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DYSCALCULIA: THE HIDDEN BARRIER OF MATHEMATICS TEACHERS' AWARENESS, EXPERIENCES AND SUGGESTIONS[1]

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Abstract

Dyscalculia is a learning disorder that affects students' ability to understand mathematical concepts and acquire mathematical skills. This study investigates elementary mathematics teachers' awareness, experiences, and suggestions regarding dyscalculia. The research employed a phenomenology design with purposive sampling, focusing on elementary mathematics teachers as participants. The researchers conducted online semi-structured interviews with 15 elementary mathematics teachers from different schools. The study explored teachers' knowledge of dyscalculia, their exposure to the concept during undergraduate education, and strategies for supporting students with dyscalculia. Data analysis was performed using content analysis methods, following validity and reliability strategies that included credibility, transferability, consistency, and confirmability criteria. The findings revealed that while most teachers possessed general knowledge about dyscalculia, they struggled to identify and support students diagnosed with the condition in their classrooms. The study concluded with recommendations for educational policies to improve academic outcomes for students with dyscalculia.

Keywords: *Dyscalculia, Mathematics learning difficulty, Teacher awareness, Teacher experience, Qualitative research.*

Diskalkuli: Matematiğin Gizli Engeli Öğretmenlerin Farkındalıkları, Deneyimleri ve Önerileri

Öz

Diskalkuli, matematiksel kavramları anlama ve matematiksel becerileri edinmede zorluk yaşayan öğrencileri etkileyen bir öğrenme bozukluğudur. Bu çalışma, ilköğretim matematik öğretmenlerinin diskalkuli hakkındaki farkındalıklarını, deneyimlerini ve önerilerini belirlemeyi amaçlamaktadır. Araştırmada nitel araştırma desenlerinden fenomenoloji deseni kullanılmış ve amaçlı örnekleme tercih edilmiştir. Farklı okullardan 15 ilköğretim matematik öğretmeniyle yarı yapılandırılmış görüşmeler, araştırmacılar tarafından çevrim içi olarak gerçekleştirilmiştir. Çalışma, öğretmenlerin diskalkuli hakkındaki bilgi düzeylerini, lisans eğitiminde diskalkuli kavramıyla tanışmalarını ve diskalkulik öğrencilere nasıl daha iyi destek sağlanabileceğini araştıran sorularla yapılandırılmıştır. Elde edilen veriler içerik analizi yöntemiyle incelenmiştir. Araştırmada geçerlilik ve güvenilirlik stratejileri takip edilerek inandırıcılık, aktarılabilirlik, tutarlılık ve teyit edilebilirlik ölçütleri kullanılmıştır. Bulgular, öğretmenlerin çoğunluğunun diskalkuli hakkında genel bir bilgiye sahip olduğunu, ancak diskalkuli tanısı almış öğrencileri sınıf ortamında tanımakta ve desteklemekte zorlandıklarını göstermiştir. Ayrıca diskalkuli tanısı almış öğrencilerin eğitiminde daha iyi başarı elde edilmesine yardımcı olabilecek eğitim politikaları önerileri sunulmuştur.

Anahtar Kelimeler: *Diskalkuli, Matematik öğrenme güçlüğü, Öğretmen farkındalığı, Öğretmen deneyimi, Nitel araştırma.*

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1. Introduction

Mathematics plays a significant role in human existence, appearing in many areas (Salisa & Rahaya, 2023, p. 94). It is often seen that a high level of mathematical skill is critical for good performance in daily life and school due to the nature of society (Lyons & Ansari, 2015). In this context, in addition to acquisition of basic skills in education, the importance given to the acquisition of mathematical skills is also increasing. These mathematical skills included in the mathematics course curriculum published by the Ministry of National Education (Milli Eğitim Bakanlığı [MEB], 2018) are as follows: Students effective usage of estimation and cognitive calculation skills, developing and effectively using mathematical literacy skills, and ensuring the development of metacognitive knowledge and skills.

The learning difficulty that complicates or prevents the acquisition of these mathematical skills in the field of education is expressed as mathematics learning difficulty (dyscalculia) in the literature (Melekoğlu, 2022, p. 7). Dyscalculia is considered as a mathematical inadequacy that appears in mathematical reasoning problems, such as arithmetic facts, number concepts, and situations such as fluent calculation (American Psychiatric Association [APA], 2013). Dyscalculia appears as a specific learning difficulty that affects an individual's ability to perform mathematical skills related to number calculations (Kunwar & Sharma, 2020). Some warning signs that should be considered in the early diagnosis of individuals at risk of dyscalculia are as follows:

- The student has a weak sense of direction and therefore frequently gets lost at school.
- They have difficulty understanding even simple number concepts and cannot grasp numbers intuitively.
- They can read, write and speak, but have difficulty with counting and arithmetic skills.
- Difficulty in making mental calculations, counting by touch and talking about mathematical operations.
- Forgetting the mathematical operations quickly and slow processing skills compared to their friends.
- They have difficulty choosing which operation (addition, subtraction, multiplication, division) to use when solving mathematical problems.
- They have difficulty perceiving the concept of time and reading clocks and estimating the passage of time.
- They struggle with using money while shopping and have difficulty understanding the value of money (Henderson, 2012; Mutlu, 2016).

Specifically, students at risk of dyscalculia show distinct behaviors such as spending excessive time for counting, having very slow calculation speeds, and experiencing difficulty in solving different types of mathematical problems (Fu & Chin, 2017, p. 3). Having dyscalculia can dramatically affect a student's thoughts towards mathematics. Students who start school enthusiastically may experience disappointment due to the difficulties they face in mathematics. For example, a 9-year-old student diagnosed with dyscalculia may have the mathematical knowledge of a 6-year-old student, or 17-year-old individuals diagnosed with dyscalculia may have the same level of mathematical understanding as a typical 10-year-old child. Consequently, 35% of students with learning difficulties, such as those diagnosed with dyscalculia, leave middle school early (Henderson, 2012).

Students diagnosed with dyscalculia may perform well in areas other than the mathematics curriculum. Due to this situation, it becomes difficult to diagnose students. In the literature, it is stated that 3% to 6% of children with learning disabilities have math learning disabilities (Kucian & Von-Aster, 2015). A comprehensive cognition and intelligence testing process is necessary for the definitive

diagnosis of students at risk for dyscalculia (Williams, 2013, p. 8). In this case, understanding the underlying causes of students' problems in conceptual understanding and mathematical reasoning can help teachers understand their students' mathematical skills (Salisa & Rahaya, 2023, p. 95).

Teacher observation is important in the diagnosis of students at risk of dyscalculia. A teacher should start to suspect dyscalculia when a student in their class has the following characteristics: If the student becomes anxious in mathematics classes and is slow to understand any numerical information, if the student cannot answer quickly and makes negative comments about themselves, if the student uses their fingers to count and sees numbers as a group while also struggling to understand the approximate values and magnitude values of numbers, if they cannot recognize patterns between numbers and cannot remember the order of calculation and cannot make predictions about the answer, and if there is inconsistency, a diagnosis of dyscalculia can be made (Henderson, 2012).

In addition, the teacher should pay attention to the effectiveness of the content presentation in conveying the subject to the student diagnosed with dyscalculia in the classroom. In other words, the use of multiple senses should also be included. Kunwar (2022) briefly explained some main ways for effective content presentation for dyscalculic students:

1. Use of multiple senses: Ensuring that students actively participate in the mathematics teaching process, thus enabling sincere learning to occur when students participate in the process. This can help a student diagnosed with dyscalculia understand difficult topics.
2. Use of technology: Modern technology can be used to accelerate basic skills in reading, writing, and arithmetic. Therefore, the use of technology can help a student diagnosed with dyscalculia to learn mathematics actively and enjoyably.
3. Concretization: Utilizing various concrete materials in your environment when teaching numbers and concepts, thus using a multi-sensory approach to provide real learning.
4. Making education fun: Since poor delivery of mathematics can lead to fears, playing games like dice and dominoes can make learning fun and help the student become familiar with counting and number relationships.
5. Using more visualization: Modeling the subject and using diagrams when explaining topics in mathematics, this can help the student to grasp the subject effectively.
6. Less teaching but regular teaching: In this teaching approach, topics are divided into small parts, and these parts are taught and given regularly and continuously. Students diagnosed with dyscalculia do not prefer long teaching methods and time-demanding calculations, so this approach can be used effectively on them.
7. Effective communication with the student: The close relationship established between students and teachers makes it easier for students to ask their teachers questions when they have difficulty learning. It can also help teachers know where to address their students' difficult moments.
8. Use of peer learning: Selecting students in the class who are intelligent and good at mathematics and asking them to explain the subject to students diagnosed with dyscalculia; in peer activities can allow students to feel comfortable learning with inspiring friends.

Dyscalculia should not be an obstacle in reaching life goals for a student diagnosed with dyscalculia. This can be prevented with the right support and determination. The increase in awareness level within the special learning difficulty of dyscalculia makes us more optimistic about the future (Hornigold, 2015).

1.1. Significance of the Study

There are studies in the literature that address teachers' views and awareness of mathematics learning disabilities (Hacısalihoğlu-Karadeniz, 2013; Kırmızıgül, 2020; Korkmaz et al., 2024; Mutlu et

al., 2022). Results of the research show that understanding dyscalculia and its characteristics can enable teachers to be better informed about potential challenges when they encounter students diagnosed with dyscalculia in their classrooms. Therefore, it can be said that the interest in dyscalculia has increased in the literature.

This study aims to reveal how much knowledge teachers have about dyscalculia and their level of awareness on this subject. This is intended to provide a foundation for developing teacher education programs and policies for dyscalculia. The importance of the study is that, in addition to the studies in the literature that reveal the views of elementary mathematics teachers about dyscalculia, it also reveals the teachers' perspectives on the inclusion of dyscalculia in undergraduate education in detail. Additionally, data obtained from teachers' classroom experiences will provide a realistic framework of the difficulties faced by students encountering dyscalculia in their educational processes.

The study is expected to be informative about practices that other teachers and educators can use by revealing the strategies and methods used by teachers when working with students experiencing dyscalculia, and to guide teacher training programs and in-service training content. The study aims to develop more sensitive approaches to students' individual differences by offering suggestions that will increase the success of students experiencing dyscalculia and support their psychological well-being. It contributes to issues of equality and inclusivity in education by presenting important suggestions for creating inclusive educational environments for students experiencing dyscalculia. This study is considered to be of critical importance in terms of creating an education system that can better respond to the needs of both teachers and students.

1.2. Purpose of the Study

Teachers play a crucial role in education by motivating students and fostering positive attitudes towards learning mathematics (Kunwar & Sharma, 2020, p. 1). Mathematics teachers and educators are important for designing different teaching processes for students diagnosed with dyscalculia (Fu & Chin, 2017, p. 10). In this context, the general purpose of the study has been determined to reveal the awareness, experiences, and suggestions of elementary mathematics teachers, who have an important role in mathematics teaching, about dyscalculia. Within the framework of this general purpose, the study seeks answers to the following sub-problems:

- What are the views of elementary mathematics teachers on the concept of dyscalculia?
- What are the views of elementary mathematics teachers on the characteristics of students diagnosed with dyscalculia?
- What are the views and suggestions of elementary mathematics teachers on how the mathematics education process should be structured for students diagnosed with dyscalculia?
- What are the views of primary mathematics teachers on providing better support to students diagnosed with dyscalculia?
- What are the views of elementary mathematics teachers on including dyscalculia-themed education in undergraduate programs and their suggestions on structuring this education?
- What are the suggestions of elementary mathematics teachers for increasing awareness of dyscalculia among educators?

2. Methodology

2.1. Research Design

The study employed phenomenological research design, which is one of the qualitative research method designs. Phenomenological studies enable the explanation of the meanings of experiences that several individuals have lived in relation to a concept or phenomenon (Aydın, 2023, p. 89). The main

aspect of phenomenological studies is to grasp the experience shared by the study group on a common ground in the research. It is important to understand that the subjective and objective experiences of individuals in the study group will be uncovered (Padilla-Díaz, 2015, p. 108). In this context, the study involves a phenomenological examination of awareness, experiences, and suggestions for increasing awareness regarding the phenomenon of dyscalculia among participants consisting of elementary mathematics teachers. This research was conducted using a qualitative research method to determine the awareness, experiences, and suggestions about dyscalculia of a total of 15 elementary mathematics teachers currently in service. Qualitative research includes verbal explanations of situations occurring in real life and explains phenomena within their own contexts (Silverman, 2018).

2.2. Study Group of the Research

In the research process, elementary mathematics teachers (grades 5-8) were determined as the study group of the research. In phenomenological studies, the study group is determined as a heterogeneous group ranging in size from 3-4 people to 10-15 people (Creswell & Poth, 2018, p. 124). Therefore, the study group was limited to 15 elementary mathematics teachers. Purposive sampling was used to select these 15 elementary mathematics teachers. The reason for choosing elementary mathematics teachers in the study is that the symptoms of dyscalculia are more noticeable in mathematics lessons. Therefore, this sample was selected to determine the awareness of mathematics teachers. Purposive sampling is the selection and consideration of rich situations that will illuminate the research question (Patton, 2014). In the study, 15 elementary mathematics teachers were coded as EMT1, EMT2, EMT3.....EMT15.

Table 1

Demographic Characteristics of the Study Group

School Type	Education Level	Professional Seniority	Participants
Private school	Bachelor's degree	0-5 years	EMT3, EMT 6, EMT13
Private school	Bachelor's degree	11-15 years	EMT1
Private school	Master's degree	0-5 years	EMT2, EMT8, EMT12
Public school	Bachelor's degree	0-5 years	EMT9
Public school	Bachelor's degree	11-15 years	EMT4, EMT5
Public school	Master's degree	0-5 years	EMT7, EMT15
Public school	Master's degree	21-25 years	EMT11
Public school	Doctorate	16-20 years	EMT10, EMT14

Table 1 shows the demographic characteristics of the study group. According to the type of school they work in, 8 elementary mathematics teachers working in public schools and 7 elementary mathematics teachers working in private schools are included in the study group. When we look at the educational status of the teachers, 7 with bachelor's degrees, 6 with master's degrees, and 2 with doctoral degrees are included in the study group. Considering their professional seniority in terms of years of

work, it is observed that 9 teachers have 0-5 years of work experience, 3 teachers have 11-15 years, 2 teachers have 16-20 years, and 1 teacher has 21-25 years of work experience.

2.3. Data Collection Tool and Process of the Research

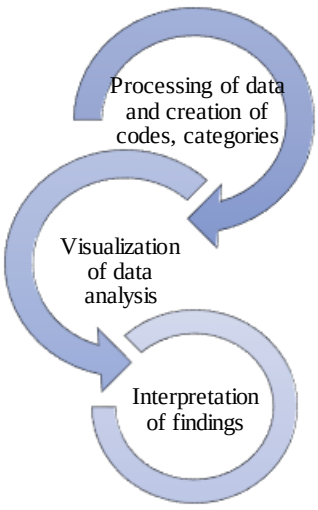
A semi-structured interview form was used as the data collection tool in the research. In preparing the semi-structured interview form, studies in the literature on teachers' awareness of dyscalculia were utilized (Hacısalihoğlu-Karadeniz, 2013; Kırmızıgül, 2020; Korkmaz et al., 2024). The semi-structured interview form was structured with research questions about how much knowledge elementary mathematics teachers have about dyscalculia, their introduction to the concept of dyscalculia in their undergraduate education, and how better support can be provided to students with dyscalculia. For the validity and reliability of the semi-structured interview form used as a data collection tool, the questions in the form were prepared in a clear and concise manner, parallel to the purpose of the research. Additionally, for validity and reliability, the questions in the semi-structured interview form were prepared taking into account examples of how adequate research questions should be, in line with Smith and Osborn's (2004) phenomenological research study (Smith & Osborn, 2004). The semi-structured interview form prepared in accordance with all these considerations was then presented to field experts. Furthermore, for the validity and reliability of the study's data, a detailed explanation of the study's purpose was provided to the study group before the application of the semi-structured interview form, and the principle of voluntariness was mentioned. The semi-structured interview form was shared online with 15 elementary mathematics teachers, and the study's data was obtained.

2.4. Data Analysis

Although various and different analysis steps are followed in each qualitative research design, there are common steps followed in each design. These steps are: Processing the data, visualizing the data, and interpreting the findings (Çelik et al., 2020, p. 384). These steps were followed in this study.

Figure 1

Qualitative Data Analysis Process of the Research



Content analysis was used to analyze the research data. The responses from the teachers were coded as EMT1, EMT2...EMT15 and this nomenclature was used in the analysis of the responses. First, the teachers' responses to the semi-structured questions were analyzed. The responses were coded with confidential content by two researchers and conclusions were made by discussing the codes that were not common. Then, categories were determined according to frequency. Subcategories were then formed

by combining multiple codes consisting of common ideas. For the validity and reliability of the data analysis of the study, the characteristics that a code should have in order to be a category were taken into consideration (Merriam & Merriam, 2009, p. 185). Main categories or themes were created by establishing links between subcategories. After the data were coded and organized into categories, the teacher responses that best represented each category were presented with examples.

2.5. Validity and Reliability

To ensure internal validity, research processes should be questioned with a critical perspective, and the degree to which the findings and results reflect reality should be controlled (Yıldırım & Şimşek, 2021). In this study, the participation of volunteers was essential. Additionally, internal validity was sought by consulting expert opinions, including two special education specialists and two elementary mathematics education specialists. The lack of using different data collection tools in terms of internal validity was considered a limitation.

External validity is the generalizability of research results (Yıldırım & Şimşek, 2021). In this context, the research design, study group, data collection tools, data analysis, and interpretation were explained in detail throughout the research process. The identities of the elementary mathematics teachers participating in the research were kept confidential. Purposive sampling was used to ensure the transferability of knowledge, experience, and awareness regarding dyscalculia in line with the study's objective. To ensure internal reliability, responses to the semi-structured interviews were objectively explained in the findings section. Data was collected in parallel with the research question. Consequently, the research question was addressed in terms of this parallelism in the findings section. To ensure the reliability of data analysis, the authors reached a consensus by including themes, categories, codes, and participant codes with the help of tables. In other words, consensus was achieved among researchers in creating codes, categories, and themes. To ensure external reliability, the processes conducted throughout the study were explained in detail under relevant headings. Consulting experts conducting similar studies is important in terms of bringing about the requirement for inter-coder reliability. In this case, when research is appropriate, inter-coder reliability can improve the internal quality of qualitative studies (O'Connor & Joffe, 2020). In this direction, it was confirmed that the analysis, findings, results, discussion, and recommendations sections were consistent with each other.

2.6. Ethical Approval

For this research ethical clearance document 2024-YÖNP-0504 was obtained from the Scientific Research and Publication Ethics Committee of Çanakkale Onsekiz Mart University on May 30, 2024, with decision number 08/08.

3. Findings

This section presents the findings obtained based on research data. The responses given by the elementary mathematics teachers who participated in the research to the research questions are presented to the reader through the created tables and models. Direct quotations from the findings are also included.

Table 2

Elementary Mathematics Teachers' Views on Their Knowledge About the Concept of Dyscalculia

Theme	Category	Codes
Concept of dyscalculia	Mathematics learning difficulty	Mathematics learning difficulty (f=10) Difficulty with mathematical terms, calculations, and symbols (f=5)

One of the sub-problems we addressed in this study is to reveal the existing facts about dyscalculia among elementary mathematics teachers. In this context, looking at the findings obtained in Table 2, it can be said that teachers meet on common ground and are consistent. Teachers know that dyscalculia is a mathematics learning difficulty. It appears that they are aware that this learning difficulty is related to mathematics. It is important that a teacher expressed the view that dyscalculia is a learning difficulty, not an intellectual disability. This is because the idea that dyscalculia stems from intellectual disability is an issue that needs to be addressed seriously.

After examining the teachers' views on mathematics learning disabilities, their views on the characteristics of students diagnosed with dyscalculia were examined. Their views on the characteristics of students diagnosed with dyscalculia were obtained through interviews with them and then subjected to data analysis. The findings are presented in Table 3.

Table 3

Elementary Mathematics Teachers' Views on the Characteristics of Students Diagnosed with Dyscalculia

Theme	Category	Codes
Characteristics of dyscalculic students	Difficulty in mathematical operations	Struggling with mathematical calculations (f=6)
		Difficulty in learning multiplication tables (f=2)
		Difficulty in reading numbers and writing them backwards (f=3)
	Difficulty in daily activities	Difficulty in reading clocks (f=2)
		Difficulty while shopping (f=1)
	Interest in the lesson	Lack of interest and attention in the lesson (f=2)
	Perception and memory problems	Short and long-term memory deficiency (f=1)
		Memory problems (f=1)
		Difficulty in mathematical perception (f=1)

When Table 3 is examined, in the findings obtained from teachers, we encounter the categories of difficulty in mathematical operations, lack of interest in the lesson, difficulty in daily activities, and perception and memory problems under the theme of dyscalculic student characteristics. As seen in Table 3, all of the teachers mentioned that dyscalculic students have difficulty in situations requiring mathematical skills as one of their characteristics. The majority of teachers noted that students diagnosed with dyscalculia struggle with calculations. Additionally, teachers expressed that students diagnosed with dyscalculia may have memory problems and memory and perception issues. It is noteworthy that one of the teachers expressed the view that these students may be uninterested and inattentive towards mathematics as a characteristic. Overall, looking at the findings, it can be said that teachers have an idea about the characteristics of students diagnosed with dyscalculia.

Following the views on the characteristics of students diagnosed with dyscalculia, the views on how mathematics education should be structured for students diagnosed with dyscalculia were examined. Teachers' views on how the mathematics education process should be structured for students diagnosed with dyscalculia were obtained through interviews and then subjected to data analysis. The findings are presented in Table 4.

Table 4

Views of Elementary Mathematics Teachers on Structuring the Mathematics Education Processes for Students Diagnosed with Dyscalculia

Theme	Category	Codes
Mathematics education for dyscalculic students	Concrete materials	Utilizing concrete materials (f=4)
	Special education	Receiving special education (f=4)
	IEP	Receiving education through an individualized education program (f=2)
	Lesson content	Providing instruction without complicating (f=1)
		Providing instruction with engaging and not too lengthy activities (f=1)
	No idea	I have no idea about this topic (f=3)

As seen in Table 4, it can be said that the indicators of teachers' mastery of the characteristics of students diagnosed with dyscalculia are evident in the theme of mathematics education for these students. Teachers are aware that concretization and visualization should be part of structuring the mathematics teaching process for students diagnosed with dyscalculia. Teachers hold the view that these students should be subject to special education and also express that they should benefit from an individualized education program with special education different from their peers. It is noteworthy that teachers state that the course content should be designed with activities that are not too long, addressing the memory problems that are among the characteristics of students diagnosed with dyscalculia.

After examining their views on how mathematics education should be structured for students diagnosed with dyscalculia, they were asked how students diagnosed with dyscalculia should be supported. Teachers' opinions were obtained through interviews and then subjected to data analysis. The findings are presented in Table 5.

Table 5

Views of Elementary Mathematics Teachers on Providing Better Support to Students Diagnosed with Dyscalculia

Theme	Category	Codes
Providing better support for students diagnosed with dyscalculia	Providing support	Providing individual support (f=3)
		Providing medical support (f=1)
		Providing one-on-one attention and support (f=2)
	Early diagnosis	Early diagnosis (f=1)
		Diagnosis during critical period (f=1)
	Family education	Raising awareness among families (f=2)
		Collaborating with family (f=1)
	Teacher education	Teacher awareness training should be provided (f=4)

Looking at Table 5, the findings of teacher suggestions for better supporting students diagnosed with dyscalculia in the mathematics education process include categories such as providing support to students in the process, early diagnosis of students, and involving families and teachers in the process. Therefore, it can be said that teachers are aware that there are many stakeholders in the process of

teaching mathematics to dyscalculic students. The view that this concept should be heard more among teachers regarding the structuring of the process stands out. An example of a teacher's view, especially on awareness, is as follows:

"... This concept should be heard and discussed among mathematics teachers, and even classroom teachers should be able to identify it. Concrete materials should be used in the teaching process and there should be cooperation with the family. This will make the child's daily life more difficult. Therefore, cooperation with the family is a must…." (EMT5).

After discussing teachers' views on how students diagnosed with dyscalculia should be supported, teachers' views on dyscalculia in undergraduate education were examined. Teachers' views on the information given about dyscalculia in higher education elementary mathematics education programs were subjected to data analysis. The findings are presented in Table 6.

Table 6

Views of Elementary Mathematics Teachers on the Topic of Dyscalculia in Undergraduate Elementary Mathematics Education

Theme	Category	Codes
What can be done regarding dyscalculia in undergraduate education	Courses should be included in the undergraduate program	A course covering all learning difficulties should be included (f=4)
		A course on teaching students diagnosed with dyscalculia should be included (f=2)
		An interdisciplinary course following past and current developments should be included (f=2)
		There should be courses that can help with the process (f=3)
		Activities should be designed, and a discussion environment should be provided (f=1)
		Concrete material support should be covered in the topics (f=2)
	Should be experienced during internship	One-on-one practical experience process should be included in the internship (f=2)

Table 6 presents the findings regarding teachers' receiving education on dyscalculia during their undergraduate education. When we look at Table 6, there are opinions stating that dyscalculia should be included as an independent course during undergraduate education, as well as opinions stating that it should be included in a course rather than as a separate course. In addition, teachers state that dyscalculia should be experienced during the internship practice in undergraduate education.

Teachers' views on the information given about dyscalculia in higher education elementary mathematics education programs were examined. Afterwards, their views on raising awareness about dyscalculia were examined. The findings are presented in Table 7.

Table 7

Views of Elementary Mathematics Teachers on Raising Awareness About Dyscalculia

Theme	Category	Codes
Increasing dyscalculia awareness of elementary mathematics teachers	In-service training	Practical training in service (f=5)
	Undergraduate process	There should be a course like dyscalculia education in undergraduate education (f=4)
		Awareness should be increased in faculties of education (f=2)
	Social stakeholders	Parents should be made aware (f=2)
		Awareness should be created in areas of social contribution (f=4)

Table 7 presents the findings regarding the suggestions of elementary mathematics teachers to increase awareness of dyscalculia. When the findings are examined, under the category of in-service training, there are subcategories of including dyscalculia in in-service seminars and applied workshops. Teachers who think that dyscalculia awareness should be gained before entering the field state that dyscalculia should be included in the undergraduate process for awareness. An example statement regarding the view that there should be a course on dyscalculia education in undergraduate education:

"…There should definitely be a course in undergraduate education, and I would like our professors in undergraduate education to provide information and raise awareness about dyscalculia. Symposiums and conferences should be given by experts on this subject in every elementary mathematics teaching department…'' (EMT12).

4. Discussion, Conclusion and Recommendations

The aim of this study is to determine the views of elementary mathematics teachers on dyscalculia. Accordingly, the results obtained were discussed based on the literature and study findings, and the contribution of the results to the literature was emphasized. When looking at the domestic literature, there are studies that address teachers' thoughts on dyscalculia (Hacısalihoğlu-Karadeniz, 2013; Mutlu et al., 2022; Tansel-Günal, 2024; Yılmaz et al., 2024). Additionally, international studies examine educators' knowledge of dyscalculia and their awareness of it (Chideridou-Mandari et al., 2016; Dias et al., 2013; Fu & Chin, 2017; Kunwar & Sharma, 2020; Rauf et al., 2023; Williams, 2013). There are also studies in the literature specifically on dyscalculia with elementary mathematics teachers (Akça & Akgün, 2024; Korkmaz et al., 2024; Nurkan & Yazıcı, 2020).

In the findings of this study on what is known about the concept of dyscalculia among elementary mathematics teachers, it was seen that teachers expressed dyscalculia as a mathematics learning disability. But it is seen that they could not give a more detailed definition than the expression of math learning disability. In the study conducted by Karasakal (2018) in the literature, it was determined that the majority of elementary mathematics teachers lacked awareness of dyscalculia, and it was revealed that teachers lacked the knowledge to effectively communicate with these students. Williams (2013) also emphasizes that teachers need to know what dyscalculia is in order to effectively help the children overcome the difficulties they face.

According to the teachers' findings obtained regarding the characteristics of students diagnosed with dyscalculia, we see that teachers identify difficulties in mathematical operations, lack of interest in the lesson, difficulties in daily activities, perception, and memory as characteristics of dyscalculic students. The fact that similar characteristics were mentioned in the study conducted by Nurkan and Yazıcı (2020) regarding the characteristics of students diagnosed with dyscalculia aligns with the

findings of this study. Similarly, in the study by Korkmaz et al. (2024) examining teachers' perspectives on dyscalculia, it was stated that teachers, reflecting on their own experiences, reported that dyscalculic students have problems in many areas of mathematics such as performing four operations, rhythmic counting, multiplication tables, reading clocks, telling time, and expressing location and direction.

The findings regarding suggestions for structuring the mathematics education processes of dyscalculic students, we see that teachers are aware that concretization and visualization should be part of structuring the mathematics teaching process for students diagnosed with dyscalculia. Teachers hold the view that these students should be subject to special education and also express that they should benefit from an individualized education program with special education different from their peers. It was stated that the course content should be designed with activities that are not too long, addressing the memory problems that are among the characteristics of students diagnosed with dyscalculia. In the study conducted by Kırmızıgül (2020) strategies for students experiencing dyscalculia were included, and it was emphasized that visual elements should be used in the classroom and concrete materials should be included for instructional designs in general. In the study conducted by Akça and Akgün (2024), it was determined that teachers do not have sufficient knowledge about intervention in dyscalculia and that they have incomplete and incorrect knowledge in teaching mathematics to students diagnosed with dyscalculia. In this context, it is similar to the finding in the study that teachers are inadequate in structuring the mathematics education process for students diagnosed with dyscalculia.

In a study conducted by Devisri and Tharani (2021) students with dyscalculia received special education. Mathematical interventions and strategies were implemented to overcome their difficulties in mathematics. As a result of the study, there was an effective change among students with dyscalculia and their attitudes towards learning mathematics changed positively. This study shows that if educators have knowledge about mathematics education in students with dyscalculia, students' perspectives on mathematics can change. In addition, the inclusion of teachers and parents in the mathematics education process, which is included in the recommendations of the study, supports the findings of the study.

There are intervention studies in literature for structuring the educational processes of students diagnosed with dyscalculia. It is seen that different instructional interventions have been developed to support students experiencing mathematics learning difficulties (Filiz, 2021). In the findings obtained in the study, teachers stated that they have partial knowledge about the educational process of students diagnosed with dyscalculia. According to this, the importance of different instructional interventions for the learning of individuals experiencing mathematics learning difficulties, which is especially emphasized in literature, draws attention. In their study, Amelia and Supena (2022) aimed to determine the effect of learning strategies on mathematics learning for dyscalculic students. They state that teachers use direct approach, group work, and individual approach strategies in learning strategies, and these strategies are reflected in the cognitive, affective, and psychomotor skills of dyscalculic students. Therefore, it is important to structure the mathematics learning process of dyscalculic students according to appropriate strategies, and it is also especially important in terms of conducting teacher awareness training.

Regarding the information about dyscalculia in the undergraduate programs of elementary mathematics teaching in higher education is examined, it is stated that dyscalculia should be included as an independent course and dyscalculia should be experienced in the internship practice during undergraduate education. In this context, in the study conducted by Baldemir et al. (2022) it was determined that prospective mathematics teachers studying in undergraduate education could not define the terms related to dyscalculia correctly, moreover, they did not have an idea about how related to dyscalculia should be implemented. Polat (2024) who conducted a study with newly graduated elementary mathematics teachers, aimed to reveal their awareness by examining the views of teachers

who have not yet started to work about dyscalculia. The results of the study revealed that newly graduated elementary mathematics teachers do not have sufficient knowledge about dyscalculia. The study overlaps with the literature in terms of emphasizing that teachers need a detailed training on dyscalculia, especially during their undergraduate education.

4.1. Recommendations

Based on the findings of the study that teachers expect to be aware of dyscalculia before service, projects to raise awareness about dyscalculia can be developed in cooperation with the faculties of education of universities. This purpose, projects that will raise awareness about dyscalculia can be developed in cooperation with the faculties of education of universities. Guidebooks and educational videos on dyscalculia can be prepared within the framework of university-school cooperation. Symposiums on dyscalculia can be organized for students during the university process. Students can be given homework such as preparing posters about dyscalculia.

Drawing on the results of the study, it is recommended that courses that provide basic information about dyscalculia should be included in undergraduate programs before service. In this context, pre-service teachers will be ready before the in-service period. It is suggested that mathematical manipulatives, educational games and technology-based applications should be introduced, and multisensory learning techniques should be integrated into pre-service teachers' instructional process planning.

Considering the finding that in-service seminars can be organized to raise awareness about dyscalculia among teachers' colleagues, it is recommended to organize in-service trainings in which effective teaching strategies and individualized education plans are prepared for students diagnosed with dyscalculia. In addition, there is a view that social stakeholders should be engaged. For social stakeholders, it is recommended to raise awareness of families and to carry out awareness raising activities.

5. References

Akça, B., & Akgün, L.(2024). Determination of secondary school mathematics teachers' level of knowledge on dyscalculia. *Journal of Dyscalculia Academy, 1*(1), 33-61.

Amelia, W., & Supena, A. (2022). Mathematics learning strategy for discalculia students in elementary school. *Jurnal Kependidikan, 8*(1), 209-219. https://doi.org/10.33394/jk.v8i1.4700

APA. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5™*. American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Aydın, N. (2023). *Nitel araştırma yöntemleri*. Özgür. https://doi.org/10.58830/ozgur.pub377

Baldemir, B., İç, Ü., & Tutak, T. (2022). İlköğretim matematik öğretmen adaylarının diskalkuliye ilişkin görüşleri. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *22*(1), 485-505. https://doi.org/10.17240/aibuefd.2022..-998739

Chideridou-Mandari, A., Padeliadu, S., Karamatsouki, A., Sandravelis, A., & Karagiannidis, C. (2016). Secondary mathematics teachers: what they know and don't know about dyscalculia. *International Journal of Learning, Teaching and Educational Research, 15*(9), 84-98.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry & research design: choosing among five approaches* (4th ed.). SAGE.

Çelik, H., Baykal, N. B., & Memur, H. N. K. (2020). Qualitative data analysis and fundamental principles. *Journal of Qualitative Research in Education*, *8*(1), 379-406. https://doi.org/10.14689/issn.2148-2624.1.8c.1s.16m

Devisri, D. K., & Tharani, S. (2021). An effect of mathematical intervention strategies for dyscalculia students. *Journal of Language and Linguistic Studies*, *17*(4), 3496-3500.

Dias, M. D. A. H., Pereira, M. M. D. B., & Van Borsel, J. (2013). Assessment of the awareness of dyscalculia among educators. *Audiology - Communication Research*, *18*(2), 93-100. https://doi.org/10.1590/S2317-64312013000200007

Filiz, T. (2021). Matematik öğrenme güçlüğü yaşayan öğrencilere yönelik öğretimsel müdahalelerin öğrencilerin akademik başarılarına etkisinin incelenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, *22*(4), 1025-1055. https://doi.org/10.21565/ozelegitimdergisi.713496

Fu, S. H., & Chin, K. E. (2017). An online survey research regarding awareness of dyscalculia among educators in sandakan district, sabah. *International Journal of Academic Research in Progressive Education and Development*, *6*(2), 1-10. https://doi.org/10.6007/IJARPED/v6-i2/2891

Hacısalihoğlu-Karadeniz, M. (2013). Diskalkuli yaşayan öğrencilere ilişkin öğretmen görüşlerinin değerlendirilmesi. *NWSA Academic Journals*, *8*(2), 193-208. https://doi.org/10.12739/NWSA.2013.8.2.1C0581

Henderson, A. (2012). *Dyslexia, dyscalculia and mathematics: A practical guide* (2nd ed.). Routledge.

Hornigold, J. (2015). *Dyscalculia pocketbook*. Management Pocketbooks.

Karasakal, M. (2018). *İlköğretim matematik öğretmenlerinin diskalkuli farkındalığı* (Tez No. 534719) [Yüksek lisans tezi, İhsan Doğramacı Bilkent Üniversitesi]. Yükseköğretim Kurulu Ulusal Tez Merkezi.

Kırmızıgül, G. H. (2020). Bir matematik öğretmeninin anlatımıyla diskalkuli: matematik öğrenme güçlüğü. *Social Sciences Studies Journal*, *6*(69), 4033-4040. https://doi.org/10.26449/sssj.2617

Korkmaz, B., Yulet Yılmaz, T., & Ertem Akbaş, E. (2024). An overview of Dyscalculia from the Perspective of Mathematics Teachers. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, *12*(2), 551-567. https://doi.org/10.18506/anemon.1461958

Kucian, K., & Von-Aster, M. (2015). Developmental dyscalculia. *European Journal of Pediatrics*, *174*(1), 1-13. https://doi.org/10.1007/s00431-014-2455-7

Kunwar, R. (2022). Impacts of dyscalculia in learning mathematics: some considerations for content delivery and support. *Learning Disabilities—Neurobiology, Assessment, Clinical Features and Treatments*, *1*(1), 125-134. https://doi.org/10.5772/intechopen.99038

Kunwar, R., & Sharma, L. (2020). Exploring teachers' knowledge and students' status about dyscalculia at basic level students in Nepal. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(12), 1-12. https://doi.org/10.29333/ejmste/8940

Lyons, I. M., & Ansari, D. (2015). Foundations of children's numerical and mathematical skills. In *advances in child development and behavior* (pp. 93-116). Elsevier. https://doi.org/10.1016/bs.acdb.2014.11.003

MEB. (2018). *İlköğretim matematik dersi 6-8.sınıflar öğretim programı*. Milli Eğitim Bakanlığı.

Melekoğlu, M. A. (2022). Özel öğrenme güçlüğü ve matematik. M. A. Melekoğlu (Eds.), *Matematik güçlüğü diskalkuli tanılanama ve müdahale* içinde (ss. 2-19). Pegem.

Merriam, S. B., & Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. Jossey-Bass.

Mutlu, Y. (2016). Matematik öğrenme güçlüğü (gelişimsel diskalkuli). E. Bingölbali, S. Arslan & İ.Ö. Zembat (Ed.), *Matematik eğitiminde teoriler* içinde (ss. 881-899). Pegem.

Mutlu, Y., Çalışkan, E. F., & Yasul, A. F. (2022). We asked teachers: Do you know what dyscalculia is? *International Online Journal of Primary Education*, *11*(2), 361-378. https://doi.org/10.55020/iojpe.1067560

Nurkan, M. A., & Yazıcı, E. (2020). Matematik öğretmenlerinin matematik öğrenme güçlüğü (diskalkuli) farkındalıklarının belirlenmesine ilişkin bir durum çalışması. *Çağdaş Yönetim Bilimleri Dergisi*, *7*(1), 95-109. https://dergipark.org.tr/en/download/article-file/1074639

O'Connor, C., & Joffe, H. (2020). Intercoder reliability in qualitative research: debates and practical guidelines. *International Journal of Qualitative Methods*, *19*(1). https://doi.org/10.1177/1609406919899220

Padilla-Díaz, M. (2015). Phenomenology in educational qualitative research: philosophy as science or philosophical science? *International Journal of Educational Excellence*, *1*(2), 101-110. https://doi.org/10.18562/IJEE.2015.0009

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). SAGE.

Polat, M., İ. (2024). Newly graduated elementary mathematics teachers' views on dyscalculia and their use of research skills on this subject. *Journal of Dyscalculia Academy, 1*(1),1-32.

Rauf, M., Uzma, D., & Asiya. (2023). Teachers' awareness of factors responsible for dyscalculia among primary school students in district Mardan, Pakistan. *Journal of Positive School Psychology*, *7*(5), 1165-1170. https://journalppw.com/index.php/jpsp/article/view/17296/10911

Salisa, R. D., & Rahaya, W. (2023). Conceptual understanding and reasoning of students with dyscalculia: a literature review. *Hexagon: Jurnal Ilmu Dan Pendidikan Matematika*, *1*(2), 94-102. http://dx.doi.org/10.33830/hexagon.v1i2.5356.

Silverman, D. (2018). *Doing qualitative research* (5th ed.). SAGE.

Smith, J. A., & Osborn, M. (2004). Interpretative phenomenological analysis. In G. M. Breakwell (Eds.), *Doing social psychology research* (pp. 229-254). Wiley. https://doi.org/10.1002/9780470776278.ch10

Tansel-Günal, P. (2024). *Sınıf, matematik ve rehber öğretmenlerinin diskalkuliye yönelik farkındalıklarının belirlenmesi* (Tez No. 900750) [Yüksek lisans tezi, Başkent Üniversitesi]. Yükseköğretim Kurulu Tez Merkezi.

Williams, A. (2013). A Teacher's perspective of dyscalculia: who counts? An interdisciplinary overview. *Australian Journal of Learning Difficulties*, *18*(1), 1-16. https://doi.org/10.1080/19404158.2012.727840

Yıldırım, A., & Şimşek, H. (2021). *Sosyal bilimlerde nitel araştırma yöntemleri* (12. baskı). Seçkin.

Yılmaz, T. Y., Ulubaş, S. C., & Gök, M. (2024). Sınıf öğretmenlerinin bakış açısıyla matematik öğrenme güçlüğü (diskalkuli). *Sinop Üniversitesi Eğitim Fakültesi Dergisi*, *1*(1), 59-83.