

EXAMINATION OF TEACHERS' AND PRE-SERVICE TEACHERS' AWARENESS LEVELS REGARDING DYSCALCULIA

(Research article)

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Abstract

The purpose of this study is to determine the awareness levels of teachers and pre-service teachers regarding dyscalculia and to examine whether this awareness differs according to various demographic and professional variables. The research was conducted using a descriptive survey model. The study group consisted of 353 participants in total, including 250 pre-service teachers studying at different universities in Turkey and 103 in-service middle school mathematics and classroom teachers. Data were collected using the “Dyscalculia Awareness Scale” developed by Sousa et al. (2017), and analyzed using the independent samples t-test. According to the findings, teachers and pre-service teachers demonstrated an overall moderate-to-high level of awareness regarding dyscalculia. Significant differences in awareness were found based on prior exposure to the concept of dyscalculia, participation in courses related to learning difficulties, and media interaction. No significant differences were observed in relation to gender, educational status, program type, years of experience, or participation in in-service training. The results highlight the importance of incorporating practical and experiential content into teacher education programs to enhance awareness of dyscalculia.

Keywords: Dyscalculia; learning difficulties; middle school mathematics teachers; pre-service teachers

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1. Introduction

Mathematics plays a fundamental role in developing individuals' problem-solving and analytical thinking skills throughout their lives. However, some students experience significant difficulties in learning mathematics despite having sufficient cognitive capacity and an appropriate learning environment. This situation points to a specific learning disability known in the literature as dyscalculia (Butterworth, 2005). Dyscalculia is defined as a neurodevelopmental disorder characterized by persistent difficulties in understanding numerical concepts, performing arithmetic operations, solving problems, and comprehending mathematical symbols (von Aster & Shalev, 2007; Haberstroh & Schulte-Körne, 2022; Shalev & Gross-Tsur, 2001).

Dyscalculia affects not only academic performance but also individuals' daily life skills. It may lead to difficulties in planning, sequencing, and executing everyday tasks (Andersson & Abdelmalek, 2021). Considering the lifelong impact of dyscalculia, the importance of early intervention becomes even more evident. Therefore, it is recommended that individualized instructional programs, conducted by trained specialists, begin during the early primary school years (Haberstroh & Schulte-Körne, 2019). International studies have reported that dyscalculia affects approximately 5% of the population (Kaufmann & von Aster, 2012). Moreover, difficulties experienced by individuals with dyscalculia negatively influence not only their academic performance but also their self-confidence and attitudes toward learning (Geary, 2011; Mazzocco, 2007). For this reason, it is crucial that teachers recognize this learning difficulty and develop appropriate instructional strategies. Low levels of teacher awareness may result in delayed diagnosis and insufficient support for affected students (Kaufmann & von Aster, 2012).

Research conducted internationally indicates that teachers' knowledge and awareness of dyscalculia are generally low (Cowan & Powell, 2014; Lewis et al., 2018). For instance, studies conducted in Malaysia by Rahman (2016) and Fu and Chin (2017) revealed that most teachers were unfamiliar with the concept of dyscalculia and tended to attribute students' mathematical difficulties to other causes. Similarly, research conducted in Greece found that a significant proportion of teachers possessed limited knowledge about dyscalculia (Anastasiou & Polychronopoulou, 2009; Dimakis et al., 2025).

Studies conducted in Turkey demonstrate a similar pattern. Karadeniz (2020) reported that most primary school teachers were unfamiliar with the term dyscalculia, while Demirtaş and Kaya (2021) found that pre-service teachers had low levels of awareness regarding learning difficulties. Another study revealed that many Turkish primary school teachers were not acquainted with the concept of dyscalculia and experienced challenges in providing effective instruction for students with dyscalculia in classroom settings (Karasakal, 2018). These findings indicate that the topic of dyscalculia is not adequately addressed within teacher education programs. Accordingly, the present study aims to determine the awareness levels of teachers and pre-service teachers regarding dyscalculia and to investigate whether this awareness differs

across various demographic (gender, educational status, program type) and professional (prior exposure to the concept of dyscalculia, participation in courses on learning difficulties, media interaction) variables. The findings of this study are expected to contribute to the development of teacher education curricula and to enhancing awareness of specific learning difficulties.

Examining the demographic and professional factors that influence teachers' and pre-service teachers' awareness of dyscalculia is considered important for both improving teacher education programs and planning in-service professional development activities. Although existing research has examined teachers' knowledge and attitudes toward dyscalculia, quantitative studies focusing on the effects of variables such as prior exposure, media influence, and experience with learning difficulties remain limited in the Turkish context. Therefore, this study provides an innovative contribution by offering up-to-date data from Turkey through a descriptive survey design within an interdisciplinary framework that connects mathematics education and learning difficulties.

The purpose of this research is to determine the awareness levels of teachers and pre-service teachers regarding dyscalculia and to identify whether these levels differ according to various demographic and professional variables (e.g., gender, educational status, program type, prior exposure to the concept of dyscalculia, participation in relevant courses, media interaction).

1. What are the awareness levels of teachers and pre-service teachers regarding dyscalculia?
2. Do these awareness levels significantly differ according to demographic variables such as gender, educational status, program type, prior exposure to dyscalculia, participation in courses on learning difficulties, or media interaction?
3. Do professional variables such as teaching experience, branch, or participation in in-service training significantly affect awareness levels?

2. Method

2.1. Research design

This study was conducted using a descriptive survey design, aiming to examine teachers' and pre-service teachers' levels of awareness regarding dyscalculia across various variables. The descriptive survey model is a research design that seeks to present the existing situation as it is and describe the relationships among variables (Büyüköztürk et al., 2014). In this context, the study aimed to determine participants' levels of dyscalculia awareness and to explore whether this awareness differs in relation to certain demographic and professional variables.

2.2. Participant (subject) characteristics

The study group consisted of senior pre-service teachers enrolled in primary school teaching and elementary mathematics teaching programs at various universities, as well as in-service classroom and middle school mathematics teachers. Participants were selected through

convenience sampling (Büyüköztürk et al., 2014). In this sampling method, the researcher begins forming the sample starting with the most accessible respondents until the desired sample size is reached (Ravid, 2024).

Using this method, a total of 353 teachers and pre-service teachers participated in the study. Of these, 284 were female and 69 were male. Among the participants, 250 were undergraduate students, while 103 were graduates. In terms of program type, 289 participants studied or graduated from Elementary Mathematics Education programs, and 64 from Primary School Education programs. Additionally, 133 participants reported having worked with students with learning difficulties, 213 stated that they had taken a course related to learning difficulties, and 57 indicated participation in scientific events on the subject.

2.3. Data Collection Tool and Procedure

Data were collected using a questionnaire designed to measure teachers' and pre-service teachers' awareness levels of dyscalculia. The instrument employed in this study was the Dyscalculia Awareness Scale developed by Sousa et al. (2017). The original scale consists of 44 items across three factors: Knowledge of dyscalculia characteristics, knowledge of dyscalculia symptoms, and knowledge of dyscalculia intervention strategies. During the process of adapting the scale into Turkish, the items were first translated by the researcher and subsequently reviewed by an expert from a university's School of Foreign Languages. Furthermore, expert opinions were obtained from a faculty member in the Department of Special Education regarding the sections related to dyscalculia knowledge and symptoms, and from a faculty member in the Department of Elementary Mathematics Education regarding the section on intervention strategies. Based on expert feedback, one item ("Experiences difficulty in spatial orientation and lateralization, e.g., in locating information in the left or right hemisphere of the brain") was determined to measure more than one construct and was therefore divided into two separate items. As a result, the total number of items increased from 44 to 45.

Additionally, demographic questions were added to the instrument to collect descriptive information about participants. The data were collected online via Google Forms from voluntary participants. All responses were evaluated in accordance with ethical principles of confidentiality and anonymity.

2.4. Data Analysis

The collected data were analyzed using descriptive statistics (frequency and mean) and parametric tests. Since the data were normally distributed, the Independent Samples t-test was used for group comparisons. The level of statistical significance was set at 0.05. The results were presented in tables, and variables showing statistically significant differences were interpreted accordingly. The normality of scale score distribution and outliers were also

examined. Skewness and kurtosis coefficients were assessed to verify distributional normality, as presented in Table 1.

Table 1. Results of the Normality Test

	Skewness	Kurtosis
Participants' survey scores	-1,027	0,909

According to Table 1, the skewness and kurtosis coefficients were examined to determine whether the data followed a normal distribution. The skewness value was calculated as -1.027 and the kurtosis value as 0.909. According to Tabachnick and Fidell (2015), if the skewness and kurtosis coefficients fall within the range of -1.5 to +1.5, the data are considered to be normally distributed. Therefore, it can be concluded that the data obtained in this study are normally distributed.

2.4.1. Validity and reliability

Content validity was initially employed to establish evidence of validity for the data collected in the study. Expert opinions were sought from two specialists: one from the Department of Special Education, who reviewed the sections of the scale related to knowledge and symptoms of dyscalculia, and another from the Department of Elementary Mathematics Education, who evaluated the section concerning both symptoms of dyscalculia and knowledge of intervention strategies for dyscalculia. Based on their recommendations, the items were revised accordingly. After the implementation phase, the data were subjected to an Exploratory Factor Analysis (EFA). Prior to conducting the analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were examined to determine whether the data were suitable for factor analysis. Both tests indicated statistical significance (KMO = .806; Bartlett's Test of Sphericity: $\chi^2 = 8693.928$, $p = .000$) (Büyüköztürk, 2015). Subsequently, Principal Components Analysis (PCA) was conducted as the extraction method to assess the construct validity of the scale.

Table 2. Exploratory factor analysis results

Item No.	Knowledge of dyscalculia characteristics	Knowledge of dyscalculia symptoms, and	Knowledge of dyscalculia intervention strategies
Item 1	.385	.209	-0.112
Item 2	.236	-0.035	-0.140
Item 3	.324	.224	-0.147
Item 4	.436	-0.149	-0.050
Item 5	.281	.083	.133
Item 6	.567	-0.098	-0.255

Item 7	.385	.001	-0.160
Item 8	.485	-0.127	.042
Item 9	.565	.188	-0.184
Item 10	.355	.335	-0.184
Item 11	.466	-0.079	-0.064
Item 12	.392	.068	-0.053
Item 13	.094	.648	-0.374
Item 14	.004	.579	-0.305
Item 15	.145	.554	-0.185
Item 16	.202	.694	-0.229
Item 17	.048	.718	-0.425
Item 18	.184	.672	-0.133
Item 19	.140	.615	-0.268
Item 20	.109	.704	-0.047
Item 21	.156	.627	-0.021
Item 22	.353	.419	-0.114
Item 23	.234	.599	.119
Item 24	.056	.353	.086
Item 25	.043	.488	.286
Item 26	.183	.622	-0.180
Item 27	.101	.675	-0.329
Item 28	.346	.404	.364
Item 29	.128	.786	.014
Item 30	.461	.445	.376
Item 31	.332	.409	.319
Item 32	.421	.414	.293
Item 33	.353	.520	.480
Item 34	.217	-0.274	.532
Item 35	.212	-0.200	.502
Item 36	.180	-0.248	.632
Item 37	.277	-0.333	.591
Item 38	.143	-0.550	.562

Item 39	.152	-0.427	.603
Item 40	.258	-0.409	.589
Item 41	.139	.127	.343
Item 42	.083	-0.444	.551
Item 43	.195	-0.429	.549
Item 44	.295	-0.287	.653
Item 45	.102	-0.353	.439

Following the initial analysis, it was determined that the scale items were grouped under 13 factors with eigenvalues greater than 1. These 13 factors together explained 69.282% of the total variance. However, since the original developers of the scale designed it with a three-factor structure, the Exploratory Factor Analysis (EFA) was performed again. Ultimately, the three-factor solution explained 48.162% of the total variance. The criterion that factor loadings should exceed 0.45 was largely met, and it was therefore decided to retain all items in the scale (Büyüköztürk, 2015).

To determine the reliability of the scale, the Cronbach's alpha internal consistency coefficient was calculated. The analysis yielded a Cronbach's alpha value of 0.904, indicating a high level of internal consistency. According to George and Mallery (2024), a Cronbach's alpha coefficient of 0.90 or above is considered to represent excellent reliability. Therefore, it can be concluded that the scale used in this study produced reliable and consistent results as a measurement instrument.

3. Results

3.1. Results regarding teachers and pre-service teachers

In this section, the levels of awareness regarding dyscalculia among teachers and pre-service teachers were examined in relation to various variables. An Independent Samples t-test was used in the data analysis, and the significance level was set at .05.

Table 3. Descriptive Statistics for Participants' Dyscalculia Awareness Scale Scores

	N	Minimum	Maximum	\bar{X}	SD
Participants' dyscalculia scores	353	70,00	128,00	112,15	10,99

Note. The possible range of scores on the scale is between 0 and 135, with higher scores indicating greater levels of awareness.

Descriptive statistics for the dyscalculia awareness scores of the 353 teachers and pre-service teachers who participated in the study are presented in Table 3. Participants' awareness scores ranged from 70.00 to 128.00. The mean score obtained from the scale was 112.15 (SD = 10.99).

This value indicates that participants generally demonstrated a moderate-to-high level of awareness regarding dyscalculia.

Table 4. Results of the Independent Samples t-Test for Teachers' and Pre-Service Teachers' Dyscalculia Awareness Levels

Independent Variable		N	\bar{X}	SD	df	t	p
Gender	Female	284	112.36	10.57	351	.714	.476
	Male	69	111.30	12.63			
Educational status	Undergraduate students	250	111.99	11.55	351	.417	.677
	Graduate	103	112.53	9.57			
Program type	Elementary Mathematics Education	285	112.02	10.69	351	.461	.645
	Primary Education	68	112.70	12.26			
Prior encounter with the concept of dyscalculia	Yes	138	114.52	10.19	351	3.288	.001*
	No	215	110.63	11.24			
Experience working with a student who has (or is suspected to have) a learning difficulty	Yes	133	112.21	11.65	351	.086	.931
	No	220	112.11	10.60			
Completion of a course on learning difficulties	Yes	213	114.32	9.30	351	4.711	.000*
	No	140	108.85	12.49			
Attendance at a symposium, seminar, or other scientific event focused on learning difficulties	Yes	57	111.28	13.60	351	.654	.514
	No	296	112.32	10.44			
Engagement with written or visual media related to learning difficulties	Yes	271	112.75	11.12	351	1.870	.044*
	No	82	109.17	10.39			
Presence of individuals affected by learning difficulties in one's immediate social environment	Yes	104	113.07	9.83	351	1.010	.313
	No	249	111.77	11.44			

The significance level was set at 0.05.

No significant difference was found between teachers' and pre-service teachers' dyscalculia awareness scores in terms of gender ($t = 0.714$; $p = 0.476$). The mean score of female participants

(112.36) was similar to that of male participants (111.30), suggesting that gender is not a determining factor in awareness levels. Likewise, there was no significant difference in awareness levels based on whether participants were undergraduate students or graduates ($t=0.417$; $p=0.677$). Although the mean score of teachers was slightly higher than that of pre-service teachers, this difference was not statistically significant, indicating that teachers' awareness of dyscalculia did not differ meaningfully from that of pre-service teachers.

The type of academic program (Elementary Mathematics Education or Primary Education) also did not lead to a significant difference in awareness levels regarding dyscalculia ($t=0.461$; $p=0.645$).

Participants who had previously encountered the concept of dyscalculia exhibited significantly higher awareness levels ($t=3.288$; $p=0.001$). The mean score of those who answered "Yes" (114.52) was notably higher than that of those who answered "No" (110.63). This finding suggests that prior exposure to the concept significantly enhances awareness.

No significant difference was found in awareness levels based on whether participants had worked with individuals experiencing learning difficulties or with students they believed to have such difficulties ($t=0.086$; $p=0.931$). However, participants who had taken a course related to learning difficulties demonstrated significantly higher awareness levels than those who had not ($t=4.711$; $p=0.000$). The mean score of those who answered "Yes" was 114.32, while that of those who answered "No" was 108.85. This finding highlights the crucial role of relevant coursework in developing awareness.

No significant difference was found between participants who had attended symposiums, seminars, or similar events on learning difficulties and those who had not ($t=0.654$; $p=0.514$). On the other hand, participants who had engaged with written or visual media content related to learning difficulties showed significantly higher awareness levels ($t=1.870$; $p=0.044$). This finding indicates that media can serve as an effective tool in raising awareness.

Finally, the presence of individuals with learning difficulties in the participants' close social circles did not emerge as a factor affecting teachers' and pre-service teachers' awareness of dyscalculia ($t=1.010$; $p=0.313$).

3.2. Results related to variables owned only by teachers

In this section, the levels of awareness regarding dyscalculia among teachers were examined in relation to various variables. An Independent Samples t-test was used in the data analysis, and the significance level was set at 0.05.

Table 5. Results of the Independent Samples t-Test on Teachers' Dyscalculia Awareness Levels

Independent Variable		N	\bar{X}	SD	df	t	p
Teaching field	Elementary Mathematics Teacher	85	112,13	8,98	101	.932	.354
	Elementary school teacher	18	114,44	12,09			
Last graduated program	Undergraduate program	85	112,48	9,50	101	.118	.906
	Graduate program	18	112,78	10,16			
In-service training on learning difficulties	Yes	8	115,50	8,02	101	.912	.364
	No	95	112,28	9,68			

The significance level was set at 0.05.

Data for the teacher group involving two independent variables were analyzed using the Independent Samples t-test. No significant difference was found in awareness levels according to the variable of teaching branch ($t = 0.932$; $p = 0.354$). Likewise, no significant difference was observed in awareness levels based on the type of degree program completed ($t = 0.118$; $p = 0.906$). Although teachers who had participated in in-service training showed relatively higher levels of awareness regarding dyscalculia, this difference was not statistically significant ($t = 0.912$; $p = 0.364$).

Table 6. Results of the analysis of teachers' dyscalculia awareness levels by years of professional experience

Source of Variance	Sum of Squares	df	Mean Square	F	p
Between Groups	1.296	1	1.296	.014	.906
Within Groups	9336.335	101	92.439		
Total	9337.631	102			

The analysis results indicated that teachers' years of professional experience did not create a significant difference in their awareness levels regarding dyscalculia, $F(1, 101) = 0.014$.

Overall, the findings revealed that *prior exposure to the concept of dyscalculia, taking a course related to learning difficulties, and engaging with media content on the topic* led to significant differences in awareness levels, whereas other variables did not yield statistically significant effects.

4. Discussion

In this study, teachers and pre-service teachers were found to have a moderate-to-high level of awareness of dyscalculia. This finding partially differs from previous studies reporting lower

levels of awareness (Anastasiou & Polychronopoulou, 2009; Cowan & Powell, 2014; Demirtaş & Kaya, 2021; Dimakis et al., 2025; Fu & Chin, 2017; Karadeniz, 2020; Karasakal, 2018; Lewis et al., 2018; Rahman, 2016). Several possible explanations may account for this discrepancy.

First, the characteristics of the sample could be a major factor. The sample of the present study included both teachers and pre-service teachers, many of whom had taken courses related to learning difficulties or had been exposed to such content through media. This may have resulted in higher awareness levels compared to participants in earlier studies. Second, the structure and scope of the measurement tool used in this study may also have influenced the results. The inclusion of both knowledge- and awareness-related components in the scale provided a broader assessment of participants' overall awareness.

Indeed, previous research has emphasized factors that enhance teachers' and pre-service teachers' awareness of dyscalculia. For instance, Cowan and Powell (2014) found that training on learning difficulties improved teachers' knowledge levels, while Rahman (2016) reported that teachers' lack of prior exposure to the concept contributed to lower awareness. Similarly, Karadeniz (2020) highlighted teachers' limited awareness of dyscalculia and the need for systematic education on the topic.

In addition, several studies have pointed out that teachers' understanding of dyscalculia is often influenced by how learning difficulties are framed within teacher education programs and national curricula. When dyscalculia is presented merely as a theoretical concept rather than through classroom-based examples or case studies, teachers tend to develop superficial knowledge rather than deep pedagogical awareness (Lewis et al., 2018). Furthermore, cultural and educational system differences may also explain variations across studies. For example, in contexts where learning disabilities are formally recognized and supported through national policies, teachers generally report higher awareness and more positive attitudes (Fu & Chin, 2017). Conversely, in settings where such topics receive limited institutional emphasis, teachers may lack both the terminology and diagnostic understanding needed to identify dyscalculia in students.

Moreover, awareness is not a static trait but a developmental process shaped by teachers' exposure, reflection, and professional learning experiences. As Cowan and Powell (2014) suggested, awareness evolves through continuous engagement with diverse learners and participation in collaborative discussions about learning difficulties. This implies that enhancing teachers' awareness requires more than one-time lectures—it necessitates sustained professional development and reflective practice opportunities.

Beyond these factors, the results can also be interpreted in light of recent educational reforms and developments in teacher training in Turkey. Over the past decade, teacher education programs have increasingly incorporated modules on inclusive education and learning disabilities. This growing emphasis may have contributed to a greater baseline awareness among pre-service teachers. Moreover, public awareness campaigns and the dissemination of

educational content through digital media may have further raised general sensitivity toward specific learning difficulties such as dyscalculia.

The study also found that variables such as gender, educational status, and program type did not produce significant differences in awareness levels. Among practicing teachers, variables such as teaching branch, degree level (undergraduate or graduate), participation in in-service training, and years of experience also did not yield significant differences. This suggests that awareness levels are more closely related to professional development and specialized training rather than demographic characteristics. Consistent with this finding, Anastasiou and Polychronopoulou (2009) also reported that teachers' length of professional experience had only a limited impact on awareness.

Interestingly, participation in in-service training did not significantly affect awareness levels. This may be due primarily to the small number of teachers who had attended such programs. In line with this, Lewis et al. (2018) found that incorporating practice-based and case-oriented modules on dyscalculia into teacher training programs led to substantial improvements in teachers' knowledge and awareness. Based on this evidence, it can be inferred that expanding in-service training opportunities on dyscalculia and designing them to include hands-on, practice-oriented activities would yield meaningful improvements.

From a practical standpoint, these findings highlight the importance of integrating dyscalculia-related content into both pre-service and in-service teacher education curricula. In particular, embedding such content within broader inclusive education frameworks may ensure that teachers develop not only conceptual understanding but also the ability to identify and support students with dyscalculia in real classroom contexts. Future research could further investigate how teachers' awareness translates into classroom practices, as awareness alone may not guarantee effective intervention or accommodation. Additionally, qualitative studies exploring teachers' lived experiences and challenges in addressing dyscalculia could provide deeper insights into the relationship between knowledge, attitude, and pedagogical response.

5. Conclusion and Recommendations

The results of this study demonstrated that teachers' and pre-service teachers' awareness of dyscalculia varied depending on certain variables. Specifically, participants who had previously encountered the concept of dyscalculia, taken a course on learning difficulties, or engaged with related media content exhibited significantly higher levels of awareness. These results indicate that direct experience, educational preparation, and access to information play a crucial role in developing awareness.

Including dyscalculia-specific content within the scope of special learning difficulties in teacher education programs is of great importance for enhancing pre-service teachers' knowledge and awareness in this area. Additionally, organizing practice-based workshops

during in-service training—where teachers can work on real case examples—would help integrate theoretical knowledge with practice and directly contribute to the teaching process.

The use of media materials (e.g., documentaries, short films, digital content) designed to raise awareness in education faculties can further enhance students' sensitivity to the issue. Moreover, implementing nationwide awareness campaigns targeting teachers could contribute to disseminating knowledge of dyscalculia among larger audiences. Finally, future studies employing qualitative research methods, particularly interviews and observations, would provide deeper insights into teachers' perceptions and understandings of dyscalculia

Declaration of Conflicting Interests and Ethics

The author declares no conflict of interest. The ethical approval was obtained from Gaziantep University Social and Humanity Research Ethics Committee with the registration number of 478892 on 15.04.2024.

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