iejee

International Electronic Journal of Elementary Education
December 2024, Volume 17, Issue 1

Effects of Dyscalculia on Personal, Social, Academic, Professional and Daily Life: A Case Study

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Received : 5 September 2024
Revised : 26 November 2024
Accepted : 24 December 2024
DOI : 10.26822/iejee.2024.365

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Abstract

Dyscalculia is a learning difficulty that negatively affects individuals' abilities to understand, apply, and learn mathematical operations. This study aims to explore the wide-ranging impacts of dyscalculia on individuals' lives. The experiences of Nur, an English teacher, are used to examine the effects of dyscalculia on personal, social, academic, professional, and daily life.

This study is designed as a qualitative case study. Nine significant stories from Nur's life were obtained through in-depth interviews and analyzed in detail using content analysis methods, focusing on themes, categories, and codes.

The findings reveal that dyscalculia significantly affects not only Nur's academic development but also her psychological well-being and overall quality of life. The difficulties in her mathematical skills have led to issues such as lack of self-confidence, social isolation, and challenges in professional skills.

The study highlights the importance of early individualized psychoeducational interventions and effective support systems to improve the lives of individuals with dyscalculia. It also emphasizes the critical role of increasing public awareness to create a supportive and inclusive environment for those with math learning difficulties.

This study highlights the significant impact of dyscalculia on individuals' lives and emphasizes the critical need for further research in this area. Developing and implementing effective intervention and support strategies is essential to enhance the quality of life and overall well-being of those affected by dyscalculia. Future research should prioritize longitudinal studies to assess the sustainability and adaptability of early interventions. Such studies should explore how tailored support strategies not only improve immediate outcomes but also contribute to long-term academic, social, and emotional development, thereby providing a comprehensive understanding of their lasting impact on individuals with dyscalculia.

Keywords:

Dyscalculia, Mathematics Learning Difficulties, Effects Of Dyscalculia, Adults With Dyscalculia

ISSN: 1307-9298

Introduction

Dyscalculia is a specific learning difficulties that affects an individual's ability to acquire arithmetic skills, with a prevalence ranging from 3% to 6.5% (Shalev, 2004; Price & Ansari, 2013). This condition manifests as significant difficulties in numerical operations, mathematical logic and problem solving skills in the individual's life (Monei & Pedro, 2017). The main features of dyscalculia are inadequacies in mathematical skills that usually begin in preschool period and negatively affect the individual's academic performance or daily life (Lewis, 2016; Kaufmann et al., 2003). Dyscalculia is a learning difficulties characterized by persistent and specific difficulties in basic mathematical skills. Individuals with dyscalculia have significant difficulties in understanding and using basic concepts related to numbers and operations. This can be observed as difficulties in processing numerical information, remembering and applying mathematical operations, and understanding mathematical concepts (Yoong, 2023).

Although the symptoms of dyscalculia can be seen differently in each individual (Gifford & Rockliffe, 2012), it is possible to mention common symptoms. In individuals with dyscalculia, understanding, sorting and comparing numbers and number sequences (Deruaz et al, 2020), understanding and performing simple addition, subtraction, multiplication and division operations (Lewis, 2016), remembering the rules of mathematical operations and formulas (Williams, 2013), reading analog clocks, understanding time concepts (Mutlu & Korkmaz, 2020), and performing money operations (Zhang, 2018), in identifying and applying the necessary steps to solve problems (Wilkey, Pollack, & Price, 2020), in remembering numerical information, especially long sequences of numbers (Geary, 2013), and in mathematical thinking and processing processes (Deruaz et al., 2020) and increased anxiety, stress and lack of motivation in mathematics lessons and mathematics-related activities (Mutlu, 2019; Williams, 2013).

The causes of dyscalculia, like its symptoms, are complex and multifactorial. In general, the underlying causes of dyscalculia include genetic factors, problems with brain development, and educational experiences in early childhood (Kaufmann et al., 2013). Dyscalculia may differ between individuals and is usually caused by a combination of multiple factors. Dyscalculia can be inherited in families. Research shows that the risk of dyscalculia is associated with genetic factors (Shalev et al., 2001). In addition, differences in brain structure and functioning have been observed in individuals with dyscalculia (Kroesbergen et al., 2023). Abnormal brain development in early childhood may increase the risk of dyscalculia. This may affect the development of brain areas critical for numerical and mathematical operations (Hughes et al., 2023). In addition, weaknesses in an individual's basic cognitive functions, such as working memory and attention deficits, can lead to the development of dyscalculia (Geary, 2004; Szucs et.al., 2013).

Although environmental factors are not directly involved in the causes of dyscalculia, inadequate or inappropriate mathematics education can make it difficult for students to understand mathematical concepts and develop mathematical skills (Witzel et al., 2023). Environmental factors such as socioeconomic status, family educational environment, and teacher expectations may also affect the risk of dyscalculia (Kaufmann et al., 2003; Lewis, 2017). In addition, insufficient interaction with mathematical concepts in early childhood may trigger the development of dyscalculia (Hughes et al., 2023). Possible delays in language and communication skills in early childhood may cause difficulties in understanding mathematical terms and concepts (Gersten et al., 2005). In addition, mathematics-related anxiety and stress can negatively affect students' mathematics learning and achievement (Rubinsten & Tannock, 2010; Mutlu, 2019). Such negative learning experiences can lead to a lack of motivation to learn mathematics, which can further deepen learning difficulties (Sella & Cohen Kadosh, 2018).

Dyscalculia (developmental dyscalculia) is diagnosed using various assessment tools and tests (Mutlu& Akgün, 2017a). These assessments help to determine educational and intervention strategies by examining the individual's mathematical abilities and difficulties in detail. However, heterogeneity among individuals with dyscalculia significantly affects the processes of diagnosis and intervention of this learning difficulties. A study by Skagerlund and Träff (2014) revealed the heterogeneity of individuals with dyscalculia and the different cognitive profiles and deficits that need to be considered in the diagnosis of this condition. The main reason why researchers use different diagnostic tools and methods is that individuals with dyscalculia have heterogeneous characteristics. For example, in a study conducted by Bugden et al. (2020), the effectiveness of the Numeracy Screener, a tool used in the diagnosis of dyscalculia, was examined. This tool is used to determine symbolic (Arabic numerals) and non-symbolic (dot arrays) numerical magnitude processing abilities and dyscalculia risk in children and can be administered in about 2 minutes. On the other hand, Kaufmann et al. (2003) state that according to the International Classification of Diseases and Health Problems (ICD-10) criteria published by the World Health Organization, dyscalculia can be diagnosed when there is a significant difference between the average intelligence level of the individual and the sub-average performance in mathematics achievement tests. This diagnostic method evaluates the relationship between specific difficulties in mathematical skills and general intelligence level. A test battery developed by

Skagerlund and Träff (2014) is used to identify students' number processing skills and dyscalculia subtypes. This test battery assesses children's numerical abilities and mathematical processing difficulties in detail. Dinkel et al. (2013) investigated the benefits and limitations of using single case functional brain imaging (fMRI) methods in the diagnosis of dyscalculia. This study shows how brain imaging technologies can be used in the diagnosis of dyscalculia. In each of these studies, almost a different diagnostic method and approach was employed. Although the debate on the variety of methods used continues, it is clear that assessments are critical in the identification and intervention of mathematical learning disabilities. This suggests that special attention and appropriate methods should be paid to the education of individuals with dyscalculia and the development of their mathematical skills.

It is important for teachers to be trained in dyscalculia and intervention techniques for dyscalculia in order to provide more accurate support to students. In this context, teachers should be made aware of the symptoms of dyscalculia observed in students and strategies that can help these students (Sousa, Dias, & Cadime, 2017). Research on dyscalculia reports that interventions contribute to the development of mathematical skills and success in the educational process. In this process, early diagnosis and intervention are critical for students' academic and social development (Ganor-Stern, 2017). Educators and therapists can use various strategies and interventions to support individuals with dyscalculia in learning mathematics. Some of these interventions and approaches can be briefly mentioned. Children with dyscalculia often have difficulty understanding abstract mathematical concepts. Therefore, using concrete materials and visual aids to visualize numbers and mathematical relationships can be effective. For example, number lines, blocks, and shapes can be used for this purpose (Monei, & Pedro, 2017). Breaking mathematical concepts into small steps and presenting each step in a clear and structured way can facilitate the learning process of dyscalculic children. It is important to give clear instructions at each step and allow children to understand the concepts at their own pace (Lewis, 2016). Each dyscalculic child has different challenges and needs. Therefore, it is important to develop individualized education plans taking into account individual differences. It is necessary to identify strategies that support the student's strengths and improve their weaknesses (Zhang et al., 2020). It can be effective to utilize technological tools and educational applications to improve calculation and problem solving skills (Mutlu& Akgün, 2017b; Mutlu& Akgün, 2019). These tools can make mathematical concepts more understandable by providing students with an interactive and fun learning experience (Deruaz et al., 2020). Providing continuous feedback to dyscalculic children supports their learning process and increases their motivation. It is important to appreciate their achievements and adopt a constructive approach to correct their mistakes (William, 2013).

Recent research has demonstrated that dyscalculia persists into adulthood and leads to significant challenges in daily quantitative tasks essential for independent living beyond academic settings (Vigna et al., 2022). Vigna et al. (2022) examined the impact of dyscalculia on adults' daily living activities and found that they face considerable difficulties with practical tasks such as managing finances, time, and measurements, which are fundamental for functional independence and quality of life. Their research utilized a standardized battery to assess numeracy skills in both formal and informal contexts, revealing poor numeracy abilities among adults with dyscalculia in all settings.

Furthermore, Mejias et al. (2012) investigated the approximate number system (ANS) deficit in adults with a history of dyscalculia. Their findings indicate ongoing difficulties with numerical estimation and magnitude representation, affecting areas ranging from academic performance to everyday numerical demands. This suggests that interventions aimed at improving numerical estimation skills in adults with dyscalculia could enhance their practical numerical abilities.

In addition to cognitive challenges, Burgio et al. (2022) reported that adults with dyscalculia often experience emotional distress and low self-esteem, negatively impacting their job choices and overall well-being. This underscores the importance of holistic approaches that address both the psychological and cognitive aspects of dyscalculia. Hosseini's (2020) research delved into the dyscalculia-related experiences of adults working in the music field—a domain requiring mathematical thinking and numerical comprehension. The study highlighted how musicians with dyscalculia cope with these challenges and how their condition affects their careers.

While these studies contribute valuable insights, there remains a significant gap in the literature concerning in-depth qualitative explorations of adults living with dyscalculia, particularly regarding how it affects various aspects of their lives over time. Most existing research focuses on children or adolescents, leaving a lack of understanding about the long-term effects and personal narratives of adults coping with this condition. Additionally, there is limited examination of how dyscalculia influences professional life outside of fields directly related to mathematics.

The main purpose of this study is to address these gaps by providing an in-depth understanding of the challenges faced by individuals with dyscalculia

through the life experiences of Nur, a primary school English teacher. Through this qualitative case study, we seek to provide insights that can inform the development of targeted interventions and support mechanisms for adults with dyscalculia. By highlighting Nur's experiences, this study contributes to a more comprehensive understanding of dyscalculia across different age groups and professional fields, emphasizing the necessity for support systems that extend beyond childhood to address the lifelong challenges associated with this condition.

Method

This study was conducted using the holistic single case design of the case study method based on the qualitative research paradigm. Case study is a research approach in which the researcher collects in-depth information about real life, a current situation with defined boundaries, or situations in a certain time period through observation, interviews, audiovisual materials or documents, and then makes a description of a situation (Creswell, 2013). By designing the study as a qualitative case study, we were able to closely relate our research method to our purpose. This design provided the flexibility and depth required to explore the intricate effects of dyscalculia on an individual's life, thereby contributing valuable insights to the existing body of knowledge on learning difficulties.

Participant

This study focuses on Nur, a primary school teacher with four years of teaching experience who, although not officially diagnosed, exhibits clear symptoms of dyscalculia based on the researcher's observations and interviews. The findings section enumerates her dyscalculia symptoms, revealing specific difficulties with mathematics despite her success in other academic areas.

Selected through purposive sampling, Nur serves as the principal participant to examine in detail her mathematical challenges at different stages of her educational life and the effects of these challenges on her personal, social, academic, and professional life. Raised in a well-off family with no history of mathematical difficulties, she is known for being friendly and sociable; However, she experiences anxiety when confronted with mathematics.

Data Collection

The data of the study were collected through a semi-structured interview with a participant named Nur, in which open-ended questions were asked. Audio recordings of the interviews with Nur were taken. During the interview, stories that were considered to be particularly striking and important were identified. Since these stories (Annex 1) were considered important for in-depth analysis and evaluation, Nur was asked to describe them in detail and in writing. In response to this request, Nur submitted detailed texts containing these stories to the researcher in the days following the interview. This process aimed to reflect the participant's experiences and perspectives in more detail and allowed the researcher to conduct a more comprehensive analysis of these experiences.

Data Analysis

The data collected in the study were carefully analyzed through content analysis methodology and evaluated using Generative Pre-trained Transformer (GPT-4) technology. This process aimed to identify Nur's math-related difficulties, emotional reactions and coping strategies in depth. The analysis allowed for a systematic categorization of the data into categories and codes (Table 2), providing an opportunity to consider Nur's experiences from a broader perspective. This approach broadened the scope of the research and contributed to a more detailed understanding of the findings.

In Table 1, the stories from the life of Nur, who struggles with dyscalculia, are organized thematically. Each theme reflects the specific situations Nur faced and their impact, ranging from mathematical struggles to practical difficulties in daily life.

Table 1

Nur's Dyscalculia Stories

No	Theme	Description of Story
1	Fighting Math	Failure and emotional impact in secondary school.
2	Tutoring days	Placement test and challenges.
3	University Journey	Transition from high school to university and math avoidance.
4	Daily Accounts	Computational challenges in everyday life.
5	Mental Calculation Race	Computational difficulties with students in professional life.
6	Percent Confusion	Percentage calculations in professional life.
7	Disoriented Teacher	Wayfinding and left-right confusion.
8	Market Showdown	Calculating change in shopping.
9	Disappearing Directions	Difficulties finding paths and directions.

Credibility and Transferability

To ensure the credibility of the study, the participant selection, data collection and analysis processes were conducted with great care. Nur, who was selected as a participant, is an English teacher with dyscalculia and her experiences constitute the focus of the study. In the data collection process, semi-structured interview technique was used and open-ended questions were asked during the interviews. This approach allowed

Table 2

Thematic analysis of the challenges faced by Nur who struggles with dyscalculia

Main Theme	Category	Codes
Personal Impacts	Personal Challenges and Coping Methods	Lack of self-confidence, Sense of inadequacy, Personal coping strategies
Social Impacts	Social Interaction and Reactions	Social isolation, Friendship relations, Family interaction
Academic Impacts	Academic Performance and Learning Processes	Classroom performance, Learning difficulties, Adaptation to learning preferences
Professional Impacts	Job and Career Guidance	Vocational skills, Workplace challenges, Occupation choice
Impacts on Everyday Life	Daily Routines and Activities	Shopping, Household chores, Daily planning

Nur to freely express her experiences from her own perspective. The interviews were designed and conducted in a way that made the participant feel at ease. Recording and later transcribing the interviews increased the accuracy of the data and transparency of the analysis process. In addition, stories from the interviews are shared with the reader in the appendix of the article.

The stories obtained from the interviews were processed through content analysis and the findings obtained from Nur's stories were grouped under broad themes. The researcher avoided subjective interpretations during the analysis process and took care to interpret the data as objectively as possible.

The transferability of the research is aimed at assessing whether the findings are valid for other situations or other individuals with similar characteristics. In this study, the findings obtained through Nur's experiences can shed light on the life experiences of other individuals with dyscalculia. However, it is left to the reader's interpretation to determine to what extent these findings are transferable to other situations or individuals.

Role of the Researcher

The researcher, who has conducted numerous academic studies on dyscalculia, examined the effects of dyscalculia on Nur's life. The researcher prioritized ethical norms and took care to collect reliable data by providing a comfortable environment for the participant. By effectively using her expertise in data collection and analysis, she strengthened both the accuracy and validity of the study. The researcher's experience in this field has contributed significantly to the wider theoretical and practical evaluation of the findings of the study.

Ethics

The ethical dimensions of the research were handled with great importance especially to the confidentiality and privacy of the participant. In this context, the name 'Nur' was used instead of the participant's real name. This was done both to protect the anonymity of the participant and to ensure the accuracy of the research. During the research process, Nur's personal information and interview data were protected and used with her explicit consent and full knowledge. This approach is critical in ensuring a data collection and analysis process that complies with ethical standards. The participant was informed about the purpose and process of the study and a voluntary consent form was signed by the participant. In addition, the ethics committee certificate for the study was obtained.

Findings

In the first part of this section, Nur's dyscalculia symptoms are presented. In the second part, the effects of dyscalculia are discussed in detail through themes, categories and codes.

Symptoms of Dyscalculia

Nur's dyscalculia symptoms and real life examples of these symptoms are given in Table 3. Each symptom is detailed in relation to Nur's own experiences. The table exemplifies Nur's difficulties with mathematical concepts and operations, practical problems she encountered in daily life, and the emotional effects of these situations.

Table 3

Nur's dyscalculia symptoms and excerpts from her life

	Symptoms Of Dyscalculia	Excerpt About Nur's Experience
1	Failure to Comprehend Mathematics Subjects	"In the classroom... I couldn't make sense of the math topics."
2	Avoiding Mathematics Lessons	"In high school... avoiding math, gravitating towards English."
3	Difficulty in Basic Mathematics	"Difficulty in percentage calculations, especially in calculating exam grades."
4	Directional Confusion and Difficulty Finding Addresses	"Difficulty distinguishing between left and right, confusion in directions in the classroom."
5	Difficulty Making Calculations with Cash	"Calculation difficulties when paying with cash."
6	Inability to Cope with Simple Mathematical Situations in Daily Life	"Inability to cope with simple mathematical situations in daily life."
7	Failure in Mathematics while Successful in Other Subjects	"Unexpected failure in math while succeeding in other subjects."
8	Difficulty performing mental operations in the classroom	"I used a calculator to add up the results of the quiz."

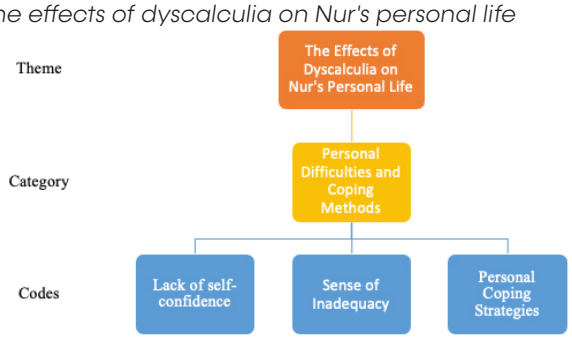
Effects of Dyscalculia

In this section, Nur's experiences of struggling with dyscalculia are analyzed under five main themes. Each theme explores in depth the effects of dyscalculia on personal, social, academic, occupational and daily life, and is classified using specific categories and codes to more clearly capture these effects. This classification illuminates the broad domain of dyscalculia and the various aspects of this condition in an individual's life.

The effects of dyscalculia on personal life

Under the theme of the effects of dyscalculia on personal life, the codes of lack of self-confidence, self-evaluation and personal coping strategies belonging to the category of "Personal Difficulties and Coping Methods" are presented in Figure 1. These codes represent Nur's processes of coping with personal difficulties and the effects of these processes on her psychological structure. Lack of self-confidence refers to individuals' perceptions of their own abilities and achievements; sense of inadequacy refer to the tendency to underestimate one's own worth and abilities; and personal coping strategies refers to the methods and approaches used to cope with difficulties. This figure illustrates the various effects of dyscalculia on Nur's life and the consequences of these effects on Nur's personal development and coping methods.

Figure 1.
The effects of dyscalculia on Nur's personal life



Lack of Self-Confidence: When Nur failed in math, it caused a serious drop in her self-confidence. Although she was successful in other subjects, this failure in math shook her self-confidence.

"It was quite upsetting and challenging as a child to go through this experience just because of math, even though I was good at other subjects." (Struggling with Math)

Sense of Inadequacy: Nur felt inadequate by evaluating her failure in mathematics in terms of her general academic ability. This was especially evident when compared to her older relatives.

"If there was more awareness, maybe these situations would not have happened." (Tutoring days)

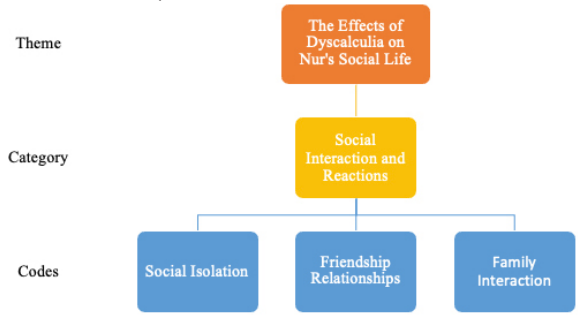
Personal Coping Strategies: Nur tried different ways to overcome her difficulties with mathematics. For example, her focus on English in high school can be seen as a coping strategy by avoiding mathematics. She also found practical solutions such as using a calculator.

"Then I looked for a solution in English, I was good with words and there was no math." (University Journey)

The effects of dyscalculia on social life

Under the theme of the effects of dyscalculia on social life, the codes of social isolation, friendship relations and family interaction belonging to the category of "Social Interaction and Reactions" are presented in Figure 2. These codes represent the difficulties Nur encountered in her social interactions and relationships and the processes of coping with these difficulties. Social isolation refers to the tendency of individuals to withdraw from their social environment; friendship relations refers to the quality of friendship ties within the social environment; and family interaction refers to the quality of communication and interaction between family members. This figure illustrates the various effects of dyscalculia on Nur's social life and the consequences of these effects on Nur's social relationships.

Figure 2.
The effects of dyscalculia on Nur's social life



Social Isolation: Nur has difficulty interacting with her friends and teachers because of her difficulties in math. Her sense of failure, especially in math classes, isolates her socially.

"Learning that day that I would not get a certificate of achievement because of one subject affected me deeply" (Struggling with Mathematics)

Friendship Relationships: Nur's relationship with her childhood friend is strained because of her friend's success in math and Nur's failure in this subject. This situation affects Nur's friendship relations.

"I was almost like an invisible student next to him. This situation pushed me to gradually withdraw into myself." (Tutoring days)

Family Interaction: Nur's family is unsympathetic to her difficulties in mathematics, which negatively

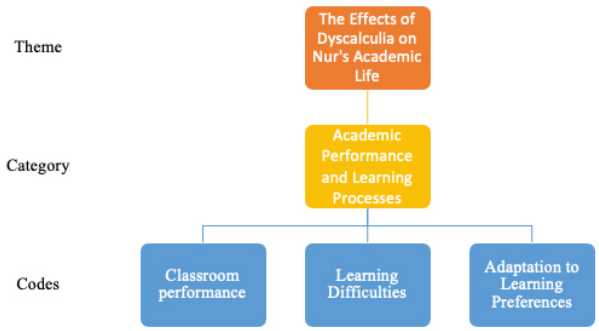
affects communication within the family. Her family's insensitivity, especially when she is upset about her report card, causes problems in family interaction.

"My family did not react when they saw my tears" (Fighting Math)

The effects of dyscalculia on academic life

Under the theme of the effects of dyscalculia on academic life, the codes of classroom performance, learning difficulties and educational support belonging to the category of "Academic Performance and Learning Processes" are presented in Figure 3. These codes represent the difficulties Nur encountered in academic environments and learning processes and the methods of coping with these difficulties. Classroom performance refers to students' activities and achievements in lessons; learning difficulties refers to the obstacles encountered in the learning process; and adaptation to learning preferences refers to the tailored approaches and methods used to align educational practices with individual student needs.This figure illustrates the various effects of dyscalculia on Nur's academic performance and the consequences of these effects on Nur's educational processes.

Figure 3.
The effects of dyscalculia on Nur's academic life



Classroom Performance: Nur was unsuccessful in mathematics compared to other subjects, which affected her academic self-confidence. Although she was successful in other subjects, this failure in mathematics had a negative impact on her overall academic performance.

"Thinking that I had been wronged, I hid my report card and returned home in tears. My family did not react when they saw my tears. I hid the truth by telling those who were curious about my report card that I received a certificate of appreciation and I did not show my report card to anyone. Although years have passed, this incident remains fresh in my memory." (Struggle with Mathematics)

Learning Difficulties: Nur had difficulty in understanding mathematics subjects during her days at the classroom. Her inability to grasp the logic of the subjects and her failure in the exams created significant obstacles in the learning process.

"I can't say that I didn't study; I really made an effort, but I couldn't get the logic of the math subjects in my mind." (Tutoring days)

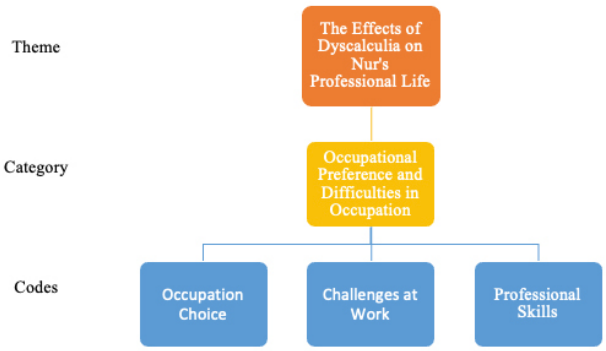
Adaptation to Learning Preferences: During high school, he tended to avoid math and gravitated towards English. This indicates changes in educational preferences and a search for alternative ways of learning.

"I had somehow survived math in high school... then I looked for a solution in English... It was accepted by my family that I could do English, but relatives - especially my cousins who were good at math - were always criticizing me." (University Journey)

Effects of dyscalculia on professional life

Under the theme of the effects of dyscalculia on professional life, the codes of professional skills, difficulties in the workplace and career planning belonging to the category of "Occupational Preference and Difficulties in Occupation" are presented in Figure 4. These codes represent the difficulties Nur encountered in the fields of work and career and the processes of coping with these difficulties. Professional skills refer to individuals' skills and knowledge levels in business life; workplace challenges refer to the obstacles encountered in the professional environment and the methods to overcome them; and occupation choice refers to the decision-making process involved in selecting a profession based on personal interests. This figure illustrates the various effects of dyscalculia on Nur's professional life and the consequences of these effects on her work and career development.

Figure 4.
The effects of dyscalculia on Nur's professional life



Occupation Choice: Nur's difficulties with math influence her career choice and progression. Her choice of English may have been a decision to avoid mathematical operations and this determines the direction of her professional development.

"I chose English teaching because of these difficulties with mathematics. I chose this path to avoid mathematical operations." (University Journey)

Challenges at Work: Nur needs to refer to the percentage calculator website when doing mathematical calculations in class.

"But I was having a hard time understanding how to calculate, how to get 25 percent, etc. I asked a math teacher a lot of questions about this. The teacher tried to explain it to me, but I still couldn't understand it and we laugh about it now. Finally, I found a percentage calculation website on the internet and did the calculations from there." (Percentage Confusion)

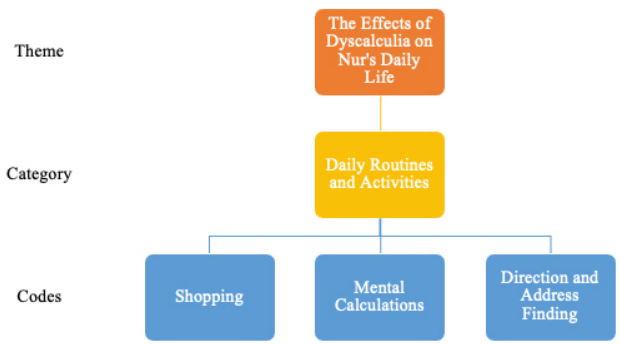
Professional Skills: As a teacher, Nur struggles with calculations in the classroom due to difficulties with mathematical operations. This affects her professional skills and causes difficulties in her teaching practices.

"When I was doing the calculation, the students gathered around me and started laughing when a student passed me and reached the result faster. It was a bit embarrassing to be honest." (Mental Calculation Race)

The effects of dyscalculia on everyday life

Under the theme of the effects of dyscalculia on daily life, the codes for shopping, mental calculations, and finding directions and addresses belonging to the category of "Daily Routines and Activities" are presented in Figure 5. These codes represent the difficulties Nur encountered in her daily life activities and the processes of coping with these difficulties. These three codes represent Nur's daily life challenges and coping strategies. The code "Shopping" refers to difficulties with financial transactions, "Mental Calculations" refers to difficulties with daily mathematical operations, and the code "Direction and Address Finding" emphasizes potential difficulties in spatial perception and orientation skills.

Figure 5.
The effects of dyscalculia on Nur's daily life



Shopping: Nur has calculation difficulties when paying with cash at the supermarket. She finds it difficult to make calculations, especially when paying large amounts with small bills. This leads to stress and difficulties when paying at the supermarket.

"While it is more convenient to pay especially with high denomination banknotes such as 100 tl, I have trouble with the calculation when I pay large amounts with small banknotes such as 20, 10, 5 ." (Market Account)

Mental Calculations: Nur is affected by the inability to cope with simple mathematical situations in everyday life.

"It can also be sad that older people who do not go to school can do mental addition better than me, sometimes I am surprised, sometimes there is a money issue at work or shopping, they add very quickly by adding immediately in their heads, and when I am in such a situation, the calculator comes to my aid immediately (Daily Accounts)

Direction and Address Finding: Difficulties in spatial perception and orientation skills create obstacles in daily life, such as finding an address.

"Finding an address is always a difficult experience for me. Sometimes, even though I've been through the same place many times, when I'm there I can't remember which way I should turn or where I came from and I get a feeling of being lost." (Disappearing Directions)

Discussion, Conclusion and Recommendations

This study focuses on Nur, an English teacher with dyscalculia, and her difficulties in learning mathematical concepts and applying mathematical operations. The findings showed how dyscalculia affected many different aspects of Nur's life. These effects reveal that her learning difficulties negatively affects not only her academic achievement, but also her daily life, social relationships and professional performance.

Nur exhibits typical symptoms associated with dyscalculia. These symptoms include difficulties with simple mathematical operations such as addition and subtraction, confusion in finding directions and addresses, difficulty in calculating with cash, and problems with mental math in the classroom (Shalev et al., 2001; Ansari & Karmiloff-Smith, 2002; Jordan, Hanich, & Kaplan, 2003; Geary, 2004; Hannell, 2005; Sharma, 2015). Mejias et al. (2012) showed that adults with dyscalculia were less successful than control groups in numerical estimation tasks with non-symbolic materials. This points to ongoing difficulties in representing and processing numerical quantities even in non-symbolic tasks. These mathematical

deficits can lead to more pronounced problems, such as the individual's avoidance of mathematics lessons and inability to cope with simple mathematical situations in daily life.

As seen in Nur's life, dyscalculia creates significant difficulties in situations requiring basic mathematical skills that individuals encounter in daily life. Studies by Muñez (2023) and Zhang et al. (2018) have documented the difficulties individuals with dyscalculia face in activities such as shopping, budget planning, and daily calculations. These difficulties highlight how dyscalculia can affect an individual's independence and quality of life (De Visscher et al., 2017).

The effects of dyscalculia on Nur go beyond academic achievement and have a profound impact on personal self-esteem and self-evaluation. Difficulties in mathematics can lead to feelings of inadequacy and contribute to a negative self-image. Burgio et al. (2022) reported that adults with dyscalculia often experience emotional distress and low self-esteem, which negatively affects their job choices and general well-being. The research highlights the need for holistic approaches that address not only the cognitive aspects of dyscalculia but also its psychological effects (Burgio et al., 2022). Furthermore, the importance society places on mathematical skills is a critical factor in how individuals perceive themselves. Studies by Landerl et al. (2004), Dowker (2005), and Mutlu, Çam, and Çalışkan (2021) have shown that the stigmatization and discrimination that individuals with dyscalculia experience due to mathematical difficulties can further undermine their self-confidence and self-belief. These studies reveal the profound effects of dyscalculia on an individual's perception of self-worth and the role of societal expectations on these effects.

The negative effects of dyscalculia on Nur's teaching career seem to be consistent with the findings in the literature. Hosseini's (2020) thesis analyzes the main challenges faced by adult musicians with dyscalculia and reveals how these challenges negatively affect not only their educational process, but also their daily lives and professional careers. As a consequence, there are serious impacts on these individuals in professional fields where math-based skills are required. On the other hand, the study by Vigna et al. (2022) examined in depth the effects of dyscalculia on daily life in adults and found that these individuals had difficulty in estimating time and measurement, as well as in handling money. The study showed that these adults were aware of the difficulties associated with dyscalculia and that this could have negative effects on their academic and professional decisions (Vigna et al., 2022; Mutlu et.al., 2024).

Dyscalculia is a complex learning difficulty that extends beyond challenges in learning mathematics; it can affect many different aspects of an individual's life. Nur's experiences illustrate how dyscalculia impacts a wide range of academic, social, occupational, and daily life dimensions. Therefore, developing effective intervention and support strategies for individuals with dyscalculia is critical for improving their quality of life and overall well-being.

This study sheds light on the difficulties experienced by individuals with dyscalculia and emphasizes the importance of further research in this area. To strengthen our understanding and address the lifelong challenges associated with dyscalculia, future research should explore several key areas. Longitudinal studies are needed to track the long-term impact of early interventions, providing insights into how support strategies influence outcomes over time. Comparative studies on the effectiveness of different educational and psychological interventions can identify the most beneficial approaches for adults with dyscalculia. Additionally, cross-cultural analyses would help understand how dyscalculia affects individuals in various educational contexts, informing culturally sensitive support mechanisms.

By focusing on these areas, future research can guide the development of comprehensive strategies to address the challenges faced by individuals with dyscalculia across different stages of life and settings. Such efforts will contribute to a more inclusive understanding and support system, ultimately enhancing the functional independence and psychological well-being of those affected by dyscalculia.

While this study offers valuable in-depth insights into the experiences of individuals with dyscalculia through the case of Nur, it is important to acknowledge its limitations. One significant limitation is the single-case study design, which may affect the generalizability of the findings to a broader population. Additionally, Nur has not received an official diagnosis of dyscalculia; her symptoms were identified based on observations and interviews conducted by the researcher.

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Annex 1. Nur's Stories

1.Fighting math

At the time, I was a student in the 7th grade of secondary school. I had progressed well in other subjects, but I unexpectedly failed in mathematics. While trying to understand this situation, I had the opportunity to talk to my mathematics teacher. On the day of the report card, I learned that my average was actually good, but the teacher could not intervene in this situation. On that day, I was deeply affected to learn that I would not receive a certificate of achievement just because of one subject. Thinking that I had been wronged, I hid my report card and returned home in tears. My family did not react when they saw my tears. I hid the truth by telling those who were curious about my report card that I had received a certificate of appreciation and did not show it to anyone.

Years later, this incident remains fresh in my memory. Even though I was good at other subjects, having this experience just because of math was quite upsetting and challenging as a child.

2.Tutoring days

At that time, we took an important exam called the Placement Examination (SBS). I remember I was having difficulty in math again. My parents sent me to a tutoring center to help me overcome this problem, but unfortunately I didn't see much benefit from these efforts. I can't say that I didn't study; I really made an effort, but I couldn't get the logic of the math topics in my mind. The questions I faced seemed completely different from each other. I had some talent for memorization, but it didn't work in math. In the exams, I was able to do most of the questions in other subjects, but in math I could only mark a few questions, which meant that I didn't get the expected score.

He was my childhood friend and also my neighbor, we used to go to the same school, and he was a student who was both well-known and well-liked by the teachers. He was very active in math classes and would often chat with the teachers and attend classes. I, on the other hand, was almost like an invisible student next to him. This situation pushed me to gradually withdraw into myself.

My friend's success in exams led to comparisons between families. Not only my own family but also my friend's family was constantly praising their children in front of my family. This was very demotivating for me. If there was more awareness, maybe these situations would not have happened. Every individual is different, but this fact is often ignored by both parents and teachers. In such cases, instead of investigating the cause of the problem, blames are often made, such as 'she doesn't work'.

3.University journey

I somehow got rid of mathematics in high school, I only saw it in the 9th grade, I failed at that time, but I passed the class with an average, then I looked for the solution in English, both I was good with words and there was no math :) otherwise I knew that if I chose equal weight, for example, I would not be able to do math again. I won the Anatolian high school and my friend was one of the best high schools at that time, we were separated there, I didn't see what he was doing anymore, in fact, this was good because there was no comparison in my family because my family accepted that I could do English, but this time, relatives, especially my cousins who were good at mathematics, were constantly criticizing me, saying that you could not win the exam by not doing mathematics, which I won in the first year, which was surprising for them, and my childhood friend was an English teacher. It was strange in this case because he did well on the numerical side and went to a better university by doing less English, such as mathematics, in this case it is quite common I have witnessed many people who have become English teachers by doing less English and doing numerical courses, this situation makes me think that I have been wronged because I think my English is better equipped, but because of such injustice, maybe we have to go to the university where our score is enough, not the university we want.

4.Daily accounts

It can also be sad that older people who do not go to school can do mental addition better than me, sometimes I am surprised, sometimes there is a money issue at work or shopping, they add very quickly by adding immediately from their heads, and when I am in such a situation, the calculator comes to my aid again I can say that in fact, this situation puts you in a difficult situation as a teacher in such environments, frankly, I am ashamed, I always feel a lack.

I am sometimes surprised and saddened by the fact that older people with no schooling can do some things that I cannot do, especially quick mental addition. For example, when they are calculating money or shopping, they do quick addition in their heads. When I encounter similar situations, I usually immediately resort to a calculator, which puts me in a difficult situation, especially as a teacher, and makes me feel incomplete. In such moments, I have to admit that I feel embarrassed and a sense of inadequacy.

5.Mental calculation race

Recently I gave a quiz to my students and afterwards we checked their correct and incorrect answers. I asked them to calculate the sum of their quiz results, back to front. Some students brought the sum immediately. I, as usual, immediately resorted to the

calculator, because it is difficult for me to do quick mental addition. My attempts are usually either wrong or take too long. While I was doing the calculation, students gathered around me and started laughing when one of them beat me and got the result faster. It was a bit embarrassing, to be honest.

On another occasion, a fourth grader recently asked me what the word 'times' means in English. I answered, but then when the student asked me for numbers from the multiplication table in English, I couldn't answer because I have never been able to memorize the multiplication table completely. I quickly changed the subject so that my student wouldn't notice this.

6.Percent confusion

I cannot grasp the concept of percentage. Especially expressions such as 'what percentage of a hundred' confuse me and I find it difficult to understand how it is calculated. When I encounter such calculations, I usually ask someone. For example, the calculation of discounted prices on discount labels in stores; in the past, sometimes we could only find out the discounted price at the checkout. In my profession, percentage calculations are also used to calculate exam grades. I took three exams and it was easy to calculate 50 percent of one of them, because that's half. But I was having a hard time understanding how to calculate the 25 percent and so on. I asked a math teacher a lot of questions about this. The teacher tried to explain it to me, but I still couldn't understand it and we laugh about it now. Finally, I found a website for calculating percentages on the internet and did the calculations there. Mathematics is really everywhere and no matter how much I try to avoid it, I always feel its importance.

7.Disoriented teacher

I constantly confuse my right and my left; it has been like this since I was a child. Every time I have to stop and think for a moment: which side is my right, which side is my left? Sometimes I try to help myself by wearing my wristwatch on my left arm, but that doesn't always work either.

This is especially evident in second grade lessons. Recently, when I was teaching the 'wool topic', I got quite confused while giving instructions like 'turn right, turn left'. I found myself in confusion while trying to show the students the right direction. Then, I started explaining by turning to the blackboard like the students. Fortunately, the situation didn't become too ridiculous because the children were small, but it was still a bit of a challenge for me.

Another example is when I am driving. When someone gives me directions and says 'turn right', I often find it difficult to understand which way is right. Then I think a little bit and say 'Oh, yes, this way is right', but it usually takes a while.

8.Market showdown

One day I went to the grocery store and there was an old lady at the checkout. This grocer only dealt in cash. I usually don't like to use cash because I find it difficult to count money. I find it easier to pay with high denomination banknotes such as 100 □, but when I pay large amounts with small denomination banknotes such as 20, 10, 5 □, I have trouble with the calculation. I usually either miscalculate or have to wait for a long time due to someone else's intervention.

That day I did my shopping and went to the checkout to pay. I gave 100 □ and the total amount was 37 □. Both I and Auntie had a hard time calculating the change, and I didn't have my phone with me that day, otherwise the calculator app would have saved me from this situation immediately. I don't remember ever feeling so nervous in my life, I felt as if I had found myself in a big test.

9.Disappearing directions

Finding an address is always a difficult experience for me. Sometimes, even though I have been there many times, I cannot remember which way I should turn or where I came from, and I get a feeling of being lost. For example, there is a road that I often use by car; I think about which way I should turn right now, but I cannot think of it. This happens more often on main roads, even if I know the road.