Original Article

Development and Psychometric Evaluation of a Scale for Identifying Specific Learning Problems in Dental Students

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Abstract

Background: Learning disabilities can adversely affect the academic and professional performance of dental students and ultimately impact the quality of health services provided to the community. Given the absence of a standardized questionnaire for assessing specific learning problems among dental students, the development of a valid and reliable tool tailored to this group is essential.

Methods: This three-phase descriptive study involved generating and refining a pool of questionnaire items through qualitative interviews and a review of authoritative literature. Subsequently, the psychometric properties of the questionnaire were assessed. To this end, face validity was examined using the item impact method, while content validity was evaluated through the Content Validity Ratio (CVR) and the Content Validity Index (CVI). Finally, the questionnaire was administered to 137 dental students, and construct validity was established through the assessment of convergent and discriminant validity using Smart-PLS software (Version 4). Reliability was further determined using Cronbach's alpha and composite reliability coefficients.

Results: The initial version of the questionnaire consisted of 70 items. Following face validity and qualitative and quantitative content validity assessments, the number of items was reduced to 48. The finalized instrument assesses 11 domains, including difficulties in reading, mathematics, writing, motor skills, language, auditory and visual processing, spatial problems, social cognition, social anxiety, and attention deficit/hyperactivity disorder. In face validity assessment, all items demonstrated acceptable impact scores. The average CVI was 86%, and the CVR was 68%.

Conclusion: The questionnaire designed to assess specific learning problems among dental students, comprising 48 items, demonstrated satisfactory validity and reliability. Completion requires no more than 15 minutes. The questionnaire, specifically developed for dental students, can be utilized in future studies.

Keywords: Questionnaire, Learning disabilities, Students, Dentistry, Psychometrics

Introduction

Learning problems are undeniable realities observed across all communities and cultures (1). Specific learning disability (SLD) refers to a disorder in one or more basic psychological processes involved in the comprehension or use of spoken or written language, which may result in deficiencies in an individual's ability to listen, think, speak, read, write, spell, or perform mathematical calculations (2). This disorder does not include students who experience learning difficulties due to visual, auditory, or motor impairments, intellectual disability, or environmental and economic deprivation. In other words, students with specific learning problems are those who, despite having normal intelligence and no sensory deficits or severe brain injuries, are unable to fully utilize educational resources and exhibit significant weaknesses in one or more academic subjects (3). Students with learning problems demonstrate lower skills and performance than expected, adversely affecting their academic progress and daily activities requiring these abilities. This deficiency is not due to impairments in sensory-motor systems or neurological disorders (4).

The presence of learning problems among students can lead to academic underachievement, reduced self-esteem, and dropout. Labels such as "retarded" or "lazy" hinder their continuation in education and can inflict irreparable psychological and economic harm on both the students and their families (5). Learning difficulties prevent talent development and cause frustration. As a result, the identification and remediation of these problems should be a priority for stakeholders in higher education (6). Identifying and addressing student learning difficulties

during their educational process not only requires modern instructional approaches but also constitutes part of the faculty's responsibilities (7, 8).

Numerous studies have examined learning problems and their impact on academic performance. For instance, a study by Kavale and Forness demonstrated that learning difficulties can lead to academic underachievement and decreased self-esteem among students (9). Moreover, Karunanayake emphasized the importance of timely identification of these difficulties and providing necessary support (10). In a study conducted by Heiman and Precel, 191 students with learning disabilities and 190 students without learning disabilities were compared across four major domains: academic challenges, learning strategies, performance during examinations, and students' perceptions of factors facilitating or hindering academic success. Data analysis indicated no significant differences between groups in grade point average, number of completed credits, or family background. However, students with learning disabilities reported encountering more difficulties than their peers in courses related to the humanities, social sciences, and foreign languages. Concerning learning strategies, students with learning disabilities tended to employ unconventional strategies and preferred verbal or visual explanations, whereas students without learning disabilities favored written examples. These differences revealed that students without learning disabilities utilized written techniques more frequently than their peers with learning disabilities. During examinations, students with learning disabilities experienced difficulties concentrating and were concerned about time constraints. They reported higher levels of stress and anxiety and felt greater frustration, helplessness, and uncertainty compared to students without learning disabilities (11).

Learning problems among students are one of the primary causes of poor academic performance and other behavioral issues in university and even within the family. Addressing learning difficulties in dental students is particularly important, as this group requires precision and specific competencies during the learning and skills acquisition process. Learning disabilities can adversely affect the academic and professional performance of these students and, ultimately, the quality of health services provided to the community. Given the absence of a standardized questionnaire to assess specific learning problems among dental students, the development of a suitable tool for evaluating these difficulties in this population is essential. Accordingly, this study aimed to design and validate a questionnaire for assessing specific learning problems in dental students at Yasuj University of Medical Sciences.

Methods
This cross-sectional descriptive study was conducted in three phases.

Phase 1: Questionnaire Design
To develop the questionnaire, the tool design procedure proposed by Waltz et al (12) was employed, and a conceptual definition of learning disorders was established. Initially, questionnaire items were extracted through a comprehensive review of existing scientific literature. Scientific databases, including PubMed, CINAHL, ScienceDirect, SID, Magiran, and Google Scholar were searched. Keywords such as "learning problems", "students", and "dentistry" were used in both Persian and English in the titles and abstracts of the articles, with no time restrictions.

Moreover, interviews were conducted with stakeholders to collect their perspectives and experiences regarding specific learning problems among students. Qualitative data were obtained through semi-structured in-depth interviews with nine participants, including dental faculty members, educational managers, the dean and vice-dean of the dental faculty, and a psychiatrist. These interviews included key questions addressing the educational challenges and needs of students, which assisted in identifying relevant questionnaire items. Stakeholders, drawing on their teaching experience and interaction with students, provided valuable insights that enriched the content of the questionnaire and ensured that the items were relevant and useful. A purposive sampling method was employed to select the participants. Each interview lasted approximately 30 minutes, with 1–3 sessions conducted per participant.

Ultimately, the data from the literature review and stakeholder interviews were integrated to form the initial pool of questionnaire items. The items were then reviewed and edited for content clarity, grammar, and comprehensibility. This process ensured that the preliminary questionnaire was both scientifically and practically valid, preparing it for subsequent face and content validity assessments.

Phase 2: Face and Content Validity Assessment
To assess the validity of the questionnaire, face validity was first evaluated using both qualitative and quantitative approaches. For qualitative face validity, aspects such as adherence to Persian language rules, appropriate word choice, proper placement of items, suitable scoring, estimated completion time, and the appropriateness of the response range were examined. All items of the instrument were repeatedly reviewed and revised by nine experts to ensure clarity, relevance, and comprehensibility. For quantitative face validity assessment, the item impact method was employed with 15 dental students outside the target group. A five-point Likert scale ("Extremely important", "Important", "Moderately important", "Slightly important", "Not important at all") was used to

rate each item. Impact scores above 1.5 were considered acceptable and retained for subsequent phases (13).

To calculate the Content Validity Ratio (CVR), nine experts, including four dental faculty members, two educational managers, the dean of the faculty, the vice-dean of the faculty, and a psychiatrist, rated each item on a three-point scale: "essential", "useful but not essential", or "not essential" (14). Items with a CVR less than 0.7 were eliminated; items with a CVR between 0.7 and 0.79 were revised, and items with a CVR above 0.79 were considered acceptable. The CVR was calculated using the following formula:

$$CVR = \frac{ne - N/2}{N/2}$$

where ne represents the number of experts indicating the item as "essential", and N denotes the total number of experts.

For the Content Validity Index (CVI), the same nine experts evaluated each item using a four-point relevance scale, ranging from 1 (not relevant) to 4 (highly relevant). The CVI for each item was calculated as the proportion of experts who rated the item as 3 or 4. According to Lawshe's table for nine experts, a CVI greater than 0.78 was considered acceptable. Accordingly, all items with a CVI above 0.78 were retained in the questionnaire (15).

Phase 3: Construct Validity and Reliability Assessment

The statistical population for this phase of the study comprised all dental students at Yasuj University of Medical Sciences, totaling 137 individuals at the time of the study, all of whom were included via a census method. The use of a census was intended to collect comprehensive and accurate data while minimizing sampling error. Moreover, since the objective of the study was to design a tool for identifying specific learning problems in students, a census method allowed for a thorough evaluation of the status of all students, thereby enhancing the validity and reliability of the results. The exclusion criteria were unwillingness to continue participation at any stage, inability to complete the questionnaire, failure to adhere to ethical considerations, and lack of informed consent. Furthermore, students with visual, auditory, motor, or similar impairments were excluded from the study.

The construct validity of the questionnaire was evaluated using second-order confirmatory factor analysis, assessing both convergent and discriminant validity via Smart-PLS software (version 4). Convergent validity was assessed using the Average Variance Extracted (AVE) and factor loadings (16). AVE values greater than 0.4 indicated acceptable convergent validity. Discriminant validity was evaluated using the Fornell–Larcker criterion (17).

Reliability Assessment

To assess the reliability and internal consistency of the instrument, Cronbach's alpha and composite reliability (CR) coefficients were calculated after data collection from the target population. For an instrument to be considered reliable, a minimum Cronbach's alpha and composite reliability of 0.7 is required. Given that Cronbach's alpha tends to increase with the number of items per factor, the CR index was also used to evaluate internal consistency, as it reflects the variance explained by items within each factor (18). Values exceeding 0.7 for Cronbach's alpha and 0.6 for composite reliability were considered acceptable (19).

Data Analysis

The collected data were analyzed using Smart-PLS software (version 4). Descriptive statistics were employed to summarize the demographic characteristics of the participants. The qualitative data obtained from the interviews were analyzed using the conventional content analysis method with MAXQDA-10 software. Content validity was assessed using the Content Validity Ratio (CVR), and reliability was evaluated using Cronbach's alpha and composite reliability coefficients.

Ethical Considerations

To comply with ethical protocols, the research proposal was approved by the Ethics Committee of Yasuj University of Medical Sciences under project number 4020001 and ethical code IR.YUMS.REC.1402.084. The participants and stakeholders received detailed information about the study objectives and procedures. Written informed consent was obtained from all participants. Participation in interviews and completion of the questionnaires were considered as indications of informed consent. All instructions were clearly communicated in the questionnaire guidelines. Confidentiality of the collected information was strictly maintained, and participants were informed of the right to withdraw from the study at any stage. The results were reported in a manner that preserved the anonymity of the participants.

Results

Phase 1: Questionnaire Design

During the literature review phase, a total of 1,714 articles were retrieved. These articles were screened based on the research objectives, and unrelated or duplicate studies were excluded. Following initial screening and review of titles and abstracts, 113 articles were selected. Upon reading the full abstracts, some were found to be irrelevant, reducing the number of selected articles to 36. Among these, full texts of eight articles in English and four articles in Persian were accessed and reviewed in detail. In the qualitative interview phase, the data from semi-structured interviews with nine stakeholders were analyzed using conventional content analysis, yielding a total of 49 extracted themes. In the final stage, results

from the literature review and interviews were integrated to form the initial item pool for the questionnaire.

To clarify how the questionnaire items were derived, operational definitions of each construct were first provided briefly. Based on the conceptual scope of the extracted concepts, the items were drafted. The preliminary questionnaire consisted of 70 items, rated on a five-point Likert scale: "Strongly Agree", "Agree", "Undecided", "Disagree", and "Strongly Disagree" (Table 1).

Phase 2: Face and Content Validity Assessment

Qualitative face validity of the items was assessed through expert feedback, and the research team reviewed and revised the items accordingly. Most items were modified following discussion and consensus during these sessions. Quantitative face validity, assessed through the item impact method, indicated that all items had impact scores greater than 1.5, confirming their suitability for subsequent content validity assessment.

During the psychometric evaluation, content validity

Table 1. Content validity index, content validity ratio, and impact score for each item

No.	Item	CVI		CVR		Impact	
		Relevance	Evaluation	Necessity	Evaluation	Importance	Evaluation
1	I feel slow when reading dental texts.	0.77	Revision	0.55	Rejected	4.42	Acceptable
2	I have difficulty reading dental content.	1.00	Suitable	0.78	Suitable	4.32	Acceptable
3	I have difficulty understanding dental content.	1.00	Suitable	0.78	Suitable	4.67	Acceptable
4	Due to difficulty understanding dental content, I require assistance from my classmates.	0.77	Revision	0.55	Rejected	4.59	Acceptable
5	I dislike reading a text for a long time or focusing on its details.	0.66	Rejected	0.33	Rejected	4.33	Acceptable
6	I have difficulty recalling dental-related terms.	0.77	Revision	0.33	Rejected	4.12	Acceptable
7	I have difficulty learning the names of diseases and specialized dental terminology.	1.00	Suitable	1.00	Suitable	4.77	Acceptable
8	My performance in courses involving calculations (e.g., Orthodontics, Periodontology, Endodontology) is lower than in courses without calculations.	0.88	Suitable	0.78	Suitable	4.32	Acceptable
9	I encounter difficulties calculating patient payments in my own clinic.	0.44	Rejected	0.55	Rejected	4.51	Acceptable
10	I have difficulty measuring angles in Orthodontics.	1.00	Suitable	0.78	Suitable	4.89	Acceptable
11	I have difficulty memorizing numbers.	1.00	Suitable	0.78	Suitable	4.84	Acceptable
12	I write excessively large when completing patient files, so it does not fit on the page.	1.00	Suitable	0.78	Suitable	4.16	Acceptable
13	I make spelling mistakes when writing prescriptions for patients.	1.00	Suitable	0.78	Suitable	4.49	Acceptable
14	Due to poor handwriting, no one except me can read my prescriptions.	0.77	Revision	0.78	Suitable	4.22	Acceptable
15	I experience difficulties in exams due to poor handwriting.	0.66	Rejected	0.55	Rejected	4.3	Acceptable
16	I vary the spacing between words when writing prescriptions or during exams.	0.88	Suitable	0.78	Suitable	4.75	Acceptable
17	My hands tremble when performing dental procedures.	1.00	Suitable	0.78	Suitable	4.91	Acceptable
18	I struggle to place instruments correctly in their designated locations efficiently.	0.77	Revision	0.78	Suitable	4.37	Acceptable
19	Objects or instruments drop from my hands during dental procedures.	0.77	Revision	0.55	Rejected	4.25	Acceptable
20	I spend excessive time completing patient work.	0.77	Revision	0.78	Suitable	4.46	Acceptable
21	I have extreme difficulty forming sentences and may struggle to speak or remain silent.	0.77	Revision	0.11	Rejected	4.32	Acceptable
22	I struggle to connect words and sentences to describe a topic or engage in conversation.	0.77	Revision	0.78	Suitable	4.29	Acceptable
23	I have difficulty expressing ideas clearly.	0.77	Revision	0.33	Rejected	4.31	Acceptable
24	I omit key vocabulary and confuse verb tenses.	0.77	Revision	0.78	Suitable	4.09	Acceptable
25	I use vague words like "thing" to replace words I cannot express.	1.00	Suitable	0.78	Suitable	4.33	Acceptable
26	Difficulty in verbal communication with others frustrates me.	1.00	Suitable	0.78	Suitable	4.67	Acceptable
27	I cannot speak fluently in sentences or can only say a few words at a time with great effort.	0.66	Rejected	0.33	Rejected	4.82	Acceptable
28	I struggle to find appropriate words when speaking or writing.	0.77	Revision	0.11	Rejected	4.76	Acceptable
29	I am unaware of mistakes in my spoken language.	0.77	Revision	0.55	Rejected	4.17	Acceptable
30	I use only a few words in speech, or repeatedly use the same words or phrases.	0.88	Suitable	0.78	Suitable	4.32	Acceptable

Table 1. Continued.

No.	Item	CVI		CVR		Impact	
		Relevance	Evaluation	Necessity	Evaluation	Importance	Evaluation
31	I have difficulty retrieving words (e.g., names of people, places, objects).	0.77	Revision	0.78	Suitable	4.36	Acceptable
32	I do not understand some words spoken by the instructor and often ask for repetition.	1.00	Suitable	1.00	Suitable	4.86	Acceptable
33	I struggle with oral questions and prefer written exams.	0.88	Suitable	0.55	Rejected	4.55	Acceptable
34	I fail to fully understand some of the patient's statements and request clarification.	1.00	Suitable	0.78	Suitable	4.42	Acceptable
35	I forget what I hear quickly.	1.00	Suitable	0.78	Suitable	4.32	Acceptable
36	I cannot concentrate when there is noise and people are talking.	0.77	Revision	0.55	Rejected	4.31	Acceptable
37	I hear explanations, but feel as if I did not listen or understand.	0.77	Revision	0.55	Rejected	4.3	Acceptable
38	I pay attention to my surroundings, but may seem inattentive when asked a question.	1.00	Suitable	0.78	Suitable	4.65	Acceptable
39	I am physically present in class, but my mind seems elsewhere.	0.77	Revision	0.55	Rejected	4.53	Acceptable
40	I have difficulty connecting the instructor's spoken words to the written slides.	0.88	Suitable	0.78	Suitable	4.32	Acceptable
41	Following the instructor's lecture is challenging for me.	1.00	Suitable	1.00	Suitable	4.63	Acceptable
42	I cannot easily recall previously seen words or sentences, affecting tests and exams.	0.88	Suitable	0.78	Suitable	4.38	Acceptable
43	I cannot quickly recall a word by its shape.	0.88	Suitable	0.78	Suitable	4.69	Acceptable
44	I lean my head close to the book when studying.	0.77	Revision	0.55	Rejected	4.26	Acceptable
45	I skip words when reading dental texts.	1.00	Suitable	0.78	Suitable	4.22	Acceptable
46	I frequently get lost in places.	0.77	Revision	0.55	Rejected	4.3	Acceptable
47	I have difficulty identifying left/right and upper/lower teeth in radiographs.	1.00	Suitable	1.00	Suitable	4.96	Acceptable
48	I make mistakes identifying impacted teeth in buccal, lingual, or palatal positions.	1.00	Suitable	1.00	Suitable	4.51	Acceptable
49	I have difficulty drawing shapes and patterns (e.g., copying radiographs in Orthodontics or drawing patterns in Parasitology).	1.00	Suitable	1.00	Suitable	4.66	Acceptable
50	I spend excessive time interpreting color patterns (e.g., stained slides in Pathology).	0.77	Revision	0.78	Suitable	4.82	Acceptable
51	I cannot interpret some behavioral reactions of instructors or students.	0.88	Suitable	0.78	Suitable	4.22	Acceptable
52	I cannot understand the emotions of my classmates.	0.77	Revision	0.78	Suitable	4.15	Acceptable
53	I have a poor understanding of social situations (e.g., inappropriate jokes or remarks).	0.88	Suitable	0.78	Suitable	4.65	Acceptable
54	I have difficulty making or maintaining friendships.	0.77	Revision	-0.33	Rejected	4.36	Acceptable
55	I am not interested in participating in social activities at the university.	0.88	Suitable	0.78	Suitable	4.86	Acceptable
56	I experience anxiety or avoidance in new social situations.	0.88	Suitable	0.78	Suitable	4.15	Acceptable
57	I feel anxious when the instructor observes me performing dental tasks.	1.00	Suitable	1.00	Suitable	4.02	Acceptable
58	I fear negative evaluation in social situations (e.g., being perceived as anxious, foolish, or lazy).	0.77	Revision	0.55	Rejected	4.16	Acceptable
59	I experience fear and anxiety when speaking or presenting in public.	1.00	Suitable	0.78	Suitable	4.55	Acceptable
60	Anxiety negatively impacts my social and professional performance.	0.88	Suitable	0.78	Suitable	4.76	Acceptable
61	I tend to be talkative when interacting with others.	0.88	Suitable	0.78	Suitable	4.47	Acceptable
62	I find performing quiet dental tasks challenging.	0.88	Suitable	0.78	Suitable	4.32	Acceptable
63	I cannot sit still and frequently leave my seat.	0.88	Suitable	1.00	Suitable	4.26	Acceptable
64	I am irritable and easily frustrated.	0.88	Suitable	0.78	Suitable	4.81	Acceptable
65	I lack concentration during dental procedures.	1.00	Suitable	1.00	Suitable	4.05	Acceptable
66	Environmental noises or visible distractions reduce my focus.	0.88	Suitable	0.78	Suitable	4.42	Acceptable
67	I cannot focus on the instructor's speech.	1.00	Suitable	0.00	Rejected	4.32	Acceptable
68	I am constantly active and busy, even during leisure time.	0.77	Revision	0.11	Rejected	4.3	Acceptable
69	Sometimes I focus so much on my work that I am unaware of anything else.	0.77	Revision	0.78	Suitable	4.65	Acceptable
70	When the instructor asks a question, I answer before the question is fully asked.	0.88	Suitable	0.78	Suitable	4.53	Acceptable

was assessed using the Content Validity Ratio (CVR) in accordance with Lawshe's table, where a minimum value of 0.78 was considered acceptable for the nine experts who evaluated the items. Based on the results, items 1, 4, 5, 6, 9, 15, 19, 21, 23, 27, 28, 29, 33, 36, 37, 39, 44, 46, 54, 58, 67, and 68 had CVR values below 0.78 and were therefore removed from the questionnaire (Table 1).

Ultimately, the questionnaire items were reduced to 48 statements. Analysis of the findings indicated that the overall mean Content Validity Index (CVI) of the items assessing specific learning difficulties among dental students at Yasuj University of Medical Sciences was 0.86, and the mean Content Validity Ratio (CVR) of these items was 0.68.

The 48-item questionnaire on specific learning difficulties among dental students encompasses 11 domains: reading difficulties (3 items), mathematics difficulties (3 items), writing difficulties (4 items), fine motor skill difficulties (3 items), language difficulties (7 items), auditory processing difficulties (6 items), visual processing difficulties (2 items), spatial difficulties (4 items), social cognition difficulties (4 items), social anxiety difficulties (4 items), and attention-deficit/hyperactivity difficulties (8 items). This questionnaire was designed on a five-point Likert scale, including: *strongly agree (5), agree (4), undecided (3), disagree (2), and strongly disagree (1).* The interpretation of mean scores is as follows: students with mean scores between 1 and 1.8 are considered not to have learning difficulties; those with mean scores of 1.81 to 2.6 are considered to have mild learning difficulties; those with mean scores of 2.61 to 3.4 are generally considered to experience learning difficulties; those with mean scores of 3.41 to 4.2 are regarded as often experiencing learning difficulties; and finally, those with mean scores of 4.21 to 5 are classified as always experiencing learning difficulties.

Phase 3: Construct Validity and Reliability Assessment

In the present study, 137 dental students from Yasuj University of Medical Sciences were invited to participate, of whom 61 completed the questionnaires, yielding a response rate of 44%. The demographic characteristics of the participants are presented in Table 2:

The construct validity of the instrument was assessed through second-order confirmatory factor analysis, employing both convergent and discriminant validity. All factor loadings obtained from the second-order confirmatory factor analysis were greater than the minimum acceptable threshold (0.40). Values above 0.40 for the average variance extracted (AVE) indicate adequate convergent validity, which for all constructs of the questionnaire ranged from 0.55 to 0.84. The factor loadings of the items and the AVE indices for the constructs confirmed the overall convergent validity of the questionnaire (Table 3). Furthermore, the data from the Fornell and Larcker matrix analysis demonstrated

Table 2. The demographic characteristics of participants

Variable	Categories	Frequency	Percentage
Gender	Female	32	52
	Male	29	47
Academic Level	Basic Sciences	21	34
	Clinical Sciences	40	65
GPA (Mean)	16.56 (out of 20)	–	–
Age (Mean ± SD)	25.47 ± 2.08	–	–

that the square root of the AVE values for all constructs exceeded the correlation coefficients among them. In other words, the discriminant validity of the model was also established. Based on these findings, and in light of the confirmation of both convergent and discriminant validity of the items and constructs, the overall validity of the questionnaire was confirmed.

To evaluate the reliability of the questionnaire, Cronbach's alpha coefficient and composite reliability were employed. The Cronbach's alpha and composite reliability indices for all constructs were above 0.70. Specifically, Cronbach's alpha and composite reliability ranged from 0.71 to 0.92 across all constructs, indicating acceptable internal consistency and stability of the instrument (Tables 2 and 3).

The high correlations observed between some constructs (Table 4) indicate substantial conceptual overlap, which may reflect potential interdependencies and complex interrelationships among these constructs. Such overlap suggests that certain constructs could be influenced by one another, highlighting the need for further investigation and discussion.

Discussion

One of the most important characteristics of any assessment tool is its validity and reliability. The quality of an instrument designed to measure a given phenomenon or concept depends directly on these two features. The present study aimed to design and psychometrically evaluate a scale for assessing specific learning difficulties among dental students. Initially, through a review of the literature and interviews with experts, a 70-item questionnaire was developed. Following psychometric analysis and validity and reliability assessments, the final version of the questionnaire was reduced to 48 items. This questionnaire comprises 11 domains: reading difficulties (3 items), mathematics difficulties (3 items), writing difficulties (4 items), fine motor skill difficulties (3 items), language difficulties (7 items), auditory processing difficulties (6 items), visual processing difficulties (2 items), spatial difficulties (4 items), social cognition difficulties (4 items), social anxiety difficulties (4 items), and attention deficit/hyperactivity disorder (8 items).

Other studies have also investigated the psychometric properties of learning difficulties questionnaires, including

Table 3. Factor analysis of the items and reliability coefficients for each construct

Construct	Item	Factor Loading	t	AVE	Cronbach's Alpha	Composite Reliability
Reading difficulties	1	0.76				
	2	0.82	11.72	0.64	0.71	0.72
	3	0.76				
Mathematics difficulties	4	0.80				
	5	0.81	8.58	0.55	0.77	0.78
	6	0.59				
Writing difficulties	7	0.80				
	8	0.81	6.55	0.68	0.84	0.85
	9	0.86				
	10	0.82				
Fine motor skill difficulties	11	0.87				
	12	0.84	15.93	0.71	0.80	0.80
	13	0.81				
Language difficulties	14	0.85				
	15	0.85				
	16	0.71				
	17	0.79	15.44	0.67	0.92	0.92
	18	0.89				
	19	0.85				
	20	0.79				
Auditory processing difficulties	21	0.88				
	22	0.89				
	23	0.80	12.63	0.67	0.89	0.91
	24	0.85				
	25	0.84				
	26	0.60				
Visual processing difficulties	27	0.90	17.83	0.84	0.82	0.84
	28	0.93				
Spatial difficulties	29	0.89				
	30	0.81	13.91	0.72	0.87	0.87
	31	0.83				
	32	0.85				
Social cognition difficulties	33	0.74				
	34	0.89	12.96	0.66	0.82	0.83
	35	0.82				
	36	0.78				
Social anxiety difficulties	37	0.89				
	38	0.89	21.06	0.77	0.90	0.91
	39	0.85				
	40	0.88				
Attention deficit/hyperactivity disorder (ADHD)	41	0.55				
	42	0.87				
	43	0.86				
	44	0.68	16.15	0.58	0.89	0.90
	45	0.69				
	46	0.77				
	47	0.68				
	48	0.89				

Table 4. Fornell–Larcker discriminant validity matrix of the scale assessing specific learning difficulties in dental students

Constructs	Anxiety	Reading	Mathematics	Language	Social cognition	Fine motor skills	ADHD	Writing	Visual processing	Auditory processing	Spatial skills
Anxiety	0.734										
Reading	0.729	1.020									
Mathematics	0.778	0.806	0.861								
Language	0.839	0.834	0.801	0.939							
Social cognition	0.627	0.941	0.994	0.841	0.795						
Fine motor skills	0.727	0.899	0.923	0.933	0.872	0.967					
ADHD	0.591	0.772	0.961	0.841	0.789	0.884	0.877				
Writing	0.716	0.943	0.920	0.904	0.844	0.883	0.963	0.722			
Visual processing	0.764	0.901	0.922	0.969	0.911	0.909	0.968	0.862	0.999		
Auditory processing	0.650	0.880	0.958	0.808	0.944	0.884	0.919	0.760	0.934	0.868	
Spatial skills	0.812	0.952	1.003	0.974	0.962	0.955	1.003	0.901	0.969	1.002	0.938

those conducted by Hajloo and Rezaei Sharif (20), Javdan (21), and Al-Qadri et al (22). Methodologically, these studies were similar to the present study. However, differences existed in the dimensions covered by their questionnaires. For example, the study by Hajloo and Rezaei Sharif examined the psychometric properties of the Colorado Learning Difficulties Questionnaire and identified five dimensions of learning difficulties: reading, social cognition, social anxiety, spatial difficulties, and mathematical difficulties (20). All of these dimensions show overlap with those assessed in the present questionnaire, underscoring their importance across various disciplines. The additional dimensions identified in the present study highlight the unique relevance of these constructs within the field of dentistry.

Another instrument, the Learning Difficulties Assessment (LDA), was developed by Kane et al (23). This questionnaire consists of 120 self-report items rated on a five-point Likert scale and covers nine major scales and fourteen subscales (including reading, writing, mathematics, listening, concentration, memory, organization, time management, oral presentation, self-control, and anxiety). The LDA incorporates several constructs that are also assessed by the instrument developed in the present study, such as reading, writing, mathematics, language, and anxiety/attention, indicating conceptual convergence between the two instruments. Similarly, in a study conducted by Glenn et al (24), learning difficulties were categorized into dimensions such as reading, writing, mathematics, and time management; some of which overlap with the dimensions identified in the present study.

The present study demonstrated the necessity of instrument development in the field of learning disorders. One of the major strengths of this study lies in its comprehensive and multi-phase methodology for data collection, which encompassed questionnaire design, validity and reliability assessment, and data analysis. The specific focus on face validity, content validity, and construct validity, along with the assessment of reliability indices, enhanced the precision and credibility of the instrument. Furthermore, incorporating the perspectives of faculty members and psychology experts during the questionnaire design process highlights the attention to both scientific and experiential foundations in instrument development, thereby improving the quality of the collected data. In addition, through the analysis and evaluation of learning disorders, this study provides a foundation for the advancement of theoretical frameworks in this field and can facilitate future research endeavors. Ultimately, the instrument developed in this study demonstrated acceptable validity and reliability, while being designed with the educational context of Iran in mind. As such, the developed instrument can be utilized as a localized tool for monitoring and assessment across various educational and clinical settings.

Despite these strengths, the present study had several limitations. First, the study was conducted exclusively among dental students at Yasuj University of Medical Sciences. Hence, the generalizability of the findings to other disciplines and universities should be approached with caution. To mitigate this limitation, diverse sampling strategies were employed, including temporal and spatial integration, participant diversity, and the use of rigorous data collection methods. Second, the limited sample size may have influenced the consistency and generalizability of the findings. Third, reliance on a self-report tool increases the potential for response bias, as participants may provide answers aligned with social desirability norms. Finally, the study focused solely on learning disorders and did not account for external factors, such as environmental stressors, family-related challenges, or social problems, that may also affect the learning process.

Conclusion

The findings from this study indicated that the scale designed to assess specific learning difficulties among dental students at Yasuj University of Medical Sciences

demonstrates satisfactory validity and reliability. Therefore, it can serve as an effective tool for identifying learning difficulties among dental students. Given that this instrument was specifically developed to address the unique educational needs and challenges faced by dental students, it has the potential to significantly contribute to improving educational processes and supporting students in their academic journey. Early identification of learning difficulties through the use of this questionnaire enables universities to develop targeted and effective interventions aimed at enhancing academic skills and reducing learning-related stress. Furthermore, this tool can assist instructors and academic administrators in adapting teaching methods to better align with students' needs and in creating learning environments that provide adequate support for those students experiencing learning challenges. Consequently, the application of this questionnaire can play a pivotal role in improving the quality of dental education and enhancing the overall academic experience of students.

Authors' Contribution
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Competing Interests
The authors declared no conflicts of interest associated with this study.

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