart is easy to read and understand. (Wrong answer) • I don't know, I have no idea. (Irrelevant answer)
0 Point	Empty answers

While analyzing the data of the study, teachers were defined as proficiency level. For this purpose, the points ranges and the qualification levels that should be determined are determined. While determining the proficiency levels (Ekiz 2009; Kılınç, 2012; Kutlu, 2018) the literature was used. Scores of proficiency levels were calculated separately for each component of teaching knowledge. For example, if you want to use The score ranges and proficiency levels of the mathematics teaching knowledge of the class teachers in the field of data processing learning are presented in Table 5.

Table 5. Distribution of grades of primary school teachers in the test related to the learning area of data processing

Points Ranges	Proficiency levels	f	%
0 – 7,8	Quite inadequate	0	0
7,9- 15,6	Insufficient	16	16
15,7- 23,4	Medium enough	49	49
23,5- 31,2	Sufficient	34	34
31,3- 39	Quite enough	1	1

When table 5 is examined, the general scores and proficiency levels of the teachers from the test are presented. The score ranges for teachers' knowledge of mathematics teaching were calculated as 7.8. Point Range = (Maximum Value - Lowest Value)/5) =(39-0)/5=7.8. Evaluation intervals of teachers' score averages; 0-7.8 is "quite inadequate", 7.9-15.6 is "inadequate", 15.7-23.4 is "medium sufficient", 23.5-31.2 is "sufficient", 31.3-39 is "quite adequate". Rather inadequate, inadequate, and moderately adequate levels are not at the desired level, but sufficient and quite adequate levels are determined as the desired level. Each teaching information component score intervals are calculated using the same formula. The score intervals for the field information component of the teaching knowledge are calculated as 3.2. Point Range= (Maximum Value - Lowest Value)/5)= (16-0)/5=3.2. The score intervals for the student and content information component of the teaching knowledge are calculated as 2. Point Range= (Maximum Value - Lowest Value)/5)= (10-0)/5=2. The score ranges for the teaching and content information component of the teaching knowledge were calculated as 1.8. Point Range= (Maximum Value - Lowest Value)/5)= (9-0)/5=1.8. The score intervals for the curriculum knowledge component of the teaching knowledge are calculated as 1. Point Range= (Maximum Value - Lowest Value)/5)= (5-0)/5=1. In this context, the lowest score to be taken from the test measuring

the knowledge of mathematics teaching is 0 and the highest score is 39. If the scores of the teachers are at the desired level, it is interpreted that the math teaching knowledge is sufficient and the mathematics teaching information is not sufficient if the teachers' scores are not at the desired level.

FINDINGS

In the study, the knowledge of classroom teachers who had just started their profession to teach mathematics in the field of data processing learning was examined through a test. While examining the teaching knowledge of classroom teachers, sub-components of this type of knowledge were used. The scores and proficiency levels of the teachers from the test are shown in Table 6.

Table 6. Distribution of grades of primary school teachers in the test related to the learning area of data processing

Points Ranges	Proficiency levels	f	%
0 – 7,8	Quite inadequate	0	0
7,9- 15,6	Insufficient	16	16
15,7- 23,4	Medium enough	49	49
23,5- 31,2	Sufficient	34	34
31,3- 39	Quite enough	1	1

When the scores of the classroom teachers were examined, it was determined that the accumulation was moderately sufficient. In addition, it was observed that there was a very sufficient level of 1 teacher and there was no teacher at a very inadequate level.

Findings Related to Content Knowledge of Classroom Teachers

The average score obtained from the answers given to the questions about the content knowledge, which is a component of teaching knowledge, is shown in Table 7.

Table 7. Teachers' field knowledge average score

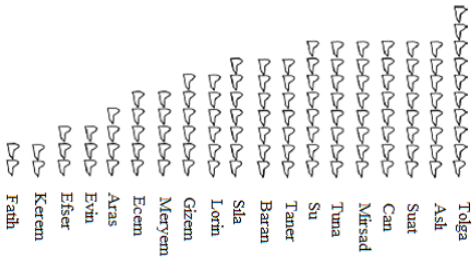
Points Ranges	Proficiency levels	f	%
0-3,2	Quite inadequate	0	0
3,3- 6,4	Insufficient	7	7
6,5- 9,6	Medium enough	30	30
9,7-12,8	Sufficient	48	48
12,9-16	Quite enough	15	15

According to the data obtained from the answers given by the primary school teachers to the questions covering the content knowledge, it was seen that the teachers generally got adequate scores, but close to 9.7 points, which is the lower limit of the sufficient level.

The 5th question, which is one of the questions covering content knowledge, and the answer of teacher Ö59 are shown in Figure 2 and Figure 3.

5- Suppose two elementary school students in a class prepare the following images to show the number of teeth their classmates have dropped.

Meltem draws pictures of his classmates on the cards to prepare the chart below. Seda cuts paper in the shape of teeth.



In terms of data presentation, how do these two impressions have similarities and differences? Type in the relevant spaces.

Similarities:

Differences:

Figure 2. Question 5 in the test

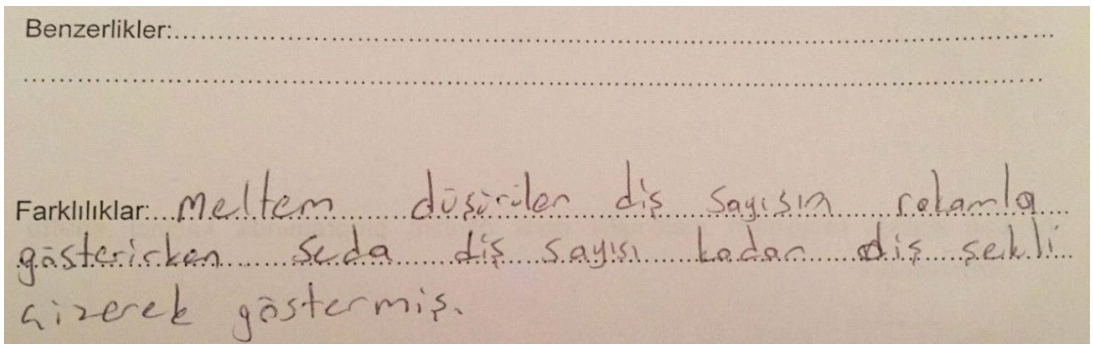


Figure 3. The answer given by the teacher coded Ö59 to the 5th question

Considering the answer of teacher numbered Ö59, information was given about the similarities and differences between the two representations, only the differences. In general, teachers answered this question in this way. The answers of the teachers who gave such answers were evaluated as partially correct and calculated as 1 point. Another question in the test 2. It was observed that the teacher numbered Ö94 gave the correct answer in the answer to item a of the question. The teacher with the code Ö87 answered the question as follows: "I would choose the object and figure graph." has answered. When the answer of the teacher coded Ö87 was examined, it was seen that the teacher did not give any justification for choosing the object or figure graphic. When the answers given by the teachers to item a of Question 2 were examined, it was observed that most of the teachers gave correct answers, but some teachers could not explain why they chose the graphic type they chose.

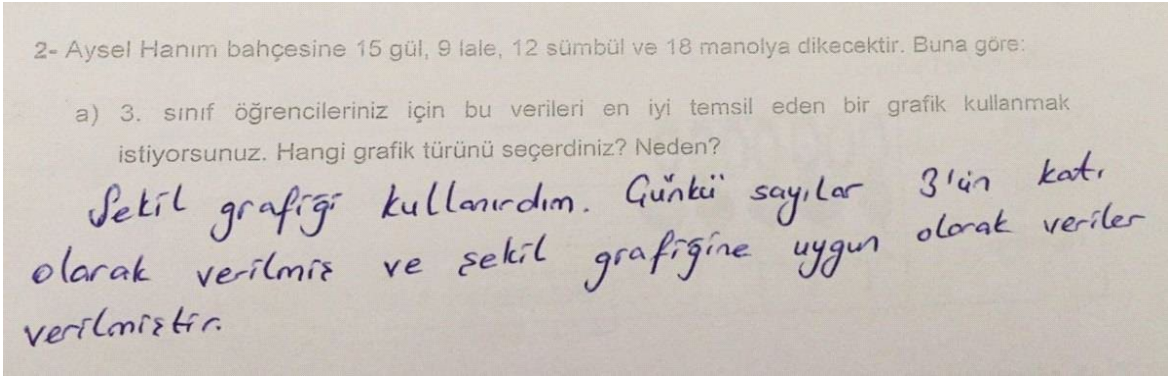


Figure 4. The answer given by the teacher coded Ö94 to item a of the 2nd question

Findings Regarding the Student and Content Knowledge of Classroom Teachers

The average scores obtained from the answers to questions related to the student and content information, another component of the teaching knowledge, are shown in Table 8.

Table 8. Students and content knowledge average scores of teachers

Points Ranges	Proficiency levels	f	%
0-2	Quite inadequate	8	8
2,1-4	Insufficient	28	28
4,1-6	Medium enough	44	44
6,1-8	Sufficient	19	19
8,1-10	Quite enough	1	1

According to the data obtained from the answers of the classroom teachers to the questions covering the student and content information, it was observed that the teachers received moderate scores in general. It was remarkable that 1 teacher got a point at a fairly sufficient level. Considering the answers given to the 14th question, which covers student and content information, 38 of the teachers answered the question completely, while 43 teachers answered the question incompletely. When looking at the answer of the teacher with the code Ö50 who answered the question in full, it is seen that the students answered the preliminary information necessary to convert the information in the column chart into a tally and frequency table in the form of being able to read the column chart, create a tally and frequency table. The teacher, code Ö50, replies: "It must have the foreground of being able to read the column chart, create a tally table, create a frequency table.". Looking at the answer of the teacher with the code Ö22, who partially answered the question, it is seen that the students answered the preliminary information necessary to convert the information in the column chart into a tally and frequency table as incomplete in the way they read and interpret the column chart. The answer of the teacher code Ö22 is shown in Figure 5.

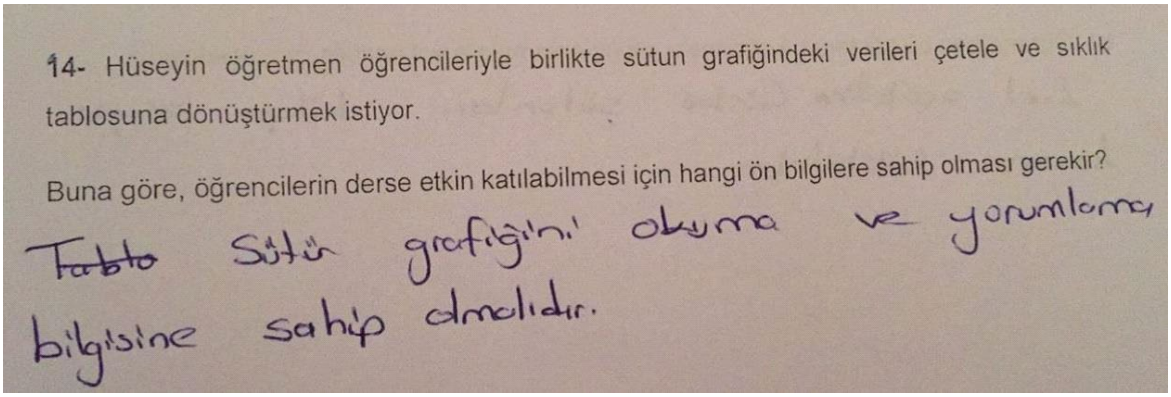


Figure 5. The answer given by ö22 coded teacher to item a of question 2

When the answers of the classroom teachers to the questions regarding the student and content information were examined, it was seen that the teachers did not respond at the desired level in general.

Findings on Teaching and Content Knowledge of Classroom Teachers

The average score obtained from the answers given to the questions about teaching and content knowledge, which is another component of teaching knowledge, is shown in Table 9.

Table 9. Teachers' teaching and content knowledge average score

Points Ranges	Proficiency levels	f	%
0-1,8	Quite inadequate	5	5
1,9-3,6	Insufficient	32	32
3,7-5,4	Medium enough	44	44
5,5-7,2	Sufficient	16	16
7,3-9	Quite enough	3	3

According to the data obtained from the answers given by the classroom teachers to the questions covering the teaching and content information, it was observed that the teachers generally scored at a moderate level. It was noted that 3 teachers scored at a very adequate level. One of the questions covering teaching and content information, question 8 and the answer of teacher Ö45 are shown in Figure 6.

8- Hülya teacher gives the following research question to 3rd grade students. He asks his students to convert this data into a graph (object or figure graph) by making a tally and frequency table.

Ayşe and Sema asked their classmates the following question and determined who liked which animal the most.

What's your favorite animal?

Chick ( ) (4 votes)

Turtle ( ) (8 votes)

Dog ( ) (10 votes)

Lion ( ) (6 votes)

The student named Buse cannot create the graph although she has created the table related to this question. If you were the teacher, how would you help your student? Explain in relation to the question.

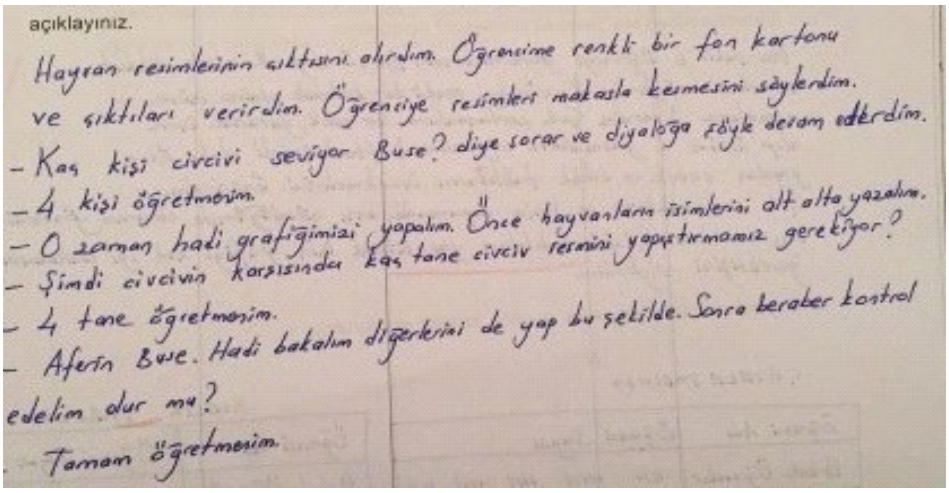

açıklayınız.
Hayvan resimlerinin sıktısını alırdım. Öğrencime renkli bir fon kartonu ve sıktıları verirdim. Öğrenciye resimleri makasla kesmesini söylerdim.
- Kaç kişi civciv seviyor Buse? diye sorar ve diyaloğa şöyle devam ederdim.
- 4 kişi öğretmenim.
- O zaman hadi grafiğimizi yapalım. Önce hayvanların isimlerini alt alta yazalım.
- Şimdi civcivin karşısında kaç tane civciv resmini yapıştırmamız gerekiyor?
- 4 tane öğretmenim.
- Aferin Buse. Hadi bakalım diğerlerini de yap bu şekilde. Sonra beraber kontrol edelim olur mu?
- Tamam öğretmenim.

Figure 6. The answer of teacher Ö45 to question 8

When the answer of teacher Ö45 is looked at, it is seen that the teacher responds correctly to the student who asks for help, both by observing the steps of creating graphics and by using a suitable teaching language. However, teachers in general answered this question partially correctly. The answer of Ö6 from the teachers who answered partially correctly is shown in Figure 7.

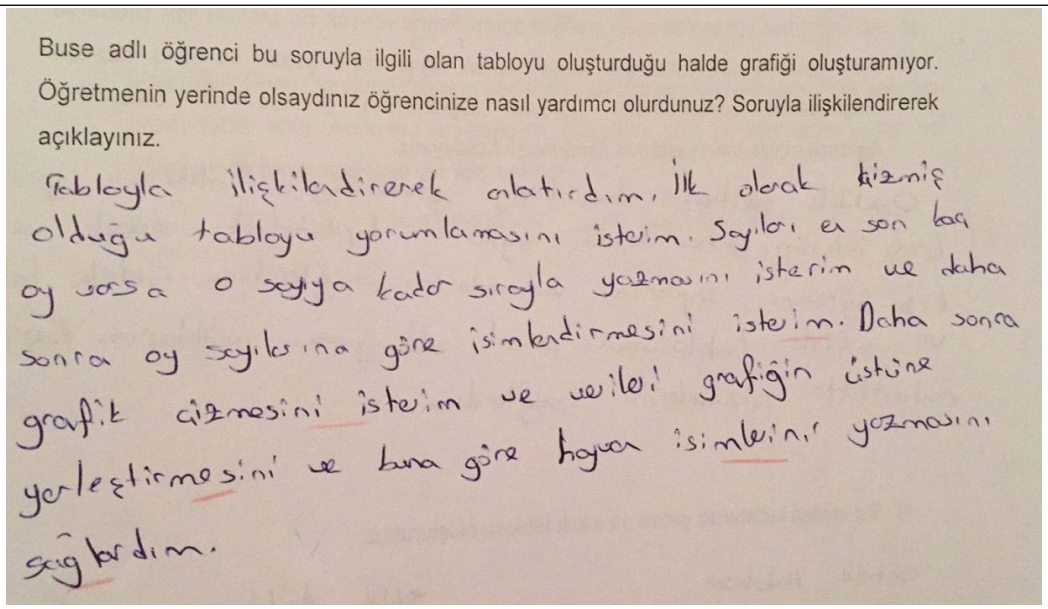


Figure 7. The answer given by teacher number Ö6 to question 8

Looking at the answer of the teacher coded Ö6, it is seen that she helped her student in creating a graph, but after determining the number of animals in the graph, she immediately asked the student to draw a graph. However, since the teacher wanted to convey the steps of creating the graph to the student in the question, such answers were partially accepted as correct answers.

Some of the teachers who answered the question incorrectly explained the solution of the problem with the scoreboard and frequency table instead of helping the students in drawing object or figure graphs. Some teachers stated that they would help students by explaining the subject again. The answer of the teachers with the code Ö5 regarding the question is shown in Figure 8.

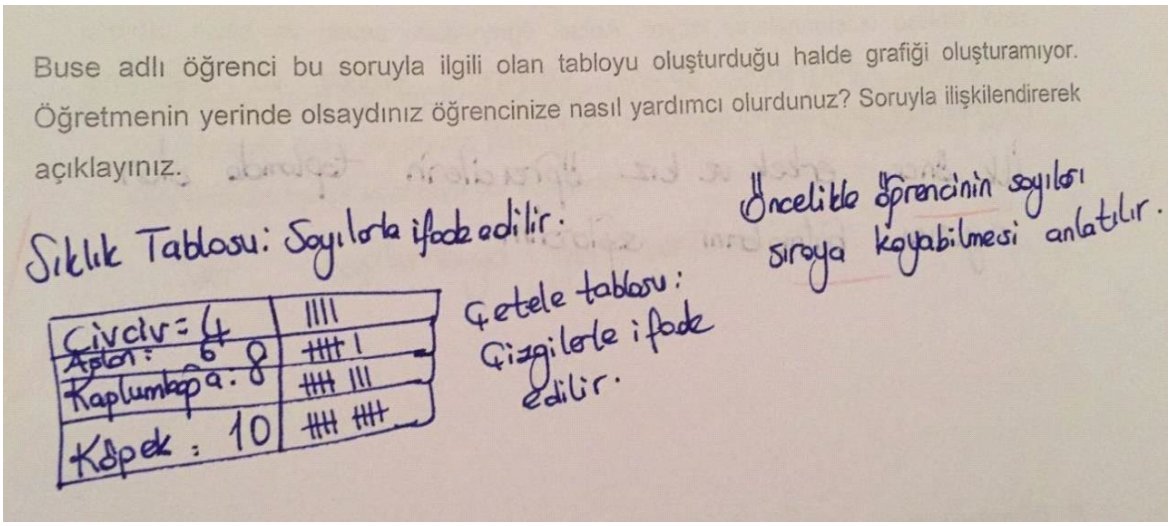


Figure 8. The answer given by the teacher coded Ö5 to the 8th question

Nearly all of the teachers (12%) who answered the question irrelevantly answered that "I do not know how to help the student". The teacher with the code Ö29 first represented the X expression with 2 votes, then tried to create the graph, but stopped creating graphics and answered "I don't know". Teachers have been shown not knowing how to help a student who can't create a chart when creating an object or shape chart. The answer of the teacher code Ö29 regarding the question is shown in Figure 9.

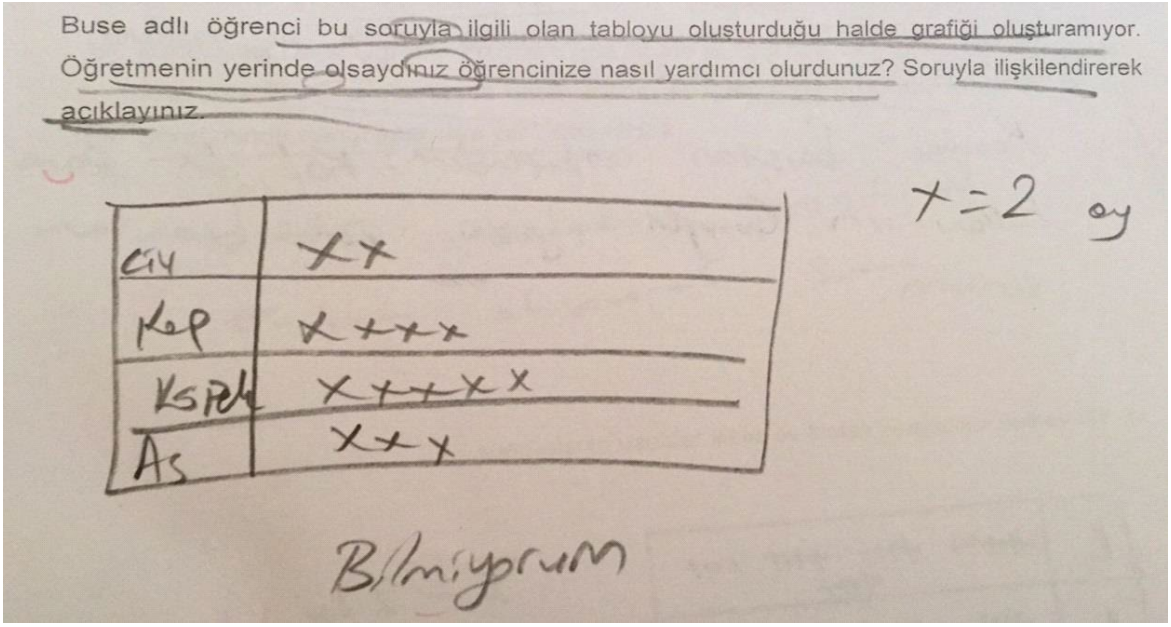


Figure 9. The answer given by the teacher coded Ö29 to the 8th question

Findings Regarding the Curriculum Knowledge of Classroom Teachers

The average score obtained from the answers to the questions about curriculum knowledge, which is another component of teaching knowledge, is shown in Table 10.

Table 10. Curriculum knowledge average scores of teachers

Points Ranges	Proficiency levels	f	%
0-1	Quite inadequate	34	34
1,1- 2	Insufficient	31	31
2,1- 3	Medium enough	19	19
3,1-4	Sufficient	14	14
4,1-5	Quite enough	2	2

According to the data obtained from the answers of the classroom teachers to the questions covering the curriculum information, it was observed that the teachers scored quite inadequately in general. One of the questions covering curriculum information, question 4 and the answer of teacher Ö77 are shown in Figure 10.

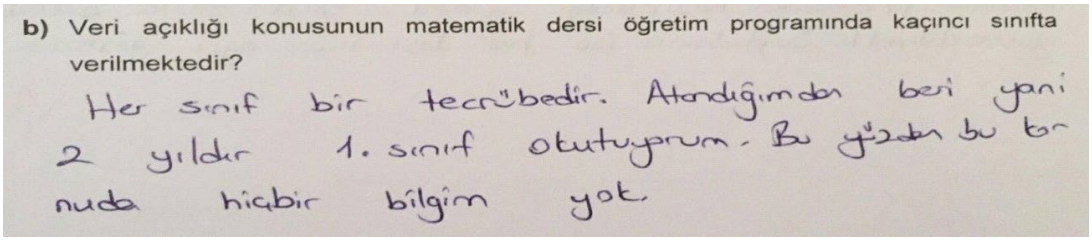


Figure 10. The answer given by the teacher coded Ö77 to item b of question 4

When looking at the answer of teacher Ö77, it states that the teacher has been teaching first grade for 2 years and therefore has no knowledge of the question. All of the teachers (27%) who answered the question irrelevantly gave this answer to the question. When looking at the answers of the teachers who answered the question incorrectly (36%), the majority stated that the data openness was the subject of the 4th grade.

As a result of the findings obtained from item b of question 10, which is one of the questions containing curriculum information, nearly half of the teachers (47%) correctly answered that the step of data collection comes after the step of creating a researchable question. While 38 teachers answered the question incorrectly, 12 teachers answered the question irrelevantly and 3 teachers left the question unanswered. The teachers who answered the question irrelevantly answered the question as "I have no idea, I don't know". Most of the teachers who answered the question incorrectly stated that the hypothesis-thesis stage came after the researchable question formation step. The answer of the teacher with the code Ö89 regarding the question is shown in Figure 11.

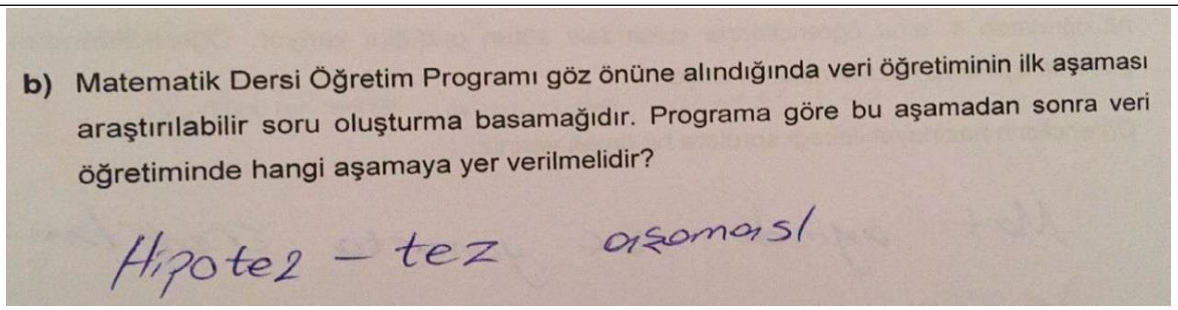


Figure 11. The answer given by teacher Ö89 to item b of question 10

According to the findings obtained from item b of question 13, which is one of the questions containing curriculum information, 63% of the teachers answered that the column chart should be taught after the figure chart. 31 teachers answered the question incorrectly. When looking at the answers of the teachers who answered the question incorrectly, it is seen that the answers that "after the teaching of the figure chart should be started, the tally chart, the tally and frequency table, the circle chart should be taught". The answers of the teachers with the code Ö68 and Ö17 are shown in Figures 12 and Figure 13.

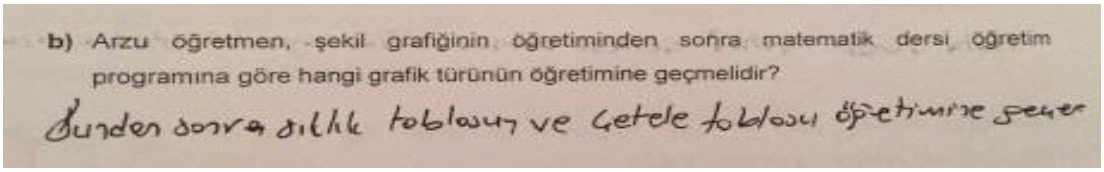


Figure 12. The answer given by the teacher coded Ö68 to item b of the 13th question

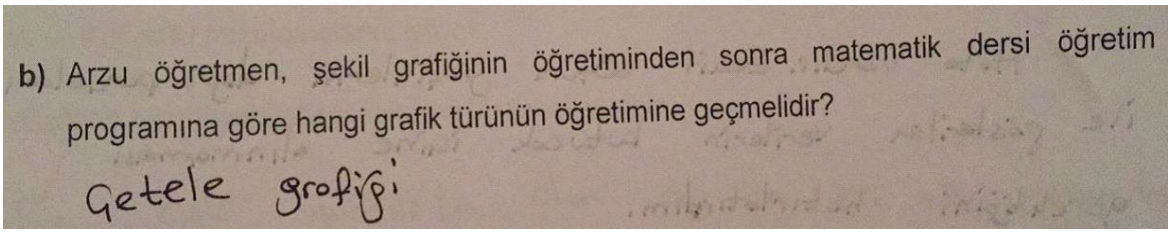


Figure 13. The answer of Ö17 coded teacher to item b of question 13

When we look at the answer of the teacher coded Ö68, he says that he will start teaching the frequency and scoreboard after the figure graph. However, in the primary school mathematics curriculum, it is seen that the figure graph, which includes the scoreboard and the frequency table, is taught from the 2nd grade onwards. In addition, when the answer of the teacher coded Ö17 was examined, it was seen that the teacher stated the scoreboard table as a type of graphic. 31% of the teachers have been a remarkable finding that cannot be discriminated between the table and graphics.

DISCUSSION

Researchers have done many studies in order for teachers to teach effectively, efficiently and qualityly (An et al., 2004; Ball et al., 2008; Shulman, 1986,1987). The common conclusion from these researches is that teaching knowledge must be sufficiently advanced in order to have a qualified education (Ball et al., 2008; Fennema & franke, 1992; Hawkins, 2012). When the answers of the teachers to the questions prepared in the designated learning area were examined, it was generally seen that they scored at a moderate level. In fact, it was determined that only 1 teacher scored at a very adequate level. In this respect, it was seen that the teachers who had just started the profession had deficiencies in the knowledge of teaching mathematics, teaching, understanding the student and curriculum. Especially in teaching information questions, it was determined that teachers did not explain enough detailed explanations to the students about the points that the students did not understand. For example, if you want to use many teachers used general expressions in such questions to answer "I would re-explain the question", "I would do homework on the question", and it was determined that they did not provide explanations that would allow students to learn conceptually. In a similar study, Kutlu (2018) stated that secondary school math teachers who had just started their profession had similar deficiencies in their teaching knowledge and were not aware of their deficiencies in teaching. In another study, Aylar (2017) examined the teaching knowledge of class teacher candidates and found that they could not put the information of teacher candidates into practice. When we look at the researches, it is seen that these deficiencies in the teaching knowledge of both teacher candidates and teachers who have just started the profession are a negative situation for a qualified education. When the teachers looked at the field information in the designated learning area, it was seen that they confused concepts such as tables and graphics. The fact that 31 percent of the class teachers who participated in the study responded as a tally chart instead of a column chart, frequency chart can be considered as an indication that teachers lacked

knowledge of the basic concepts of data processing learning. Şahinkaya and Aladağ (2013) supported teachers in their studies on graphics by mixing graphic and table concepts. In a similar study, Ertaş (2014) stated that teachers who compared the mathematical knowledge of math teacher candidates with international averages with the questions related to the TEDS-M project were below average in data processing alone. In addition, when the net averages of the "2018 and 2019 Teacher Field Knowledge Test "(20.32) of the classroom teachers are looked at, it is seen that the teachers did not answer half the questions correctly. In another study, Küçük et al. (2012) examined the readiness levels of prospective classroom teachers for the field of data learning. In the light of the information obtained from the results of these two studies, it was seen that the mathematical knowledge of the classroom teachers about data processing while taking courses at the faculty of education was at a moderate level, and after graduating from education faculties, their mathematical knowledge of this area continued at the same level. In studies that emphasize the importance of content knowledge for a qualified mathematics teaching (Ball, 1990; Even, 1993; Shulman, 1986), it has been stated that comprehensive content knowledge positively affects teaching knowledge.

Teachers' knowledge of students and content was measured with questions containing sub-items of understanding the student, estimating what the student knows and how much, and being able to predict where the students will have difficulty in the subject and where they will understand more easily. As a result of the answers of the teachers in the study, it was determined that the general knowledge of the students and content of the teachers was not sufficient. Particularly, the teacher's answers to some questions drew attention. For example, if you want to use In question 7, teachers were asked at what points the student was struggling to solve the question, and the majority of teachers did not answer the question correctly. In item a of the 12th and 14th questions regarding the knowledge of knowing the student, the fact that the minority of the teachers answered the question as "I don't know" shows that the teachers who have just started their profession are insufficient in recognizing and understanding the student. Karal-Eyüpoğlu (2011) stated that teacher candidates lacked in predicting the preliminary information of the students and predicting which part of the problem the students would struggle with. In the study Yurtyapan (2018), which produced similar results, he investigated the knowledge of secondary school mathematics teachers to recognize the student about triangles and quadrilaterals and found that the teachers were very lacking. Kutlu (2018), which examined the teaching knowledge of mathematics teachers at the same seniority as the current study, repeated that teachers were inadequate in recognizing students. In his research, Açıksöz (2017) compared experienced teachers and inexperienced teachers within the scope of knowing the student. As a result of the research, it was determined that inexperienced teachers knew the students and knew which students had difficulties in which subject, but they were insufficient to understand why the students had difficulties in the determined subjects. Likewise, in the study conducted, it was observed that the teachers identified student mistakes in most of the questions, but they could not provide sufficient explanations for why they made these mistakes.

The partly accurate answer of teachers' teaching questions also shows that they are not helping their students enough. Teachers' teaching and content knowledge were examined within the scope of guidance at points where students were confused, the way students answered different questions, and the ability to show different solutions to a problem. Teachers' short, simple and inadequate answers in the form of solving more examples in general, doing homework and recounting the subject in order to help students with difficult questions show shortcomings in teachers' teaching knowledge. In addition, the fact that some teachers have been teaching for 1-2 years but have not made any time for this learning area shows that teachers do not realize the importance of this field. In the first years of teaching, it is obvious that teachers have difficulty especially in teaching. In the study applied, the shortcomings of teachers in teaching were repeated. In a similar study, Şen (2019) said that teachers use a limited number of methods and techniques in their teaching knowledge about quadrilaterals and that they cannot remember the name of some of these methods and techniques they applied. Looking at the literature within the scope of teaching knowledge, Aksu and Konyalıoğlu (2014) stated that the classroom teachers were inadequate in teaching the subject of transactions with fractions, and in the Bütün (2012) study, teacher candidates were not sufficient for teaching when explaining a partition process to their students, and in the Toluk-Uçar (2011) study, teachers knew the four procedures rules related to fractions but could not explain why these rules were used. In a different study, Aydın (2015) observed that classroom teachers generally use traditional methods in the teaching of science classes and do not benefit from contemporary methods.

It is a great concern that classroom teachers who have just started the profession score at a very inadequate level in curriculum knowledge, which is another component of teaching knowledge. In fact, the fact that some teachers have been teaching first grade for 2 years, so I don't know about this subject, shows that teachers do not learn enough about curriculum knowledge at university. When the studies examining the curriculum information are examined (Aksu, 2013; Aydın, 2015) teachers are generally inadequate in this information component. Kutlu (2018) stated in her study that the curriculum information of secondary school mathematics teachers in the first years of their profession was insufficient, and Açıksöz (2017) stated that novice teachers should increase their curriculum knowledge. As Gess-Newsome (1999) states, the first steps of teaching knowledge are taken in educational faculties. The education that teachers receive here affects the whole professional life in a positive or negative way. For this reason, courses containing curriculum knowledge in education faculties should be reviewed again. It is thought that another reason for this deficiency in teachers' curriculum information is that MEB constantly changed the mathematics curriculum in 2009, 2015 and 2017. As a result of all this information, it was seen that the teacher had shortcomings in the types of information determined for effective teaching. In the pre-service period, teacher training institutions and academicians working in these institutions have a great responsibility in eliminating the deficiencies of teachers in this regard. In addition, the Ministry of National Education and teachers should also do their part in this regard.

CONCLUSION AND RECOMMENDATIONS

According to the results of the study, the knowledge of classroom teachers who are just starting out in the profession to teach mathematics in the field of data processing is not sufficient. In the light of the data obtained in the answers of teachers, the lack of teaching knowledge is noticeable in the majority of teachers. Although teachers' field knowledge scores were lacking, they were found to be better than other components. Within the scope of student and content information, it was determined that teachers were particularly lacking in getting to know students. In fact, it has been determined that new teachers cannot express themselves to students. It was determined that the explanations they gave to the students were not sufficient due to the general inexperience of the teachers within the scope of teaching and content knowledge. In addition, the fact that the teachers generally gave partially correct answers to the instructional knowledge questions showed that they did not have sufficient knowledge about the concepts of graphics and tables. Within the scope of curriculum knowledge, which is another component of teaching knowledge, it has been determined that teachers are very lacking.

Considering all these shortcomings, it is thought that classroom teachers should be able to cooperate with groups, participate in workshops and in-service activities, and even improve themselves by continuing postgraduate education. As a result of the study, it may be recommended to increase the course hours of the courses such as "Mathematics Teaching I-II" and "Teaching Practice" or to make new arrangements for the applications of the courses in order to compensate for the shortcomings of the newly started classroom teachers in the field of teaching before starting the profession. In order to eliminate the shortcomings of teachers in field knowledge, the field knowledge at the elementary school level should be taken into account more in the content of the "Basic Mathematics" or "Mathematics in Primary School" courses given in the faculties of education. In addition, in order to eliminate the deficiencies in teachers' curriculum knowledge, courses called "Elementary School Curriculums" can be added in the courses in the faculties of education. At the same time, when there is a change of program, seminars should be organized for teachers and the new program should be introduced in detail.

As seen in the study, it was observed that the academic knowledge levels of teachers were not sufficient in some basic concepts. Therefore, it is thought that the preparation of guidebooks that help the teacher with the necessary explanations for the basic conceptual misconceptions that MEB classroom teachers often encounter in mathematics teaching will benefit the teaching.

Researchers who will be inspired by the study and will work within the scope of this subject in the future can be studied in different learning areas and different data collection tools will be used to measure teaching knowledge. Such studies can be applied to teachers in different branches. This study was evaluated within the framework of the "Mathematical Knowledge for Teaching" model developed by Ball et al. (2008). Other researchers can conduct studies using different models. Studies can be carried out comparing the teaching knowledge of experienced teachers with inexperienced teachers or even teachers who are at certain periods of their professional life (1-5-10). By identifying fewer participants, the development of teachers who have just started the profession can be examined according to the years. Within the scope of the information obtained from the results of the study, studies can be carried out to eliminate the deficiencies of teachers in teaching knowledge.

Declaration of Conflicting Interests

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Statements of publication ethics

We hereby declare that the study has no unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The first author conceived the presented idea and collected the data. The second author guided the research process.All authors discussed the results and contributed to the final version of the article.

Ethics Committee Approval Information

This study was carried out in accordance with the approval of Karadeniz Technical University Graduate Education Institute. (Sciences Ethics Committee. (Ethics Committee Approval Date: 29/03/2018, Approval Number: 82554930-4001732)).

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