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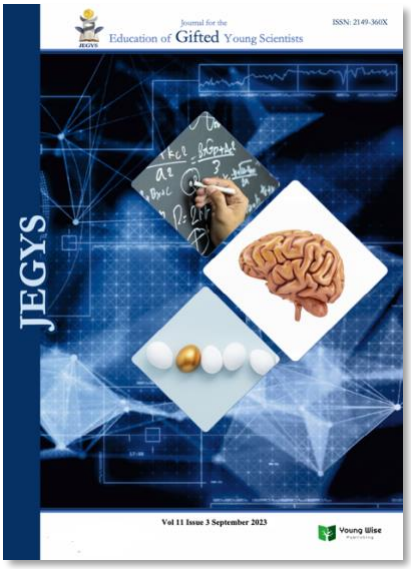

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From the Editor

New fields for gifted youth and the future is in gifted education: Artificial intelligence, space studies, new energy technologies, autonomous cars and flying objects

Hasan Said Tortop[1]

Social Sciences Institute, Interdisciplinary Disabled Studies Program, Trakya University, Edirne, Turkiye

Abstract
JEGYS, which was established to provide a breath of fresh air to the aging aspect of gifted education and especially science education, continues its publishing life by giving importance to the education of young scientists. JEGYS's support for the publication of articles on future popular areas is in line with its own goals.
Keywords:
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JEGYS was founded in 2013 by Hasan Said Tortop with a great and important ideal. This person is a person who has both worked as a science teacher and worked with gifted students. He saw the bottleneck in science education. I thought that in the future such nonsense as "science for life" would disappear. Because the future of human evolution will be too valuable for human intelligence to be left solely to its own biological and chemical structure. When the human species sharply moves its dominance over micro-level existence in the 19th century to the nano-level very recently, the purpose of science and educating scientists will now be reduced to only an elite segment (gifted youth). These will be young scientists with higher intelligence. The education of these children must evolve to keep up with today's developments in fields such as artificial intelligence, space studies, new energy technologies, and autonomous transportation vehicles. JEGYS's purpose, target and mission are in parallel with these sharp developments in the world. In the articles published in this issue, it is seen that there is an evolution towards this situation. However, I call on academics who are sensitive, hard-working and full of wisdom to read this editorial. Please read the goals of JEGYS and let's walk towards these goals together. Let's make JEGYS the most effective talented youth education platform in the world with your contributions such as publishing of the special issues and creation of field editorships. I trust you and value your contributions, and I thank you in advance. We are here with 16 articles in our autumn issue, enjoy reading.

Best wishes

Dr. Hasan Said Tortop
Editor-in-Chief of the JEGYS

[1] Assoc.Prof., PhD (secondly) Student, Director, Social Sciences Institute, Interdisciplinary Disabled Studies Program, Trakya University, Edirne,Turkiye. E-mail: hsaidtortop@trakya.edu.tr and hasansaidfen@gmail.com

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Research Article

Developing of in-service training program for teacher working with gifted learning disabled students[1]

Hasan Said Tortop[2*] and Gokhan Ilgaz[3]

Interdisciplinary Disabled Program, Social Sciences Institute, Trakya University, Edirne, Turkiye

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Abstract

It is noteworthy that there is little research on the education of twice exceptional students. In fact, most of these studies are descriptive studies. The rarity of studies on twice exceptionality is due to the problems in diagnosis and the lack of knowledge and experience of teachers on this subject. There is no in-service training program for teachers on this subject. This research is a research on the problem of designing an in-service training program for teachers of gifted learning disabled students. This research is action research model because the researcher is both the practitioner and the researcher of the research and takes the role of an active solver for the solutions to the problem. Fifteen special education teachers working in this institution formed the study group of the research. Data collection tools are Teacher Needs Analysis Determination Form, Metaphoric Perception Test for Twice Exceptional Students, Word Association Test (WAT) for Twice Exceptional Students, and Documents. Teacher In-Service Training Program Preparation Process; In the preparation of the in-service training program, the Taba Model, in which the inductive approach is used, was used. The program, designed as a result of the research, consists of 6 sessions and 11 instructional stages. In this program, there are 17 outcomes that are expected to be developed by teachers. For the realization of these outcomes, 15 instructional designs (activities) were created. The duration of the training program was determined as 10 hours, with an average of 40 minutes for each activity. The in-service training program prepared for students who twice exceptionality has the feature of improving teachers' self-regulation and exhibits a program approach to direct their own learning. Therefore, the activities progress on the worksheets and by giving instructions.

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Introduction

Twice exceptionality studies, definition of twice exceptionality, describing accompanying disability , modeling of twice exceptionality (Ronksley-Pavia, 2015), the role of teacher and parent in the phenomenon of twice exceptionality (Baum et al., 2017; Besnoy, 2015), psychological aspect of twice exceptionality (Amiri, 2020). Twice exceptionality studies, from the first studies (Baum, 1989) to the period when the increase in research was observed (2000-2015), is considered holistically, it is seen that the researches are mostly focused on the specific learning disability disability (SLD) and there

[1] This research partially was presented at 3rd International Congress on Gifted Youth and Sustainability of Education (ICGYSE). This article was produced at first author doctoral thesis.

[2] Corresponding author: PhD student, Interdisciplinary Disabled Program, Social Sciences Institute, Trakya University, Edirne, Turkiye. E-mail:hsaidtortop@trakya.edu.tr ORCID: 0000-0002-0899-4033

[3] Assoc.Prof., Curriculum Development and Instruction Department, Faculty of Education, Edirne, Türkiye. E-mail: gokhani@trakya.edu.tr ORCID: 0000-0001-8988-5279

are few experimental studies (Foley-Nicpon, 2015; Lovett & Sparks, 2008). 2013). In order for the situation of twice exceptional students not to turn into a serious obstacle by the social environment and society, first of all, awareness and understanding should be developed. Teachers play a key role in recognizing and identifying these students, as well as in their education (Bianco, 2005; Foley-Nicpon et al., 2011; Baldwin et al., 2015; Alsamani, Alsamiri & Alfaidi, 2023).

It is known that the teachers of twice exceptional students have deficiencies in terms of their knowledge and experience about their education (Sumaia et al., 2020). This is due to the deficiencies in teacher training on twice exceptionality. In Turkey, there is no course for the education of these children in the classroom and special education teacher education programs that are most likely to encounter twice exceptional students (Council of Higher Education of Turkiye, 2023a-b). However, it is seen that there are new studies on creating elective courses recently (Sakar and Köksal, 2022). Teachers have twice exceptional in-service deficiencies regarding the education of students (Sumaia et al., 2020; Bianco, 2005). There are not many studies on developing and implementing an in-service training program for teachers (Sumaia et al., 2020). It has been determined in many studies that teachers' knowledge and self-efficacy regarding the education of special talents is not sufficient and that they need in-service training (Kaya & Ataman, 2017; Şahin & Kargın, 2013; Güneş, 2015). It was also determined that the in-service training program that primary school teachers liked and was most interested in was the training of special talents (Ergin, Akseki, & Deniz, 2012; Serin & Korkmaz, 2014).

In this study, it is aimed to give the details of the preparation of the in-service training program for the education of gifted learning disabled from the group of twice exceptional students and the details of the relevant program. In addition to this main purpose, the following sub-objectives are;

- Creating a needs analysis form for the in-service training program for teachers interested in the education of gifted learning disabled students,
- Creating in-service training program sessions and learning stages for teachers interested in the education of gifted learning disabled students
- To determine the achievements of the in-service training program for teachers who are interested in the education of gifted learning disabled students,
- Creating in-service training program instructional designs (activity) and features for teachers interested in the education of gifted learning disabled students,
- It is to create an instructional design (activity) and worksheet for the in-service training program for teachers who are interested in the education of gifted learning disabled students.

Method

Research Model

In this research, it is in the action research model because the researcher is both the practitioner and the researcher of the research and takes the role of an active solver for the solutions to the problem. In addition, it is suitable for the case study model in terms of describing an existing situation. At the same time, it is suitable for the document analysis research technique in terms of creating the training program by scanning and examining the relevant literature of the needs analysis related to the in-service training program.

Participants

Bursa province, which is a medium-development province in Turkey, was chosen for the research. In the study, a special special education rehabilitation center was selected where learning disability and giftedness are seen together and the probability of being seen is very high. 15 special education teachers working in this institution formed the study group of the research.

Table 1. Structures of participants

No	Seniority (years)	Graduation	Education	Gender	Code
1	0-2 years	Child development	Graduated	Female	P1-C-F
2	10-15 years	Special education	Master	Male	P2-S-M
3	5-10 years	Other	Graduated	Male	P3-O-M
4	5-10 years	Child development	Graduated	Female	P4-C-F
5	0-2 years	Other	Graduated	Male	P5-O-M
6	0-2 years	Child development	Graduated	Female	P6-C-F
7	10-15 years	Classroom teacher	Graduated	Male	P7-CT-M
8	0-2 years	Child development	Graduated	Female	P8-C-F
9	0-2 years	Classroom teacher	Graduated	Female	P9-TC-F
10	0-2 years	Other	Graduated	Female	P10-O-F
11	2-5 years	Other	Graduated	Female	P11-O-F
12	5-10 years	Classroom teacher	Graduated	Female	P12-CT-F
13	0-2 years	Other	Graduated	Female	P13-O-F
14	0-2 years	Other	Graduated	Male	P14-O-M
15	5-10 years	Child development	Graduated	Female	P15-C-F

As seen in Table 1, it is seen that the teachers in the experimental group have 0-2 years and 2-5 years of work experience, and there is only one teacher with 10-15 years of experience. Considering the graduations of the teachers, it is 1 person as a special education teacher, 5 people for child development, 1 person for classroom teaching, 6 people who have graduated from different fields and completed the certificate programs organized by the Ministry of National Education regarding special education. Most of the teachers are undergraduate graduates (14 people) and only one teacher has a graduate degree. 5 of the teachers are male and 10 of them are female.

Data Collection Tools

Teacher Needs Analysis Determination Form

Twice was created to determine the knowledge, experience and competence levels of teachers who are interested in the education of exceptional students. In the creation of this form, first of all, a literature review was made, a draft form was created, and then the form was finalized by referring to the expert opinion. Teacher needs analysis form This form consists of six dimensions and 12 questions. This form was delivered to the participants with the help of a Google survey.

Documents

Since there are not many documents about the education of twice exceptional students, documents suitable for gifted education and teacher training for learning difficulties were selected. These; differentiated education of gifted students in their education (Tortop, 2018) and in the training program module to be prepared; The following modules in the "Twice-Exceptional Students Gifted Students with Disabilities" booklet published by Colorado Education Affairs in 2009 were used. In the research, the modular structure and content of the two related documents were examined. After the examination, a draft was created on basic subjects such as diagnosis and features, preparing instructional design, preparing instructional materials, individualized education (mentoring), preparing a strategy plan, and family guidance.

Data Analysis

Content analysis method was used in the analysis of the answers given by the teachers in the needs analysis form and their views on the in-service training program after the application.

Validity and Reliability

In the qualitative dimension of the research, some concepts put forward in the literature regarding validity and reliability are as follows; Transferability is a concept that explains the generalizability of research as in quantitative research. In order to ensure transferability, all processes of the research should be described in detail. In this respect, all the details such as the sampling method chosen in the research, the conditions of inclusion in the sampling, the characteristics of the participants, and the questions about the semi-structured interviews are presented.

Ethics

For the research, first of all, the research proposal was applied for the permission of the Ethics Committee, together with the scales for which the permissions were obtained. E-29563864-050.04.04-2323318 numbered E-29563864-050.04.04-2323318 and dated 28.03.2022 permission of Trakya University Social and Human Sciences Research Ethics Committee. Afterwards, applications were made to Bursa Provincial Directorate of National Education for research permission. This permission was obtained on 23.05.2022.

Results

Implementation of Need Analysis

Data were collected with the needs analysis form, which is a semi-structured interview form, for teachers who are likely to work with students diagnosed with special learning disabilities and giftedness. Opinions were received from two field experts in the creation of the needs analysis form. When the expert opinions were confirmed, a teacher needs analysis form was created.

Table 2. Gifted learning disabled needs analysis form for teachers working with students

Dimensions	Dimension title	QN	Question examples
D1	Identification gifted learning disabled	3	Question 2. What are the characteristics of gifted learning disability, different from just special learning disability or just giftedness? Do you have any lack of knowledge and experience on this subject? If so, what are they?
D2	Preparing Instructional Designs for Gifted Learning Disabled Students	4	Question 6. Should the instructional design for gifted learning disabled students differ from the instructional design for gifted learning disabled students? What is your level of knowledge and experience on this subject? Do you have any shortcomings?
D3	Preparing Instructional Material for Students with Gifted Learning Disabled	1	Question 8. What is your competence in preparing instructional materials for gifted learning disabled students? Do you have any shortcomings in this regard? What are they?
D4	Mentoring, Effective Educational Leadership for Gifted Learning Disabled Students	2	Question 10. What is your level of knowledge and experience in effective mentoring for gifted learning disabled students? What points do you think are missing?
D5	Approaching for Gifted Learning Disabled Students' Parents	2	Question 11. Do you have sufficient knowledge and experience about the approach of families of gifted learning disabled students? In which areas do you think you have deficiencies?
D6	Other Issues	1	Question 13. Are there any other things that you think are insufficient in terms of knowledge and experience about gifted learning disabled students and their education? Please explain.

D: Dimension **QN**: Question Number

As seen in Table 2, this form consists of six dimensions and 12 questions. Excerpts from the opinions of the participants about the data obtained with the needs analysis form are presented.

Dimension 1. Identification of the Gifted Learning Disabled Student

As stated in the literature (Niselsen, 2022), it was obtained from the interview forms that most of the participants had insufficient knowledge and experience about the diagnosis and characteristics of two different students. Quotations from the participants on this subject are presented below.

I am not well equipped to define and adequately support it. (P14-O-M)

I have very little knowledge of what their strengths and weaknesses are. (P1-C-F)

I have no knowledge about this. I have a hard time recognizing and describing it. I don't know what its features are. (P2-CT-M)

Within the framework of the opinions of the participants, it is seen that there is a lack of knowledge and experience about the characteristics of gifted learning disabled children. Teachers in the working group give education to students with special learning difficulties in special education. These teachers are more likely to encounter different students twice. However, there are no procedures for identifying different students twice in Turkey. Tortop and Ilgaz (2022) in the practices in Turkey on the identification of different students twice; They stated that there is no diagnostic procedure, and that there is a possibility that some students may be eliminated in the group screening stage in the diagnosis of gifted students due to the fact that they have other special education needs. In this respect, a student who can be a gifted student may also be a student with a diagnosis of special learning disability in the institutions where these teachers work. Because of this situation, it is necessary to include content related to the characteristics and diagnosis of students who show gifted learning disabled for their educational needs for the service.

Dimension 2. Preparing Instructional Design for Gifted Learning Disabled Students

It has been obtained from the interviews that the teachers who are involved in the education of gifted learning disabled students have low level of knowledge about how their education will be and lack of experience. Some excerpts from these interviews are presented.

I think I am lacking in supporting these children (P14-O-M)

I have no knowledge and experience on this subject (P12-TC-F)

I think that the design and strategy to be prepared should be planned individually. At this point, I think that I do not have enough knowledge to create this design yet (P5-O-M)

I have never prepared such a form before. I would like to receive information (P3-O-M)

I can't answer because I don't know enough (P1-C-F)

It is seen that the teachers stated that they are insufficient in terms of knowledge and experience about the education of students with gifted learning disabled and preparing instructional designs. A teacher's response that teaching should be individual may have been given because they did individual work with students with special learning disabilities. He stated that he did not have enough information about the individual teaching to be done with these students.

Dimension 3. Preparation of Instructional Materials for Gifted Learning Disabled Students

In student groups with special educational needs (such as autism spectrum disorder, attention deficit and hyperactivity disorder (ADHD), special learning disability) materials that will provide effectiveness in teaching are used, and there are courses related to this in undergraduate education periods (YÖK, 2022). However, there are no elective courses related to gifted learning disabled students in areas such as classroom teaching and special education teaching. However, courses have started to be opened in some education faculties related to this (Sakar and Koksal, 2023). Since in-service training will be planned for students with giftedness and special learning difficulties in our research, content should be created about materials that can be prepared in these two areas. Excerpts from teachers' views on material preparation are presented.

Although I think that I have clear information about the need for an individual-oriented approach to children, I do not think that this information is at a sufficient level yet (P5-O-M)

They do not have a tendency to prepare instructional materials for these students (P12-CT-F)

I would like to be informed. I've never worked with a twice-qualified child before (P8-C-F)

Dimension 4. Gifted Learning Mentoring for Disabled Students, Effective Educational Leadership

In the education of gifted learning disabled students, students need effective individualized teaching in terms of emotional-behavioral, psychological, interests and abilities, strengths and weaknesses. In the education of these students, who also have a giftedness aspect, the most important instructional strategy that supports their emotional-social development and increases their knowledge and abilities is mentoring (Sak, 2009). Strategy teaching is very important for students with special learning difficulties (Girli, 2014). Educators use tutoring (Tortop, 2018), which is a method

for individualizing teaching in gifted students. There is a need for information content on the effective use of these individualized instructional strategies. Some of the teachers' views on the effective management of gifted learning disabled students' instructional processes and their knowledge and experience in mentoring are presented below.

My knowledge and experience are insufficient (P1-Q-F)

I am not knowledgeable about this (P9-CT-F)

I don't have much experience (P14-O-M)

Dimension 5. Approach to Families of Gifted Learning Disabled Students

The importance of family education and guidance in the education of students with special educational needs is emphasized in studies (Barber & Mueller, 2011; Besnoy et al., 2015; Dare & Nowicki, 2015). There is a false belief in society that gifted children can solve their problems because of their abilities (Tortop, 2018). Gifted learning disabled situation is an area where families and children have serious difficulties due to their special education needs, and families face problems even in getting the necessary educational support. There are studies on the positive contributions of informing and supporting families about their situation and teaching rights advocacy (Dare, & Nowicki, 2015; Besnoy et al., 2015). In this respect, it should be included in the content of the in-service training program. Some quotations from the teachers' views on their knowledge and experience in approaching the families of gifted learning disabled students are presented below.

No I don't have it (P13-O-F)

Although I think that the approaches of families will differ greatly, I think that I lack information on what the appropriate approach is and the strategies that should be applied to guide this approach (P5-O-M)

In this regard, I need to improve myself in general (P9-TC-F)

I do not have enough knowledge and experience (P1-C-F)

Dimension 6. Other Issues

In the research, the participating teachers were asked to indicate which other subjects they lacked knowledge and experience about the education of gifted learning disabled students. Eker (2020)'s in-service training program includes the use of technology as well as material design, as sustainability and technological developments in education lead to changes in our educational and instructional approaches, as well as the lack of knowledge and competence development of teachers in these new fields. The opinions of the teachers were asked to indicate their different educational needs, as in this example. Excerpts from some of his views are presented below.

I feel inadequate about how to work with different students twice, what the expectations should be, how the process should be planned (P10-O-F)

I wish I was more competent in the emotional field (P3-O-M)

On their psychology (P13-O-F)

It is seen that the teachers who participated in the research stated that they had incomplete knowledge and experience in other subjects, especially the psychology of gifted learning disabled students and the provision of their emotional support. Therefore, it was thought that it would be appropriate to consider this aspect in the in-service training program to be created, rather than the subject of family education and guidance.

Determining Teachers' Perceptions of Gifted Learning Disabled Students

It was determined that the teachers' perceptions about gifted learning disabled students consisted of metaphors in 4 categories (needing to be understood, needing care, having different aspects and having difficulty). The fact that the number of metaphors in the category of having difficulty is the lowest may give an idea that the participants have deficiencies in the approach to the families of the students who are different twice, and their psychological states (Amiri, 2020) and guidance. It is seen that areas of disability such as ADHD, Autism, Asperger's and other special education needs such as talent are associated in the minds of the participants.

Development of In-Service Training Program

As a result of the needs analysis, it was determined that the teachers had deficiencies in knowledge and experience in the six dimensions determined. Then, the stage of creating the training program was started. In the in-service training program, the topics that emerged in line with the needs analysis were planned in six sessions, one of which was the content that plans the strategies for intervention. In order to meet these educational needs, achievements were created and the number of sessions, session name and instructional stages were determined in order to realize these gains. Accordingly, it was decided that the in-service training program would consist of six sessions. These sessions and the gradualness of the sessions are shown in Table 3.

Table 3. Sessions and stages in the in-service training program for gifted learning disabled students

SN	Session Title	ISN	Instructional Stage Name
Session 1	Overview of Giftedness and Special Learning Disability	2	Developing knowledge and awareness about gifted students Developing knowledge and awareness about students with special learning difficulties
Session 2	Recognizing Gifted Learning Disabled Students	2	Awareness development for students showing gifted learning disabled Knowing the diagnostic procedures of gifted learning disabled students
Session 3	Instructional Design for Gifted Learning Disabled Students	2	Awareness development for instructional strategies for gifted learning disabled students Developing awareness of differentiation strategies and principles for gifted learning disabled students
Session 4	Instructional Material Design for Gifted Learning Disabled Students	2	Awareness and skill development about instructional material design for gifted learning disabled students Awareness and skill development about being a teacher who promoting creativity Developing awareness of effective instructional material features for students with specific learning difficulties
Session 5	Guidance and Psychological Support for Gifted Learning Disabled Students	2	Psychological support and guidance for gifted learning disabled students, awareness about parent education Psychological support strategies for gifted learning disabled students (such as bibliotherapy, film therapy, short-term dynamic therapy) awareness development
Session 6	Intervention-Strategies Plan for Gifted Learning Disabled Students	1	Developing awareness and skills about preparing an intervention strategy plan for gifted learning disabled students

SN: Session No **ISN**: Instructional Stage Number

As seen in Table 4, an in-service training plan was created with six sessions and eleven instructional stages. The instructional designs of these sessions (with activities) were started to be planned.

Creating Instructional Designs (Activities)

After the sessions and instructional stages were determined, the stage of creating instructional designs (activities) for the relevant acquisitions was started. Accordingly, the activities created in Table 4, their relationship with the outcome, activity type, activity task and material are given.

Table 4. Activities in in-service training for the education of gifted learning disabled students

Activity Name and Number	Activity Type	Activity Tasks	Relation to Outcomes	Material
A1. Create Your Own Theory of Giftedness	Independent study, research	Analyzing theories and introducing new theory	**O1**. Explains the theories of giftedness	Puzzle
A2. Create Own Giftedness Rating Scale	Observation	Identifying giftedness traits	**O2**. Explains the characteristics of giftedness.	Fragment of Faraday's life: movie section
A3. Alice in the Land of Learning Disabilities	Independent study, research	Making cartoons describing learning difficulties	**O3**. Explains the characteristics of students with learning difficulties	Worksheet
A4. Gifted Learning Disabled Fashion Designer: How Do I Look?	Exploratory individualized study	Combining pieces and interpretation	**O4**. Tells the characteristics of gifted learning disabled students.	Worksheet

			O5. Makes the definition of gifted learning disabled student	
A5. My Diagnostic Tool Bag	Exploratory individualized study	Get to know the features of diagnostic tools	**O6.** Explains the identification of gifted learning disabled students	Presentation Worksheet
A6. Find the Appropriate Instructional Strategy	Exploratory individualized study	Teaching with problem scenario	**O7**. Explain the educational strategies of gifted students (such as grouping, acceleration)	Presentation Worksheet
A7. Can You Offer Me My Appropriate Differentiation Menu?	Exploratory individualized study	Teaching with problem scenario	**O8**. Knows the principles of curriculum differentiation for gifted students **O9.** Knows curriculum differentiation models for gifted students	
A8. I Find Talent Points	Exploratory individualized study	Teaching with problem scenario	**O10**. Explains how to organize family and environmental environments for gifted learning disabled students	Worksheet
A9. Is the Material I Designed Suitable for the Gifted?	Exploratory individualized study Group discussion	Teaching with problem scenario	**O11**. Explains the characteristics of the teaching materials to be prepared for gifted students.	Presentation Worksheet
A10. Produce My Difficulty Easier Material	Exploratory individualized study Group discussion	Filling in the worksheet Material design	**O12**. Explain the characteristics of the instructional materials to be used in the education of students with special learning difficulties.	Presentation Worksheet
A11. What Level of Creativity Promoter Am I a Teacher?	Exploratory individualized study Group discussion	Filling the observation form	**O13**. Knows teacher characteristics that promoting creativity	Presentation Worksheet
A12. I'm Gifted, But I May Have Psychological Problems	Group discussion	Watching movie Discussion	**O14**. Knows the psychological problems experienced by gifted students.	Film Articles
A13. I'm Doing a Film Therapy Intervention	Problem scenario Group discussion	Filling in the worksheet	**O15**. Knows psychological support strategies for gifted learning disabled students.	Film
A14. I'm Learning Effective Parent Education Programs	Group discussion	Teaching with problem scenario	**O16**. Gifted learning disabled students know how to organize family and environmental environments	Worksheet
A15. I'm Designing an Intervention Strategies Plan for the Gifted Learning Disabled Student	Narrative Question answer Group discussion	Filling in the worksheet	**O17**. Knows the stages of preparing a strategy plan for gifted learning disabled students	Worksheet

A: Activity **O**: Outcome

The descriptions of the activities prepared are as follows;

Activity 1. Create Your Own Theory of Giftedness

A worksheet is given in which the theories of giftedness and related concepts are written on geometric figures. If they had created their own theory of giftedness, they are asked to write and explain the puzzle which concepts they would use and the reason for it.

Activity 2. Create Own Giftedness Rating Scale

A rating scale related to the behavioral characteristics of gifted students is given to the participants. First, they are asked to review it. Then, they are asked to mark the features they see while watching the documentary, which includes a section from the life of Faraday, who may be gifted in the academic field. Then you will be asked what features you would get if you created your own list. Ask them to explain why.

Activity 3. Alice in the Land of Learning Disabilities

They are asked to imagine a universe with examples of dyslexia, dysgraphia, and dyscalculia, describe (with cartoons) how different appearances will be compared to normals in this universe, and interpret how they can correct it.

Activity 4. Gifted Learning Disabled Fashion Designer: How Do I Look?

Giftedness and special learning disability areas are likened to a model and the clothes on it. It symbolizes the behavioral and emotional feature that will occur due to learning difficulties of each garment. Participants comment on the appearance of the model on which they dress.

Activity 5. My Diagnostic Tool Set

Diagnostic tools for measuring intelligence and its components are described in the worksheet as different tools (hammer, saw, pliers). Participants are asked to make designs about which of these tools will be used to reveal the unknown aspect of two different individuals, and their reasons are interpreted.

Activity 6. Find the Appropriate Instructional Strategy

It explains how instructional strategies, grouping, acceleration and mentoring strategies are applied for gifted students. For students whose case studies are presented, worksheets on which strategy should be applied and why are given.

Activity 7. Can You Offer Me My Appropriate Differentiation Menu?

Differentiation strategies and principles are briefly explained. The student prototypes, whose student characteristics are given in the worksheet, are given the task that asks them to make a choice about which differentiation strategy to apply. The reasons and consequences of this choice to write down are on the worksheet.

Activity 8. I Find Talent Points

Participants are given a worksheet showing the out-of-school learning environments and their characteristics, with an example. After the student's interests and tendencies are written, they are asked to search for appropriate learning, research centers, and environments that support talent development, such as individuals, on the internet. 5 minutes are given. It is then discussed.

Activity 9. Is the Material I Designed Suitable for the Gifted?

A worksheet with the characteristics of a teaching material that needs to be developed for gifted students and an equalizer display is presented to the participants. First, a teaching material is presented to them and they are asked to paint the indicator of which direction it is on the equalizer. They are asked to explain why the sound, that is, the material, will be appropriate.

Activity 10. Produce My Difficulty Easier Material

Worksheets are provided explaining specific learning difficulties and reasons for suggestions and materials for dealing with those difficulties. Discussion is made on the example. He is then given 5 minutes to develop instructional material that will address many of these learning difficulties. The selected design is discussed with all participants.

Activity 11. What Level of Creativity Promoter Am I a Teacher?

The characteristics of promoting creativity and the teacher's use or creation of teaching materials with his student are explained. Each participant is then asked to make their own self-assessment.

Activity 12. I'm Gifted, But I May Have Psychological Problems

There is a group discussion on the psychological problems seen in the movie Little Man Tate and Vitus, which was given homework to be watched before. They are asked to read movie review articles about these movies.

Activity 13. I'm Doing a Film Therapy Intervention

Participants are asked to create an imaginary student case related to previously determined psychological problems, find the movie they will choose for this, and write down how they will design a therapy application with relevant sections from this movie.

Activity 14. I'm Learning Effective Parent Education Programs

Participants are provided with worksheets showing effective family education programs, features, and implementation procedures. This is discussed about training programs. Discussions are held about their own family approaches and the aspects that may be wrong with them.

Activity 15. I'm Designing an Intervention Strategies Plan for the Gifted Learning Disabled Student

Participants are shown an intervention strategy plan based on a case study. It explains all the components of the plan and how it was created. They are asked to create a plan like this plan on their own students.

It is planned as a teaching hour for each activity. A total of 15 hours of in-service training program has been established. Some of these activities are given as examples (Figure 1, Figure 2).

Use of Differentiation Approaches in Instructional Design

Since the developed activities will be created for teachers who take part in the education of students with giftedness and special learning difficulties, it has been paid attention to use differentiated teaching strategies, especially for gifted

students. While applying the activities, teachers will also be able to raise awareness about the pedagogical approaches that should be applied for gifted students. This situation is explained through sample activities.

Activity 4. Gifted Learning Disabled Fashion Designer: How Do I Look?

First, let's examine the behavioral and emotional characteristics of gifted children and children with learning disabilities. Thus, we can describe gifted learning disabled students with these features together.

Behavioral-Emotional Appearances of the Gifted Student	Behavioral-Emotional Appearances of Students with Special Learning Disabilities
Bored, Disinterested **Explanation:** These situations are very common, especially when they are told about the subjects they know.	**Contradictory, Unstable** **Explanation**: In particular, doubts about her own performance, worrying about what their peers will think of they, may cause her to display a contradictory and indecisive attitude.
Aggressive, Willing **Explanation:** Especially in the environments where there is competition, aggressive and eager attitudes and selfish tendencies are seen in order to put themselves forward.	**Overly Excited and Disturbing** **Explanation**: Sometimes when placed in a reading group with their peers he may struggle to read like them. This can make him overly excited and uncomfortable.
Introverted, Irresponsible **Explanation:** The situation explained by the concept of masking and normalization may occur, especially when the student is put into high expectations and encounters some problems by family, teacher. (See Vitus movie)	**Extremely Angry, Aggressive** **Explanation:** The students who can do the multiplication difficult may have a nervous breakdown when she cannot do it, and when they cannot focus on reading, they may close her book and display an angry and aggressive attitude.
Sensitive, Emotional **Explanation:** While imagining the story, it can cause very strong emotional impact (See Little Man Tate movie, mother earth melting scene and his tolerance for his mother). Example: While I was telling my student group that a phenomenon related to space would harm our world, the student got emotional because my parents didn't know about my words, jokingly, that you should be in your bed at that hour or the temperature would drop too much.	**Anxious, Introverted** **Explanation:** Anxiety, depression and introversion can be seen due to failure and difficulty in learning areas where they have difficulty.
Arrogance, Conceit **Explanation**: To despise others, to make fun of them. For example, the boy wearing the magician costume from the movie Little Man Tate	**Challenger** **Explanation**: Attention-altering, objectionable and rule-challenging behaviors can be seen to mask failure in learning areas.
Playful, Witty, Energetic **Explanation:** I have never seen children with such characteristics in the children I have worked with until now. It may be in children of broken families, but it manifests itself with instability. It can sabotage the activity where it isn't.	**Masker** **Explanation:** They may exhibit a concealing, masking attitude to prevent the emergence of weakness and failure in learning.

Examine these and other features. *Continue*

Figure 1. Worksheet of Activity 4. Gifted Learning Disabled Fashion Designer: How Do I Look? (first page)

Now let's suggest some clothes for these behavioral-emotional traits.

Bored, Disinterested

Hooded t-shirt or cardigan

Aggressive, Willing

Long boots, skinny jeans

Introverted, Irresponsible

Ripped jeans

Sensitive, Emotional

Suit

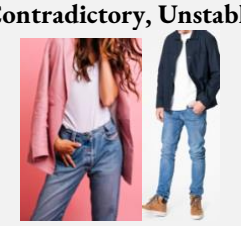
Arrogance, Conceit

Tuxedo

Playful, Witty, Energetic

Sneakers

Contradictory, Unstable



Combination dress

Overly Excited and Disturbing

Evening dresses

Extremely Angry, Aggressive

Leather jacket

Anxious, Introverted

Full length dress

Challenger

Leather bracelets

Masker

Mask

Now think of someone who you think may be gifted learning disabled, make a design according to his features and draw it below. What could be the reasons for having those features/clothes? Discuss.

Figure 2. Worksheet of Activity 4. Gifted Learning Disabled Fashion Designer: How Do I Look? (Second page)

When the activity example in Figure 1 is examined; It is seen that the activity has a cascading and gradual nature. It is emphasized that the gradualness of Learning Contracts, Tiered Instruction and Independent Study strategies, which are among the differentiated teaching strategies, should be used for the development of the student's self-regulation skills (Tortop, 2018: p.54). In the first stage, the emotional-behavioral situation that a gifted student may experience is briefly

explained. In this way, it is aimed that teachers understand this situation. In the second stage, it is aimed to understand how these situations can be experienced together to a certain extent or there may be intersections, so that it can occur in gifted learning disabled students. The activity was constructed on the basis of the fact that the teacher, who tries to understand these phenomena with metaphorical analogies made on dresses, is a fashion designer. As it is very important to develop metaphorical, creative thinking and empathy among the differentiated teaching strategies for the gifted (Kaplan, 1993; Tortop, 2018: p.185), the instructional designs to be developed for the gifted should not be didactic but develop skills and abilities. In this activity, it was tried to be shown through the phenomenon of being a fashion designer that gifted learning disabled students are doing activities to design and develop their imagination. At the last stage of the event, the need to explain how the fashion design will be created by the participants and what the reasons might be, and to feel the need to do research for these explanations, even for a short time, were taken into consideration. The development of research skills is supported by revealing the interests and curiosity of gifted learning disabled students by using immersive question generation and thought-provoking question generation strategies (Maker, 1982; Tortop, 2018: p.62).

Activity 5. My Diagnostic Tool Set		
Below are some tests that can help you identify the student, their brief descriptions, and some of the repair tools that can be compared to them. Match these repair tools and test simulations yourself. You can suggest repair tools by researching different diagnostic tools in the blanks.		
Developmental Visual-Motor Coordination Test	It is a test to measure sensory-motor skills. (Deniz, Hamarta ve Akdeniz, 2014, p.59).	 Ruler
Visual Aural Digit Span Test	It is a test that measures attention, short-term memory, sequencing, intra-sensory and inter-sensory integration. (Deniz, Hamarta ve Akdeniz, 2014, p.59).	 Hammer
Bender Gestalt Test	It is a test that allows measuring visual motor perceptions. It measures performances such as distortion, rotation, merging, integration, copying. (Deniz, Hamarta ve Akdeniz, 2014, p.59).	 Saw
Mangina Test	In this test, a stimulus is asked to find the same one in complex shapes, such as space orientation, direction, magnitude, and size. Visual perception and learning skills are determined (Turgut, 2008, p.31).	 Wrench, Pincers
Frostig Test	It measures the ability of visual perception to manifest itself in different performances (visual motor coordination, figure-ground relationship, shape constancy, location in space, space relations). (Deniz, Hamarta ve Akdeniz, 2014, p.59).	 Spirit level
Ankara Developmental Screening Inventory	It is an inventory that allows the measurement of the developmental areas (language, fine motor skills, gross motor skills, etc.) in children (Deniz, Hamarta ve Akdeniz, 2014, p.60).	 Handsaw
Specific Learning Disorder Clinical Observation Battery	This battery assess reading, writing, and math skills, and identifies the disorders frequently encountered in learning difficulties (visual perception, sequencing and sequencing, right-left discrimination, clock drawing, lateralization, and fine motor). (Çelik, 2019, p.97)	 Tool Set
Suggest a few as well.		
		Continue

Figure 3. Activity 5. My Diagnostic Tool Set (first page)

Features; what it provides; Make an analogy of the repair tool used.

Now we are given resources such as wood, timber; for building the stairs.

- Whether splintered or flat (Handsaw and Spirit level)
- Whether it turns the nail - its hardness (Hammer and nail)
- Division into certain parts (Saw)

You can make a repair or carpenter's tool analogy to identify other features.

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According to the above analogy; describe what specific learning disability you have in a student you meet and which test tool you can use to diagnose it.

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Suggest practicesand exercises to improve these characteristics. If there are related websites, write them below

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.....

Figure 2. Activity 5. My Diagnostic Tool Set (second page)

In the activity sheet example in Figure 2, some information is given at a certain rate, but whether these are correct and whether the analogies are appropriate is left to the teacher. In this respect, it is aimed to develop critical thinking skills (VanTassel-Baska & Wood, 2009) in terms of both learning by discovery and testing the accuracy of information and analogies (Tortop, 2018: p.82, 185). In addition, the gradualness of the activity sheet also makes the Learning Centers strategy (Tortop, 2018: p.49). The problem situation in the student and the development of research skills (Williams, 1993; Tortop, 2018: p.138) by doing research during the practice and exercise proposition for its solution, and the suggestion of something new by themselves improves the creative thinking skills (Sak, 2009, 2010; Tortop, 2010). 2018: p.185) shows that it has a supportive aspect to its development.

It has been prepared in accordance with the "self-regulated learning" principles approach in order for teachers to understand that the development of self-regulation skills, which is one of the most important problems of students who experience gifted learning disabled phenomenon in all activities, is Tortop, 2018: p.292). Because, in order for the teacher to be able to develop self-regulation in gifted learning disabled students, they must first develop their own self-regulation (Tortop & Eker, 2014). In order to improve themselves in the education of gifted learning disabled students, teachers need to be self-developing, researching, experimenting, implementing and monitoring people as in self-regulated learning. In the worksheets, attention was paid to the fact that the teacher was an active learner.

Conclusion and Recommendations

Since there are not many sample programs for developing in-service training programs for the education of gifted learnign disabled students, the principles and stages of program development were taken into consideration in the development of the in-service training program in the research. The created in-service training program is planned to consist of 6 sessions, 15 activities and 15 hours. These activities were associated with 15 outcomess. In the creation of instructional designs (activities), it has been prepared in the form of worksheets suitable for the application of the

principles of instructional differentiation of gifted students and the self-regulated learning approach for teachers to improve themselves. This in-service training program is the first in-service training program prepared for teachers of gifted learning disabled students.

It can be suggested that this in-service training program be developed for different teacher groups as well. This in-service training program and instructional designs have been prepared for students with gifted learning disabled intelligence. It may be suggested to prepare in-service training programs for other groups in the definition of twice exceptionality.

Biodata of Author

Hasan Said Tortop graduated from Celal Bayar University, Faculty of Education, Science Teaching undergraduate program. He graduated from the same university in the field of Science Education. He graduated from Suleyman Demirel University, Institute of Science and Technology, with a PhD in Physics. PhD thesis topic; It is the use of project-based learning and meaningful field trips in the teaching of solar energy and its applications. Tortop also graduated from Anadolu University Open Education Faculty, undergraduate program in Philosophy. In 2014, he received the title of associate professor from the field of science education. His fields of study are science education, gifted education and special education. He works as an editor and managing editor in many journals. E-mail: hasansaidfen@gmail.com ORCID: 0000-0002-0899-4033

Assoc. Prof. **Gokhan Ilgaz** works at Trakya University Educational Sciences Department. He received his bachelors degree in Science Teaching Department from Trakya University in 2004. He completed his masters degree in Curriculum and Instructions programme in Trakya University in 2006. He received his doctorate certificate in Science Teaching Department from Gazi University in 2011. He has studies in areas Self-efficacy, self-regulation, science teaching, curriculum designing. He is currently working as deputy head of Science Department, Head of Curriculum and Instruction also Director of Institute of Roma Language and Culture Studies in Trakya University. Affiliation: Trakya University, Edirne, Türkiye. E-mail: gokhani@trakya.edu.tr ORCID: 0000-0001-8988-5279

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Research Article

Turkish adaptation of Social Coping Questionnaire for gifted students[1]

Ayca Koksal Konik[2*]

Department of Special Education, Istanbul University Cerrahpasa, Istanbul, Turkiye

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Abstract

The objective of this research is to conclude the Turkish adaptation, validity, and reliability analysis of Swiatek's Social Coping Questionnaire (SCQ), which was first published in 1995. (However, the most recent 2001 version of the questionnaire is employed in this study.) A total of 266 gifted students (130 females and 136 males) participated in the study. The participants' ages ranged from 11 to 15. Exploratory and confirmatory factor analyses showed that the Turkish version of the scale retained the five-factor structure of the original scale. SCQ consists of 25 items in total and examines coping techniques using 5 subscales. Furthermore, the SCQ is a self-report, seven-point Likert type questionnaire that assesses five coping styles: denying giftedness (7 item), social engagement (6 item), humor (3 item), and popularity (5 item). The factor loadings of the items are ranged from .79 to .40. The range of all item-total correlation coefficients was between .44 and .77. Cronbach Alpha Coefficients were determined as .77 for denying giftedness, .60 for social interaction, .60 for humor, .57 for popularity, and .48 for peer acceptance. Test re-test coefficients were as follows; .62 denying giftedness, .48 social interaction, .50 humor, .45 popularity, and .39 peer acceptance scale. The UCLA Loneliness Scale was administered to another gifted students sample to test the convergent validity of the instrument (n=102), as expected peer acceptance and humor subscale correlates negatively (-.43) and denying giftedness subscale correlates positively (.27) with UCLA scores. The model fit was evaluated via confirmatory factor analysis using the structural equation modeling program. The analysis were performed on the 25 social coping items and resulting fit indices clearly revealed that the five-factor model of social coping provided a good fit to the data (x2 =437.08, df=262, (x2/df=1.66)), RMSEA=0.050, GFI= 0.88, CFI=0.85, NNFI=0.83, SRMR=0.072).

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Introduction

Being intellectually gifted and talented means being different in various aspects of life, including at home, school, and in the community, due to their unique set of skills. They tend to learn faster in school, may have difficulty relating to their peers (Milgram, 1991), question life and many abstract concepts more deeply (Scholwinski,Reynolds,1985) and may be perceived as "strange" by others. Being a gifted student in schools is also hard phenomena. Schools Schools are not only places for acquiring knowledge and receiving education, but also environments where social interactions take place, emotional connections are formed, various emotions are experienced, and life is rehearsed. Children learn through all of these components. However, for gifted children, accessing these fundamental needs can be more challenging in some cases compared to their peers. (DeLay et al., 2016; Neilhart, 2016). Additionally, being labeled as gifted may affect

[1] This research was presented at WCGTC 21st biennial World Conference 2015, Odense, Denmark.
[2] Corresponding author: Asist. Prof., Department of Special Education, Istanbul University Cerrahpasa, Istanbul, Turkiye. E-mail: akoksal@iuc.edu.tr ORCID: 0000-0001-6726-8739

students' perceptions of acceptability from their peers, making them feel stereotyped and limiting their social options (Cross et al., 2018). "The stigma of giftedness" has been used to describe this phenomena.This term frequently disscussed in the literature. Also, according to Tannenbaum (1981), gifted students are influenced by how other people perceive their talents. According to Mendaglio (2012), gifted students experience stigmatization, and their fear of stigmatization is simply a result of having the label "gifted.". Because of this, gifted students come up with a variety of techniques to hide their intellectual differences (Cross et. al, 1991).

Several coping mechanisms are used by students to minimize perceived social stigma, according to early studies on the stigma of giftedness (Buescher, 1985; Coleman & Cross, 1988, 2000); Coleman & Sanders, 1993). These studies claim that gifted children try to cope with their "differentness" by underachieving (Janos et al., 1987), missing to respond to questions in class, asking questions that are not appropriate, acting like the class clown, reducing their vocabulary and lying about getting good grades, making up examinations or assignments to seem tough (Cross et al., 1995), and even denying that they are gifted (Buescher, 1985).

Some gifted students believe that they are treated differently and seen as different when others notice their giftedness. (Coleman & Cross, 1988; Cross et al., 1993; Manaster,Chan, Watt, & Wiehe, 1994; Manor-Bullock, Look, & Dixon, 1995). As a result, these children don't necessarily want to be treated differently or differ intellectually from their peers (Swiatek, 2002). However, the experience of stigma may not affect gifted students in the same way. The ability to cope may be more challenging for those who are extraordinarily gifted. This can be explained by the "asynchronous development" characteristics of gifted children. As stated by the Columbus Group, as intellectual capacity increases, social adjustment becomes more complicated. According to Swiatek (1995), gifted individuals with exceptional verbal ability are more likely than those with exceptional mathematical aptitudes to experience more of the negative social consequences of being gifted.

In the context of giftedness, researches on social coping is still developing. Despite some limitations in the existing studies, they indicate that giftedness makes social adjustment more challenging, poses difficulties in being different, and emphasizes the need for individual or group counseling for such children. However, in order to identify the challenges related to social coping, there is an urgent need for reliable instruments. Therefore, the purpose of the study is to test reliability, factor structure and convergent validity of the Social Coping Scale (Swiatek, 2001) on gifted Turkish elementary school students.Validity and reliability studies of the original scale have been conducted with high school students. However, with permission from the corresponding author, a validity and reliability study has also been conducted for middle school students in Turkey. By the way, with a reliable instrument for determining social coping strategies in gifted elementary school children, it is possible to take the necessary precautions early on and prevent the effects of this situation.

Problem of Study

The social coping strategies of gifted children are different from their peers. Identifying this difference is crucial for the development of guidance and counselling programs. It is also highly important for understanding the psychology of gifted children. When considering national studies related to social coping strategies, it has been observed that there are no valid and reliable instruments to assess this topic for gifted children. Therefore, this study was conducted with the aim of to adapt the Social Coping Questionnaire developed by Swiatek (2001) to Turkish and to perform validity and reliability studies.

Method

Research Model

This study was performed in a methodological-descriptive-cross sectional manner in order to adapt and evaluate the validity and reliability of Social Coping Questionnaire in Turkey. A cross-sectional study uses to simultaneously collects data from a population. It is a snapshot of the population at a particular moment rather than a study that tracks changes over time. A cross-sectional descriptive survey assesses how frequently, widely, or severely the variable of interest occurs throughout a specific demographic.

Participants

266 gifted students (130 female, 136 male) participated in the study were selected from 5 different science and art centers where gifted and talented students are educated in Turkey during the spring semester of 2015. It can be said that the first and largest step taken for the education of gifted individuals in Turkey is the establishment of "Science and Art Centers." Science and Art Centers are educational institutions that specifically work with identified gifted students and provide programs tailored to their needs. In the beginning, there were only 5 SACs in 5 cities of Turkey. But, now in 2022, there are 355 SAC in 81 cities of Turkey. Approximately 68,000 students are in education.

The age ranges of participants are between 11 and 15 (m=13,32). The age distribution of the gifted students are as follows. 8.6% is 11 years old (n=23), 20.7% is 12 years old (n=55), 7.1% is 13 years old (n=19), 56.4% is 14 years old (n=150) and 7.1% is 15 years old (n=19). Data gathered from this first group were used in the exploratory and confirmatory factor analyses. The SCQ and UCLA were tested on a second sample of gifted students in order to calculate the convergent validity of the scale (n=102).

Instruments

In terms of the purpose of the study, the Social Coping Questionnaire was used to examine validity and reliability, and the UCLA Loneliness Scale was used to assess convergent validity.

Social Coping Questionnaire

Swiatek developed the Social Coping Questionnaire in 1995 to evaluate the particular coping mechanisms employed by gifted students.In its original form, the SCQ (Swiatek, 1995) had 35 questions "that address beliefs and activities relating to various social aspects of intellectual giftedness." A component analysis of the scores revealed four social coping mechanisms: Denial of Giftedness, Popularity/Conformity, Peer Acceptance, and Activity Level. Swiatek's (2001) most recent replication used a 34-item SCQ yielded a six-factor solution almost identical to that found in her previous study (Swiatek, 2001). Compared to all previous replications, these factors explained the most variance in students' responses to items on the SCQ (40.5%). Swiatek (2007) conducted a new study about construct validity of SCQ. And in this study did not introduce any revisions to the SCQ, the items were again factor analyzed to ensure that the social coping scales. Results yielded five factors that accounted for 42.0% of the variance: Denying Giftedness, Social Interaction, Humor, Focus on Popularity/Conformity, and Peer Acceptance.

The Social Coping Questionnaire developed by Swiatek (2001) was used to test its validity and reliability in the Turkish culture. The SCQ, a 34-item self-report questionnaire, was created to evaluate the coping strategies employed by gifted kids to deal with the negative stereotypes and social pressures brought on by being recognized as gifted in a school environment. Respondents provide an answer to each item on a 7-point, Likert-type scale (1 = Strongly true, 7 = Strongly false); higher scores always indicated stronger endorsement of a coping strategy. As a result, some items in the peer acceptance and popularity subscales are reverse-items(reverse items are: 1,2,3,9,16,18,25,28). SCQ measures five coping styles: *Denying giftedness* subscale consists of 7 items, (eg. "I don't think that I am gifted." Or "People think that I am gifted, but they are mistaken."), *Social Interaction* subscale consists of 6 items, (eg. "People come to me for help with their homework." Or "I explain course material to other students when they don't understand it.") *Humor* subscale consists of 3 items, (eg. "I tell a lot of jokes in school." Or "I'm good at making people laugh."), Focus of *Popularity* subscale consists of 5 items (eg." Other students do not like me any less because I am gifted." Or "I would fit in better at school if I were not gifted.") and *Peer Acceptance* subscale consists of 4 items (eg." I try to look very similar to other students." Or "I try to act very much like other students act.")

Many studies using the SCQ have shown that there are differentiated social coping strategies according to the sample group in which that study was conducted. As a result, different factorial structure emerged in different studies (Swiatek, 1995, 2001; Swiatek & Dorr, 1998; Swiatek & Cross, 2007; Cross & Swiatek, 2009). These analyses have yielded between four and seven social coping scales. Each study has discovered three basic scales, which are known as the following: denying giftedness, peer acceptance, and social interaction (Swiatek, 2001).

The alpha coefficients of the five scales in SCQ are reported as .77 for Denying giftedness, .69 for social interaction, .68 for humor, .66 for popularity, and .61 for peer acceptance in the original study.

The original scale has been professionally translated by a professional into Turkish with the the corresponding author's permission, and then translated back into English. The Turkish and English translations have both been examined by six academics with PhD's in Gifted and Talented Education. The scale was initially tested on a small sample of gifted students to evaluate their comprehension of the items. Then the final version administered to the participants.

UCLA Loneliness Scale

The UCLA Loneliness Scale is a widely used assessment tool developed by Russell, Peplau, and Ferguson in 1978 to measure subjective feelings of loneliness. It consists of 20 self-report items designed to evaluate an individual's perceived social isolation and the subjective experience of loneliness. Participants are asked to rate each item on a 4-point Likert scale, ranging from "Never" to "Often." The scores on the scale range from 20 to 80, with higher scores indicating higher levels of loneliness. Demir (1989) adapted the scale for Turkish use, and it proved to be reliable. The Cronbach alpha value in Demir's (1989) study was .96. In this study, is found to be.87.

Procedure

The following analyses were conducted to test the (a) "*construct validity*" of the Turkish version of SCQ: Exploratory and Confirmatory Factor Analysis, for testing (b) *"convergent validity"*: bivariate correlations with UCLA, for to test (c) *item analysis* ; t-tests are analyzed. Also the difference between the *upper and lower 27% scores* of items and *item total correlations* were calculated. For testing the (d) *reliability* of the Turkish version of SCQ: internal consistency coefficients and test-retest values were calculated.

Results

Exploratory Factor Analysis

A principal component analysis with varimax rotation has been used to assess the instrument's structural validity. When a minimum eigenvalue of 1.0 was used as the criterion for determining the number of factors in the factor analysis, 11 factors were identified . This result was similiar with Swiatek's revision study in 1998. Because it was the most straightforward to interpret and most in touch with the theoretical literature, a five-factor solution was ultimately chosen (Swiatek, 1995). The scale with the lowest factor loading retained for further analysis is .40. After extracting the data, problematic items (ones that are low-loading (under .40), crossloading or freestanding) dropped and rerun the analysis. It has been determined that the KMO (.66) and Barlett Sphericity (x2=1494; p.000) values are sufficient for an appropriate analysis. The principal component analysis produced five factors which explained 46% of the total variance and loaded between.82 and.40. It is considered sufficient for the factor loadings of the items to be 0.30 or higher (Seccer, 2013: 129), and for the explained variance to be at least %40 (Buyukozturk, 2008).The first factor (7 items denying giftedness scale) explains 13,95 % of the overall variance. The second factor (6-item social interaction scale) explains %10,61. The third factor (3-items humor scale) explains %7.98. The fourth factor (4-items peer acceptance scale) explains %6.94, and the fifth factor (5-items popularity scale) explains %6.24 of the overall variance. The factor loadings for each scale are presented in Table 1. In the current form, all items with a load greater than .40.

Table 1. Exploratory Factor Analysis

	Factors				
Items	**Denying Giftedness**	**Social Interaction**	**Humor**	**Popularity**	**Peer Acceptance**
34	.798				
11	.787				
23	.692				
27	.652				
31	.548				
24	.486				
7	.456				
12		.627			
5		.623			
17		.531			
32		.492			
20		.486			
6		.457			
21			.828		
14			.823		
4			.526		
10				.690	
3				.684	
26				.460	
25				.446	
22					.742
15					.720
16					.500
2					.449
9					.403

Items dropped: 1,8,13,18,19,28,29,30,33

Confirmatory Factor Analysis

The structural equation modeling software Lisrel 8.50 (Joreskog & Sorbom, 2001) was used to conduct confirmatory factor analysis to assess the model's fit. The 25 social coping strategies were analyzed, and the maximum likelihood method of estimate was applied. The model did not permit cross-loadings or correlated error measurement (Kline, 2005). The following primary fit indicators were established in order to assess how well the defined model fit: (x2 =564.08, df=265, ($x^{2/df}$=2.12)), RMSEA=0.063, GFI= 0.86, CFI=0.76, NNFI=0.73, SRMR=0.078) (Figure 1). This model fit indices was suggested some modifications.

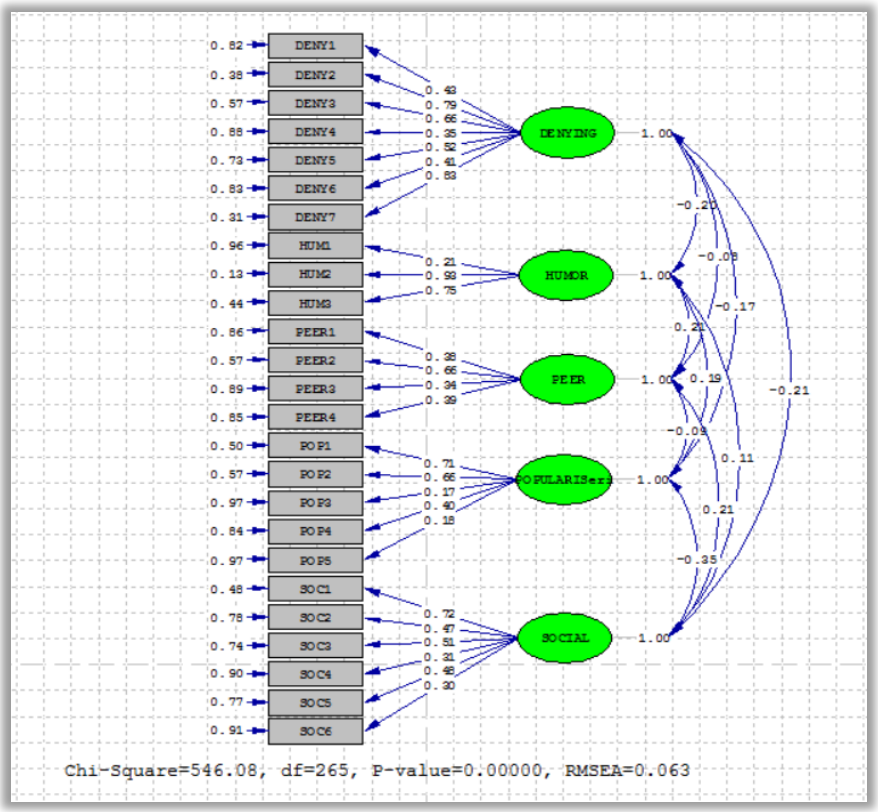

Figure 1. Standardized solution of the five-factor model of the social coping questionnaire

In order to evaluate the fit of the second model the primary fit indices were established as follows: (x2 =437.08, df=262, ($x^{2/df}$=1.66)), RMSEA=0.050, GFI= 0.88, CFI=0.85, NNFI=0.83, SRMR=0.072). (Figure 2) Also, the fit of these values is shown in Table 2

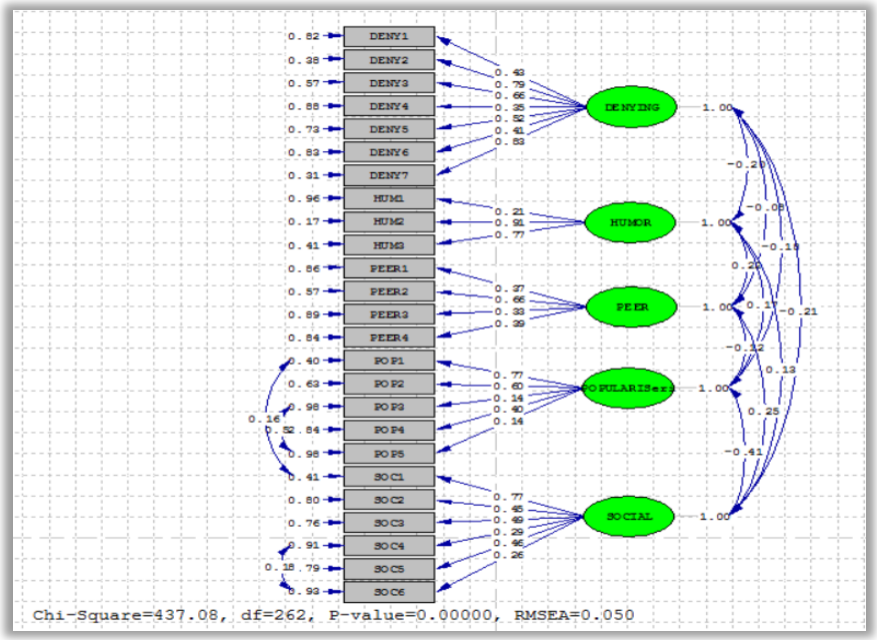

Figure 2. After modification standardized solution of the five-factor model of the social coping questionnaire

Table 2. Model Fit Values of Confirmatory Factor Analysis

Fit Indexes	Values	Definition	Source	Result
Chi-square/sd	1.66	Lower than 3 indicates good-fit, lower than 5 indicates close-fit.	(Cokluk, Sekercioglu and Buyukozturk, 2010) (Kline, 2011)	Good fit
RMSEA	.050	Lower than or equal to .05 indicates good-fit, between .05-.08 indicates close-fit.	(Hu and Bentler, 1999) (Kline, 2011)	Good Fit
GFI	.88	Higher than .95 indicates perfect-fit, higher than or equal to .90 indicate good-fit. Higher than or equal to .85 is acceptable.	(Tabachnick and Fidell, 2007)	Acceptable
CFI	.85	Higher than or equal to .95 indicates good-fit, higher than or equal to .90 indicate close-fit	(Hu and Bentler, 1999) (Sumer, 2000)	Below the acceptable limit
NNFI	.83	Higher than or equal to .95 indicates good-fit, higher than or equal to .90 indicate close-fit.	(Hu and Bentler, 1999) (Sumer, 2000)	
SRMR	.07	Lower than or equal to .05 indicates good-fit, lower than or equal to .08 indicates close-fit.	(Tabachnick and Fidell, 2007)	Close fit

According to Table 2, Chi-square/sd and RMSEA values both indicate "good model" fit. The other fit indices, CFI (.85) and NNFI (.83) values are slightly below the acceptable limit, while GFI (.88) and SRMR (.07) fall within the acceptable limits (Hu & Bentler, 1999; Tabachnick & Fidell, 2007). Therefore the five-factor model of social coping provided a good match to the data, as demonstrated by the fit indices that followed.

Item Analysis

The items and subscales of the SCQ scale were evaluated by calculating item-total correlations and t-test values were computed to compare both the item and scale scores of upper and lower 27%. All item-total correlations coefficients is found between .43 and .78. Additionally, all t-values for the difference between the scores of upper and lower 27%of items and scales were significant (Table 3.)

Table 3. Item-total correlations and difference between item scale scores of upper and lower %27

		Lower %27		Upper %27			Item Total
	N	M	Sd	M	Sd	t	r
Denying		**14,60**	**2,71**	**33,01**	**4,32**	**-30.64****	
SCQ 7	72	1,35	0,65	2,82	1,54	-7.46**	.48**
SCQ 11	72	1,31	0,64	4,46	1,37	-17,64**	.77**
SCQ 23	72	1,17	0,41	3,43	1,55	-12,00**	.65**
SCQ 24	72	3,67	1,86	6,35	1,02	-10,70**	.51**
SCQ 27	72	2,00	1,27	4,53	1,45	-11,12**	.65**
SCQ 31	72	3,85	1,87	6,51	0,93	-10.80**	.56**
SCQ 34	72	1,26	0,67	4,92	1,55	-18,30**	.78**
Soc. Int.		**31,92**	**4,30**	**49,24**	**2,90**	**-28,33****	
SCQ 5	72	4,96	1,90	6,75	0,47	-7,76**	.57**
SCQ 6	72	4,54	1,64	6,56	0,75	-9.50**	.61**
SCQ 12	72	3,10	1,94	6,04	1,07	-11,26**	.59**
SCQ 17	72	3,47	1,98	5,57	1,50	-7,16**	.44**
SCQ 20	72	5,32	1,38	6,72	0,59	-7,92**	.45**
SCQ 32	72	3,47	1,72	6,01	1,22	-10,24**	.57**
Humor		**15,42**	**2,36**	**27,33**	**2,43**	**-29,87****	
SCQ 4	72	1,14	0,54	3,18	2,02	-8.27**	.50**
SCQ 11	72	4,07	1,51	6,50	0,65	-12,52**	.66**
SCQ 21	72	3,97	1,53	6,56	0,71	-13,00**	.65**
Peer Acc.		**25,29**	**3,49**	**40,97**	**2,23**	**-32,13****	
SCQ 3	72	4,36	2,05	6,61	0,80	-8.67**	.53**
SCQ 10	72	4,11	2,11	6,72	0,88	-9.71**	.58**
SCQ 25	72	2,82	1,75	5,47	1,73	-9.14**	.49**
SCQ 26	72	4,58	2,03	6,39	1,00	-6,77**	.43**
Popularity		**10,32**	**2,01**	**25,32**	**3,52**	**-31,36****	
SCQ 2	72	1,54	1,11	3,99	1,87	-9.55**	.58**
SCQ 9	72	1,82	1,53	4,49	1,83	-9.47**	.56**
SCQ 15	72	2,04	1,30	4,82	1,51	-11,79**	.61**
SCQ 16	72	2,33	1,66	4,92	1,75	-9,08**	.54**
SCQ 22	72	1,43	0,87	4,11	1,86	-11,08**	.60**

Participants were given the UCLA Loneliness Scale to examine the instrument's convergent validity. (n=266). As expected peer acceptance and humor subscale correlates negatively (-.433, p<.001; -.151. p<.005) and denying giftedness subscale correlates positively (.271, p<.oo1) with UCLA scores.

For to test reliability of the instrument test-retest coefficients and Cronbach Alpha coefficients were calculated. Cronbach Alpha Coefficients were found as .77 for Denying Giftedness, .60 for Social Interaction, .60 for Humor, .57 for Popularity, and .48 for peer acceptance scale. Test re-test study was conducted with a sample of 55 gifted students from 6th and 7th grades of an elementary school in Istanbul. SCQ has been given to this new study group two times in a period of three weeks. Test re-test coefficients were found to be 62 (p<.01) for Denying giftedness, .48 (p<.01) for social interaction, .50 (p<.01) for humor, .45 (p<.01) for popularity, and .39 (p<.01) for peer acceptance scale.

Table 4. *Cronbach alfa, means and standart deviation for SCQ (both U.S and Turkiye)*

Scale	Cronbach Alfa		Mean		Standart Deviation	
Social Coping Questionairre	U.S. (Swiatek, 2007)	Turkiye (current study)	U.S. (Swiatek, 2007)	Turkiye (current study)	U.S. (Swiatek, 2007)	Turkiye (current study)
Denying Giftedness	.77	.77	3,63	3,55	1,00	1,07
Social Interaction	.69	.60	5,24	5,24	0,84	0,94
Humor	.68	.60	4,27	4.29	1.03	1,18
Popularity	.66	.57	2,70	3.06	0,98	1,13
Peer Acceptance	.61	.48	4,44	5,27	0,88	1,16

As seen in Table 4, many values exhibit similarities between the U.S. and Turkey samples. However, the difference between the mean of peer acceptance social coping strategies in the Turkish sample and the original form can be discussed. This could be attributed to the greater importance of peer acceptance and social interactions in Turkish culture compared to Western cultures. Conducting future studies on this topic will provide more reliable information and insights.

Conclusion and Discussion

The Social Coping Questionnaire (Swiatek, 2001) is a significant tool that reveals the social problems and coping strategies of gifted students that may arise from their giftedness. The questionnaire encompasses these strategies in five dimensions: denying giftedness, social interaction, humor, focus on popularity and peer acceptance. No Turkish scale specifically measuring these strategies was available and the current study was conducted with the aim of addressing this need and developing a scale that can fulfill this purpose in Turkey. To this end, the validity and reliability of the Turkish translation of the SCQ were tested, and exploratory and confirmatory factor analyses were conducted.

The five-factor structure of social coping strategies with Turkish gifted kids aged 11 to 15 was confirmed by the factor analysis results, and the model had a good match to the data. There was also confirmation of the previously suggested convergent validity between the SCQ and the UCLA. Both items had a good correlation with SCQ scales, according to the item analysis of the SCQ, and a significant difference between the upper 27% and lower 27% item scores was discovered. At last, the reliability of the SCQ was confirmed as shown by the test-retest and Cronbach's alpha coefficients. These results replicate the reliability of the 25 item, five factor SCQ in Turkish that Swiatek (2007) found in samples from the United States. The Turkish version of the five factors and items of the SCQ are as follows; *denying giftedness*; 25,9,18,22,23,19,6; *social interaction*; 10,4,14,24,15,5; humor; 16,11,3; *peer acceptance*; 8,2,21,20; *popularity*; 17,12,13,1,7; *reverse items*; 1,2,7,13,20. On the other hand, SCQ has originally been tested on high school gifted students; however the present study is conducted with elementary gifted students, the scale was found to be reliable and valid for 11-15 years old gifted students. Also with this findings the age range of the original test is expanded towards 11. The psychometric properties of SCQ could further be tested among primary school gifted student samples among Turkish childrens to fill the gap in measuring tools in Turkiye.

Overall, the study's findings indicate that the Turkish SCQ is a helpful tool for evaluating social coping strategies in gifted and talented students.. Furthermore, with this study, the age range of the original scale has also been expanded to middle school. Thus, it can be said that social coping strategies of gifted students can be identified starting from middle school, and this information can guide the development of effective psychological support programs.

Limitations

The current study has certain limitations that should be acknowledged. Firstly, the sample size of this study is relatively small. Although data was collected from gifted students in six cities of Turkiye, expanding the sample to include more cities would enhance the generalizability of the findings. Therefore, a recommendation for future research would be to investigate a larger and more diverse sample to provide a more comprehensive understanding of the topic.

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Biodata of Author

Ayça Köksal Konik, Phd born in Istanbul, Turkiye, July 09, 1977. She graduated from the Department of Guidance and Psychological Counseling in 2000, from Istanbul University. She obtained her Master and Phd degree, from the Istanbul University, in Educational Sciences, in 2007. Her main areas of expertise are the psychology of gifted children, their social-emotional needs, and providing psychological counseling to gifted children and parents of gifted children. She has been conducting clinical and theoretical studies in these fields since 2007. She is a certified play therapist and a family and couple therapist. **Affiliation:** Istanbul University Cerrahpasa **E-mail:** akoksal@iuc.edu.tr **ORCID:** 0000-0001-6726-8739 **Phone:** (+90) 212 866 3700

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Appendix 1. Social Coping Questionnairre (Turkish Version)

Social Coping Questionnairre (Turkish Version)								
1 Kesinlikle doğru **2** Doğru **3** Kısmen doğru **4** Kararsızım **5** Kısmen yanlış **6** Yanlış **7** Kesinlikle yanlış								
No	Madde	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	Popüler olup olmadığımı önemsemem.							
2	Üstün zekalı olmasaydım, okula daha iyi uyum sağlardım.							
3	İnsanlar benim "sınıfın palyaçosu" olduğumu düşünüyor.							
4	Ders konularını diğer öğrenciler anlamadığında, onlara açıklarım.							
5	Ders dışı etkinliklere katılarak benimkine benzer ilgi alanlarına sahip arkadaşlar edinirim.							
6	Elde ettiğim başarıların çoğu şansa bağlıdır.							
7	Uzun vadede popüler olmak önemli bir şey değil.							
8	Üstün zekalı olduğum için diğer öğrenciler tarafından daha az sevilmem söz konusu değil.							
9	İnsanlar benim üstün olduğumu düşünüyorlar ama yanılıyorlar.							
10	İnsanlar ödevlerinde yardım etmem için bana geliyorlar.							
11	İnsanları güldürme konusunda iyiyim.							
12	Diğer öğrenciler nasıl davranıyorsa öyle davranmaya çalışıyorum.							
13	Diğer insanların benim hakkımda ne düşündükleri önemli değil.							
14	Yoğun programım nedeniyle, popülaritemle ilgili endişelenmeye zamanım yok.							
15	Bildiklerimi, diğer öğrencilere yardım etmek için kullanmaya çalışırım.							
16	Okulda birçok espri yaparım.							
17	Diğer öğrencilerle çok benzer görünmeye çalışırım.							
18	Üstün zekalı değilim; sadece okul başarısı konusunda şanslıyım.							
19	İnsanlara üstün zekalı olduğumu söylemem.							
20	Yalnız başıma birşeyler yapmayı, diğer çocuklarla birlikte yapmaya tercih ederim.							
21	Üstün zekalı olmak popülerliğime zarar vermez.							
22	Büyüdükçe ve akademik çalışmalar zorlaştıkça, insanlar beni üstün olarak görmeyi bırakacaklar.							
23	Benim olduğumdan daha üstün olan birçok insan var.							
24	Çoğunlukla kendimi oldukça meşgul tutuyorum.							
25	Üstün zekalı olduğumu düşünmüyorum.							

Ters maddeler: 1,2,7,13,20

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Teaching Practices Article

A new encryption task for mathematically gifted students: Encryption arising from patterns

Fatma Erdogan[1]* and Neslihan Gul[2]

Faculty of Education, Fırat University, Türkiye

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Abstract

The concept of encryption is noteworthy in terms of both familiarizing mathematically gifted students with technological developments and working with mathematically challenging tasks. Once the proper foundations are established, students can begin to formalize encryption and decryption with algebraic formulas. Encryption can be an important resource for developing functional thinking. Based on the given information, this study designed an encryption algorithm through linear patterns that can be presented as a teaching task in classroom environments to students who are learning at elementary school level and explained the implementation process. The task named "Encryption arising from patterns" is considered important in terms of both creating an encryption algorithm and providing content for the development of mathematical patterns and therefore functional thinking. In the task of "Encryption arising from patterns", the general term of the linear pattern was created by starting from two prime numbers. The numbers corresponding to the first 29 terms of this linear pattern have been calculated. The letters of the alphabet and the terms of the pattern were paired in order. Then, Caeser's Cipher was applied to the letters in the alphabet. Thus, the numbers corresponding to the key letters were assigned to the letters in plaintext. The letters of plaintext were sent to the receiver along with the numbers corresponding to the key letters and the first three steps of the linear pattern, and the encryption task was completed.

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Introduction

The education of mathematically gifted students is one of the current topics of discussion in mathematics education (Leikin, 2021). Mathematically gifted students exert more mental effort on mathematical and complex tasks (Leikin et al., 2017). In this context, National Council of Teachers of Mathematics (NCTM, 2016) emphasizes that mathematically promising students should be provided with differentiated instruction that will develop their mathematical abilities, curiosity and creativity in mathematical learning environments inside or outside the school. The concept of encryption is noteworthy in terms of both familiarizing mathematically gifted students with technological developments and working with mathematically challenging tasks. In addition, one of the cognitive characteristics of mathematically gifted students is generalizing mathematical structures (Leikin, 2021; Paz-Baruch et al., 2022). Generalization, which is one of the elements of mathematical thinking, is related to mathematical patterns (Assmus and Fritzlar, 2022).

[1] Corresponding Author: Faculty of Education, Fırat University, Türkiye. Email: f.erdogan@firat.edu.tr ORCID: 0000-0002-4498-8634
[2] Teacher, Elazig Science and Art Center, Türkiye. Email: gulneslihan85@gmail.com ORCID: 0000-0003-2137-0206

People have been trying to hide the content of their written messages since the discovery of writing and have developed different methods of doing so (Holden, 2017). Encryption that ensures privacy plays a key role in ensuring data security. In the modern world, encryption can be done with many methods such as computer-based cryptography (Miller & Bossomaier, 2021). Ciphers and encryption are mathematically interesting (Holden, 2017). Cryptography is an important topic for students from primary school to university, as it provides students with the opportunity to solve problems in different contexts (Kaur, 2008).

One of the most important goals of mathematics education is to enable students to establish the connection between mathematics and daily life (NCTM, 2000). In this context, studies have been conducted in which encryption tasks were designed and implemented in mathematics education with the aim of enabling students to establish the connection between information security, technology, daily life, and mathematics (Chua, 2006, 2008; Erol & Saygı, 2021; Ho, 2018; Katrancı & Özdemir, 2013; Kaur, 2008; Özdemir & Erdoğan, 2011; Patterson, 2021). In the studies conducted, it was noticed that the pattern context was not emphasized based on the mathematical function structure of encryption. However, once the proper foundations are established, students can begin to formalize encryption and decryption with algebraic formulas (Patterson, 2021). This is one of the reasons for designing the encryption task based on patterns.
Cryptology algorithms consist of mathematical functions (Holden, 2017). Although functions are included in the secondary mathematics curriculum in most countries, studies are being conducted on how to approach functional thinking with elementary students (Schliemann et al., 2012). Functional thinking focuses on the relationship between two (or more) co-varying quantities (Smith, 2008). Patterns are one of the most important tools that deal with the relationship between co-varying quantities in elementary school and enable students to think functionally (Blanton et al., 2015).

NCTM (2000) emphasized that opportunities should be created for students at all levels from preschool to high school to understand patterns, relationships and functions. Encryption can be an important resource for developing functional thinking. Encryption can also be a fun way of teaching mathematics as it is a popular and interesting science today. Based on the given information, this study designed an encryption algorithm through linear patterns that can be presented as a teaching task in classroom environments to mathematically gifted students who are learning at elementary school level and explained the implementation process. The task named "Encryption arising from patterns" is considered important in terms of both creating an encryption algorithm and providing content for the development of mathematical patterns and therefore functional thinking. In addition, it is important to design encryption tasks that require mathematical challenge for mathematically gifted students. Providing encryption task for mathematically gifted students can offer foresight to teachers or curriculum developers in their differentiated program preparation studies.

Theoretical Framework

Mathematical giftedness

According to Krutetskii (1976), one of the authoritative names in the field of mathematical ability, mathematical giftedness is a combination of mathematical abilities that manifests itself as a successful performance in a mathematical task or superior creativity in a subject. Leikin (2019) defines a mathematically gifted student as a student who demonstrates a high level of mathematical performance and produces creative mathematical ideas within a reference group. Mathematically gifted students can differentiate themselves from other students by exerting less mental effort on mathematical and complex tasks (Leikin et al., 2017). In addition, gifted students prefer to deal with challenging tasks and autonomy in learning environments (Wu et al., 2018). Mathematical challenge is defined as a mathematical challenge that a person is motivated to overcome (Leikin, 2014). In this context, it is emphasized that differentiated instruction should be provided in the education process of mathematically gifted students. Thus, mathematically gifted students will have opportunities to develop their mathematical abilities, curiosity and creativity in their mathematics learning processes (NCTM, 2016). In addition to all these, it is important to reveal and develop the abilities of mathematically gifted students with the developing technology in terms of the development of countries in mathematics, science and technology fields (Erdoğan & Erben, 2020; Sheffield, 2018). The concept of encryption is

noteworthy in terms of both familiarizing mathematically gifted students with technological developments and working with mathematically challenging tasks.

Among the cognitive characteristics of mathematically gifted students are the competencies of generalizing, abstracting and noticing mathematical structures, relations and patterns (Assmus & Fritzlar, 2022; Leikin, 2021; Paz-Baruch et al., 2022). Generalization, which is one of the elements of mathematical thinking and thus algebraic thinking, is related to mathematical patterns (Assmus & Fritzlar, 2022). Although it is emphasized that more attention should be paid to patterns in studies conducted in the field of education of mathematically gifted students (Leikin & Sriraman, 2022), studies examining the patterning skills of gifted students are very limited (e.g., Amit & Neria 2008; Assmus & Fritzlar, 2022; Eraky et al., 2022; Erdogan & Gul, 2022). Therefore, it is expected that the design of an encryption task based on patterns will contribute to the field of education of mathematically gifted students.

Encryption

Derived from the words "kryptos" and "lo-gos" in Greek, the word kryptos in encryption means "hidden", logos means "establishing cause-effect relationship, logical analysis area" (Bauer, 2021). As the first example, people who examine secret messages usually use the terms code and cipher in two different meanings. "A code consists of thousands of words, phrases, letters and syllables that replace these plain text elements with code words or code numbers. In ciphers, the basic unit is letter. The work of sending secret messages with codes and ciphers is called cryptography. The work of reading such secret messages without permission is called cryptanalysis or code breaking. Cryptography and cryptanalysis together form the field of cryptology (Holden, 2017). Cryptology is the science of encryption. While classical cryptology is concerned with hiding messages, modern cryptology since 1975 is concerned with communication in the presence of enemies (Bauer, 2021).

The history of encryption dates back hundreds of years. Ancient Roman Emperor Julius Caesar, he used a simple substitution cipher known as Caesar's Cipher, which is a classic example of symmetric key encryption (Santos, 2023). Roman historian Suetonius describes Caesar's Cipher as follows: Caesar has letters to Cicero and if he has something secret to say in the last one, he writes it in code. Caesar changes the order of the letters in the alphabet and writes no words in an incomprehensible way. Anyone who wants to solve them and find their meanings should replace D, the fourth letter of the alphabet, with A, and others in the same way (Holden, 2017). That is, in Caesar's Cipher, each letter in the alphabet is encrypted with three next letters.

Ciphers and encryption are mathematically interesting (Holden, 2017). Since cryptology is a mathematical science based on number theory in general, cryptology algorithms consist entirely of mathematical functions. For this reason, one-to-one and covering functions are used to encrypt messages in cryptology, while inverse functions are used to decrypt them (Santos, 2023).

Patterns and Functional Thinking

Patterns have an important place in the development of functional thinking, which is one of the elements of algebraic thinking in mathematics education (Steele, 2008). When looking at the definitions of pattern, according to Souviney (1994), pattern; it is the systematic structuring of geometric shapes, sounds, symbols and actions. Guerrero and Rivera (2002) defined pattern as a rule between the elements of a series of mathematical objects (numbers, shapes, etc.) that are structured. Features such as understanding, creating, continuing patterns are important skills in seeing mathematical relationships, generalizing, grasping the essence of mathematics (Burns, 2000). The relationships between numbers or mathematical shapes in patterns can be classified as recursive and explicit. Obtaining the next step by using the previous step is a recursive relationship (Orton & Orton, 1999). In explicit relationship, it is about relating the step number with the term in that step. That is, when the explicit relationship is thought of as a functional relationship between dependent and independent variables (Blanton & Kaput, 2004). Functional thinking concerns the process of generalizing this relationship based on specific situations (Smith, 2008). Therefore, the role of patterns in the development of students' functional thinking cannot be denied.

Patterns can be categorized according to their structure and presentation forms. It is seen that pattern types are classified in different ways in the literature. Stacey (1989) classified patterns according to n. term as linear (an+b) and

quadratic (an^2+bn+c). There are achievements in the elementary school mathematics curriculum for students to work with linear patterns and generalize linear patterns (Ministry of National Education, 2018). Therefore, the encryption algorithm task was structured in the context of linear patterns.

Purpose

The purpose of this study is to design an encryption algorithm task that can be used in mathematics classes at elementary level, can be enhanced with variable character table, and is based on linear patterns and prime numbers.

Structures of Math Teaching Practice

The task named "Encryption arising from patterns" can be applied to students who have the ability to generalize linear patterns. In the context of Türkiye, students who are studying at the seventh and eighth grade level can use the task of "Encryption arising from patterns". Indeed, in the elementary school mathematics curriculum, acquiring the achievement of "Expresses the rule of number patterns with a letter, finds the desired term of the pattern whose rule is expressed with a letter" at the seventh grade level is a prerequisite for performing the task. In addition, students need to have knowledge about the concept of prime numbers at previous grade levels. Therefore, the achievement of "Determines prime numbers by their properties." at the sixth grade level can also be seen as a prerequisite. The task can be applied to students individually or in groups. The duration of the task application may vary depending on student skills, but it may take one lesson hour (40 minutes). There is no need for special material for the implementation of the task. The task can be presented to students in the form of activity sheets.

Implementation of Math Teaching Practice

The steps of the encryption algorithm based on linear patterns and prime numbers, called "Encryption arising from patterns", are explained in the following section.

Assigning Numbers in Pattern Steps to Letters and Applying Caesar's Cipher

In the task of "Encryption arising from patterns", firstly, any two of the prime numbers 2, 3, 5, 7, 11, 13, 17, 19 are taken. A pattern rule is created from this prime number pair. The pattern rule is "Small prime number. Term order + Large prime number". The first three terms of the pattern are created as a numberical or figural pattern to send to the receiver. Since the Turkish alphabet consists of 29 letters, the terms in the first 29 steps of the pattern are determined. For terms greater than 29, the value (mod 29) is taken based on modular arithmetic. Since elementary school students do not see the concept of modular arithmetic, the instruction "Take the remainder of dividing the result by 29" is used. The terms of the pattern are assigned to each letter in the alphabet in order. Then, according to Caeser's Cipher, each letter in the alphabet is encrypted with three next letters and key letters are found. Thus, the numbers corresponding to the key letters are determined. As a result, the final number corresponding to each letter is reached.

Sending the Message to the Recipient

First, the first three terms of the linear pattern are designed as a numberical or figural pattern. Then, the first three terms of the pattern and the numbers of the encrypted text are sent to the receiver. To prevent the numbers from mixing with each other, a dot is placed between each number indicating a letter.

Decryption of the Message

The receiver first determines the rule of the pattern according to the first three terms of the pattern. Then, he multiplies the difference between the terms in the pattern by three (because the letters are shifted three steps according to Caeser's Cipher). The multiplication result is added to the terms of the pattern. Then, the letters in the alphabet are written in order for each term of the pattern. Thus, by finding the letters corresponding to the numbers, plaintext is reached.

Example Encryption Application

Text to be encrypted: MATEMATİK HAYATTIR ("math is life" in English)

Let the prime numbers chosen be 2 and 3. The rule of the pattern is "2.term order +3". The first three terms of the pattern are created as a numberical or figural pattern (Figure 1). Then, the first 29 steps are determined according to the rule. These terms are as follows:

5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61.

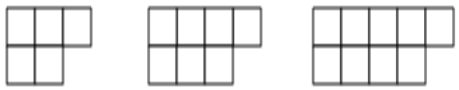


Figure 1. Presentation of the First Three Terms of the Pattern with Figural Representation

The value (mod 29) is determined for terms greater than 29. Accordingly, the new terms are as follows:
5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 1, 3.

The terms of the pattern are assigned to the letters of the alphabet sequentially (Table 1). Then, according to Caeser's Cipher, each letter in the alphabet is encrypted with three next letters and key letters are found. Thus, the numbers corresponding to the key letters are determined. Thus, the final number corresponding to each letter is reached (Table 2).

Table 1. The terms of the pattern corresponding to the letters of the alphabet

Letter	A	B	C	Ç	D	E	F	G	Ğ	H	I	İ	J	K	L	M	N	O	Ö	P	R	S	Ş	T	U	Ü	V	Y	Z
Term	5	7	9	11	13	15	17	19	21	23	25	27	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	1	3

Table 2. Numbers corresponding to the letters in the alphabet according to Caeser's Cipher

Letter	A	B	C	Ç	D	E	F	G	Ğ	H	I	İ	J	K	L	M	N	O	Ö	P	R	S	Ş	T	U	Ü	V	Y	Z
Key	Ç	D	E	F	G	Ğ	H	I	İ	J	K	L	M	N	O	Ö	P	R	S	Ş	T	U	Ü	V	Y	Z	A	B	C
Term	1	1	1	1	1	2	2	2	2	0	2	4	6	8	1	1	1	1	1	2	2	2	2	2	1	3	5	7	9

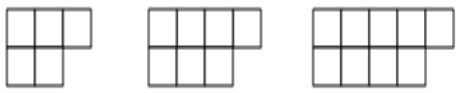
The letters of the plaintext are sent to the receiver along with the numbers of the key letters and the first three terms of the linear pattern (Figure 1 and Table 3). The transmission of the ciphertext is as follows: 12.11.28.21.12.11.28.4.8.0.11.7.11.28.28.2.22.

Table 3. Numbers corresponding to the Letters of the Ciphertext

M	A	T	E	M	A	T	İ	K	H	A	Y	A	T	T	I	R
12	11	28	21	12	11	28	4	8	0	11	7	11	28	28	2	22

Decryption of the message

The figural representation of the first three terms of the linear pattern and the cipher that came to the receiver are as follows:



12.11.28.21.12.11.28.4.8.0.11.7.11.28.28.2.22

The receiver first creates the rule of the pattern using the figural pattern: "2. Term order +3". Since the difference between the terms in the pattern is 2 and the letters are shifted 3 steps according to Caeser's Cipher, 6 is added to the terms of the pattern. Then, the letters in the alphabet are written in order for each term of the pattern. Thus, the message corresponding to the numbers is determined (Table 4). 12.11.28.21.12.11.28.4.8.0.11.7.11.28.28.2.22=MATEMATİK HAYATTIR.

Table 4. Letters of the Alphabet corresponding to the Terms of the Pattern

Terms	5	7	9	11	13	15	17	19	21	23	25	27	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	1	3
Arranged terms	11	13	15	17	19	21	23	25	27	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	1	3	5	7	9
Letter	A	B	C	Ç	D	E	F	G	Ğ	H	I	İ	J	K	L	M	N	O	Ö	P	R	S	Ş	T	U	Ü	V	Y	Z

Conclusion

In the task of "Encryption arising from patterns", the general term of the linear pattern was created by starting from two prime numbers. The numbers corresponding to the first 29 terms of this linear pattern have been calculated. The letters of the alphabet and the terms of the pattern were paired in order. Then, Caeser's Cipher was applied to the letters in the alphabet. That is, according to Caeser's Cipher, each letter in the alphabet was encrypted with three next letters. Thus, the numbers corresponding to the key letters were assigned to the letters in plaintext. The letters of plaintext were sent to the receiver along with the numbers corresponding to the key letters and the first three steps of the linear pattern, and the encryption task was completed.

When decrypting, first of all, the general rule of the pattern was found by using the first three terms of the linear pattern. The amount of increase between terms and the amount of shift in Caeser's Cipher (3 letter shift) were multiplied and added to the terms of the pattern. The letters of the alphabet were assigned to the terms of the most recently reached pattern and deciphered. When reaching the terms in pattern during encryption and decryption processes, (mod 29) was taken into account.

Limitations and Implications

OECD (2021) emphasizes the need to develop mathematical creativity and flexibility of students at different class and ability levels. Encryption algorithms can be used to develop the creativity of mathematically gifted students, which is one of their distinctive characteristics (Leikin & Sriraman, 2022). Based on the "Encryption arising from patterns" task designed in this study, mathematically gifted students could be asked to develop different encryption algorithms.

The task of "Encryption arising from patterns" was designed using linear patterns. In future studies, encryption tasks could be designed for students who are studying at more advanced levels by considering quadratic patterns. In addition, designing encryption algorithms with patterns of different structures may be one of the factors that will increase the difficulty levels of the tasks. Thus, the challenging tasks that mathematically gifted students need can be diversified.

The limitation of prime numbers to 2, 3, 5, 7, 11, 13, 17, 19 in the process of creating linear patterns is to ensure that students focus on the pattern and Caeser's Cipher rather than operational fluency. The set of prime numbers could be expanded. In the task of "Encryption arising from patterns", the letters were shifted according to Caeser's Cipher. Different substitution ciphers can be used to design encryption tasks from patterns. Applying the pattern task presented in this study in classroom environments and presenting its impact on instructional and educational outcomes will contribute to the field of mathematics education.

Biodata of Author

Fatma Erdogan is an associate professor with the Mathematics Education program at the Firat University. She holds a Ph.D. in mathematics education from Marmara University, a M.A. in mathematics education from Eskisehir Osmangazi University, and a B.S. in elementary mathematics education from Anadolu University. She conducts researches on mathematics education, gifted education, teacher training, high order thinking skills, problem solving-posing, collaborative learning.

Affiliation: Fırat University, Faculty of Education, Department of Mathematics and Science Education, Elazig, Türkiye. **E-mail:** f.erdogan@firat.edu.tr **ORCID:** 0000-0002-4498-8634

Neslihan Gul is a mathematics teacher at the Elazig Science and Art Center. She holds a M.A. in mathematics education from Firat University, and a B.S. in mathematics from Firat University. She is interested in mathematical giftedness, mathematics education, and gifted education.
Affiliation: Elazig Science and Art Center, Elazig, Türkiye.
E-mail: gulneslihan85@gmail.com **ORCID:** 0000-0003-2137-0206

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Research Article

Critical reading self-efficacy of gifted students[1]

Eren Agin[2], Elif Oznur Tokgoz[3]* and Ozlem Ortak Kilinc[4]

MoNE Şehit Abdullah Buyuksoy Science and Arts Center, Ankara, Turkiye

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Abstract

The present study aimed to determine the critical reading self-efficacy levels of gifted students and to discuss certain variables that affect self-efficacy levels. The study was conducted with 299 (Female: 138, Male: 161) students attending four Science and Arts Centers (SACs) in Ankara during the 2022-2023 academic year. The participant were 5th and 6th grade students in the Recognition of Individual Talent (RIT) program. Participant Data Form and Critical Reading Self-Efficacy Scale were used to collect the omit data. The study was designed with the quantitative relational research method and the analyses were conducted on the SPSS software. The study findings were analyzed with descriptive statistics, independent samples t-test, and ANOVA. Analysis findings revealed that the critical reading self-efficacy levels of the gifted students were high. Ownership of a private library significantly affected the critical reading self-efficacy levels of the gifted students. In other words, the critical reading self-efficacy level of the students who had a library was higher than those who did not. Furthermore, students who read books every day had higher critical reading self-efficacy skills when compared to the students who did not read books every day. Other study findings demonstrated that gender, education level of the parents and household income did not have a significant effect on the critical reading self-efficacy level. In the study, it was also determined that gifted students mostly read science fiction and scientific books.

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Introduction

Current advances in digital technologies led to the popularization of new media tools and increased the significance of data in the changes observed in modern life. Undoubtedly, individuals, societies and states that could keep up with these changes and technological advances acquired advantages in global competition. Education plays a critical role in the ability of modern society to cope with technological innovations and developments. Thus, the aim of education is no longer to get a diploma that allows the acquisition of only technical knowledge, but it aims to train individuals who can adapt to current requirements, have a high foresight and a critical approach. The aim of education is to train individuals with critical knowledge that would allow them to distinguish between true and false information and create concepts and philosophies about rapid information updates. Thus, curricula, a dominant component in education, should be

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[2] Dr. Turkish language teacher, MoNE Şehit Hüseyin Gültekin Science and Arts Center, Ankara, Turkiye. e-mail: erenagin@gmail.com ORCID: 0000-0001-8497-2197

[3] Author of correspondence: Dr. Science teacher, MoNE Şehit Abdullah Büyüksoy Science and Arts Center, Ankara, Turkiye. e-mail: elifoznurtokgoz@gmail.com ORCID: 0000-0001-8028-9251

[4] Science teacher, MoNE Şehit Hüseyin Gültekin Science and Arts Center, Ankara, Turkiye. e-mail: ozlm.kilinc@gmail.com ORCID: 0000-0002-4852-4036

revised based on current requirements and developments. Curricula would also contribute to the training of individuals with 21st century skills. Certain 21st century skills such as critical thinking, media literacy and digital literacy emphasize reading, comprehension and interpretation skills (Voogt & Roblin, 2010). Critical thinking skills play a key role in contemporary educational approaches, and acquisition of these skills have been considered among important educational goals. According to Larsson (2017), one of the most important goals of education is the development of critical thinking skills among the students.

Critical thinking that plays a key role in education could be described as the collective skills of active data collection, use, analysis, and application of that data (Din, 2020). Thus, critical thinking allows the individuals to question their premises, beliefs and approaches. To acquire critical thinking skills, individuals should also have critical writing, critical listening and critical reading skills. The concept of critical reading includes two interrelated concepts that are not independent from critical thinking (Sahin, Diliduzgun, & Tascilar, 2020). The correlation between these two concepts would be associated when individuals acquire critical reading skills at a young age and make this a habit and transfer it to other stages of life, with improved critical thinking skills (Kurnaz & Nas, 2022).

The acquisition of critical reading skills requires re-interpretation of the newly acquired information by filtering it through self-knowledge, experiences, reason, and logic (Ozdemir, 2009). Critical reading includes paying attention, doubting, asking questions and metacognitive thinking, where the individual concentrates on a text, harbors strong and systematic doubts, but could be convinced by adequate evidence. Furthermore, critical reading could lead questions at every stage of the process (Ciftci, 2006). Metacognition, which plays a key role in critical reading, allows individuals to organize reading strategies and construct learning, examine the reading text in depth, with care, and in detail (Karaday, 2013) to make an inference. Critical reading is different from the basic reading skills since it requires inference, interpretation and analysis (Karadeniz & Gursoy, 2014). In critical reading that covers all these skills, the course syllabi focus on student queries and analysis with a critical approach after the comprehension of the material (MEB, 2019). Thus, critical reading is required for the individuals to fully comprehend the text and achieve permanent learning. Previous studies reported that high-level thinking and reading comprehension skills and academic achievement of the students improved with critical reading skills (Sahin, 2019b; Unal, 2006). In critical reading, the student is expected to analyze and question the text in depth and develop various approaches. In critical reading, the individual could distinguish different aspects of the text, the ideas advocated by the author, the author's perspective, the difference between the facts and opinions, understand the difference between emotions and ideas, and investigate events in detail (Aydin, Erol, & Kaya, 2020).

Critical reading self-efficacy is among the significant factors that improve critical reading skills (Ozdemir, 2017). Critical reading self-efficacy was described as the individual judgment about whether the individual had the skills required to complete a task (Bandura, 1986). Critical reading self-efficacy is the belief of the students in their critical approach when reading (Schunk & Pajares, 2009), an affective factor that triggers critical reading to achieve a goal (Sahin, 2019a), and the belief in the ability to employ the skills required for critical reading (Kurnaz & Nas, 2009). 2022). All these descriptions demonstrated that critical reading self-efficacy was required for active, permanent and effective learning.

The present study aimed to investigate the effects of certain variables on critical reading self-efficacy levels of junior high school students attending the Science and Arts Centers program in four central districts in Ankara province. The research questions were determined as follows:

- What are the critical reading self-efficacy levels of SACs' students?
- Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on the grade?
- Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on gender?
- Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on household income?

- Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on parental education level?
- Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on library ownership?
- Is there a significant correlation between the daily reading duration and critical reading self-efficacy skills of SACs' students?
- What kind of books SACs' students prefer to read?

Literature review revealed only a few studies on critical reading self-efficacy and science and arts centers. Studies were mostly conducted with primary school students attending formal education institutions. (Duran, 2013; Karabay, 2013; Ozmutlu et al., 2014; Ozdemir, 2017; Sahin, Diliduzgun and Tascilar, 2020; Kurnaz and Nas, 2022; Dogan, Gunes and Demir, 2022). It could be suggested that the present study on the gifted students and their critical reading skills would contribute to the literature. Since critical reading self-efficacy plays a key role in educational activities due to its correlation with active and critical thinking, digital literacy and media literacy 21st century skills.

Method

The Research Model

The present research is a relational study that aimed to determine the critical reading self-efficacy levels of students attending the Science and Arts Centers and certain variables that affect these levels. The relational research method is employed to determine the status of the variables and the correlations between these variables (Karasar, 2011). In the present study, the critical reading self-efficacy level variable and other variables that affected this variable (grade, gender, parental education level, household income, library ownership, and daily reading), and the types of books that students read were discussed.

The study was approved by the Middle East Technical University, Human Research Ethics Committee (IAEK) (protocol number: 0153-ODTUIAEK-2023; date: 28.02.2023). The field study permission was obtained from Ankara Provincial Directorate of National Education (no: E-14588481-605.99-69294815; date: 26.01.2023).

Study Group

The study sample included 5th and 6th grade junior high students attending the RIT1 and RIT2 programs in four Science and Arts Centers in the central districts of Ankara province during the 2022-2023 academic year. Participant demographics is presented in Table 1.

Table 1. Participant demographics

SACs	Gender		Grade		N
	Female	Male	5th	6th	
A	58	56	42	72	114
B	28	46	43	31	74
C	38	31	28	41	69
D	14	28	24	18	42
Total	138	161	137	162	299

In Table 1, four Science and Arts Centers located at central Ankara districts, where the study was conducted are coded with letters (A, B, C and D). Participating students attended 5th and 6th grades. These students attended Recognizing Individual Talents program at the Science and Arts Centers, and 5th graders were coded as RIT 1 and 6th graders were coded as RIT 2. In the study, maximum variation, a non-random sampling method, was selected to assign the participants. Maximum diversity was employed to improve diversity (Buyukozturk et al., 2008). Thus, the authors aimed to include a diverse sample based on gender, parental education level, household income, and number of students in each program.

Data Collection Instrument

The study data were collected with the Participant Data Form and Critical Reading Self-Efficacy Scale. The Participant Data Form included questions about the Science and Arts Center that the student attended, the program type (RIT 1 and RIT 2), student grade, parental education level, average monthly household income, and daily reading. The Critical Reading Self-Efficacy Scale was developed by Kurnaz and Nas (2022), and the study was conducted with 722 junior high school students. In the study, a 5-point Likert-type scale that included 4 sub-dimensions (analysis, inquiry, difficulty and research) and 19 items was developed. All items in analysis (7 items), inquiry (5 items) and research (3 items) scale sub-dimensions included positive and all items in the difficulty (4 items) sub-dimension included negative statements. A high scale score reflected high critical reading self-efficacy level. The reliability coefficients of the scale sub-dimensions were .80 for the analysis, .77 for the inquiry, .79 for the difficulty, and .73 for research, and .87 for the whole scale. The permission to use the scale was obtained from the authors via e-mail.

Data Analysis

The analyses were conducted on SPSS software in the present relational study. Descriptive statistical analysis was employed to determine critical reading self-efficacy levels of the students, independent samples t-test was used to determine the effects of the gender and grade variables on the critical reading self-efficacy level because if the number of groups being compared is two, t-test is used. One-way ANOVA was conducted to determine the effects of the other variables on critical reading self-efficacy level because if the number of groups is more than two, one-way ANOVA is used.

Findings

In the study, initially, the first research problem, namely "What are the critical reading self-efficacy levels of SACs' students?" was addressed. To determine this problem, the arithmetic mean of the student scores in Critical Reading Self-Efficacy Scale sub-dimensions and the overall scale was analyzed. The findings are presented in Table 2.

Table 2. Descriptive statistics of sub-dimension and total scale scores

Factor	N	Minimum	Maximum	$\bar{x}$
Analysis Sub-Dimension	299	7	35	28.27
Inquiry Sub-Dimension	299	5	25	18.62
Research Sub-Dimension	299	3	15	8.95
Difficulty Sub-Dimension	299	4	20	16.09
Total scale score	299	19	95	71.94

Table 2 includes the minimum and maximum sub-dimension and total Critical Reading Self-Efficacy Scale scores, and the mean student scores in each sub-dimension and the overall scale. As seen in Table 2, the mean student score in the analysis sub-dimension was 28.27. The mean score in this sub-dimension that included 7 items (28.27/7=4.04) was high (An item is scored between 1 and 5 on a 5-point Likert scale. As the mean score of each item approaches 5, it indicates a high value, and as it approaches 1, it indicates a low value). This reflected that the students had acquired the desired critical reading self-efficacy level in the analysis sub-dimension. The arithmetic mean student score in the inquiry sub-dimension that included 5 items was 18.62 (18.62/5=3.72) and high, demonstrating that the students' critical reading self-efficacy levels were at the desired level in the inquiry sub-dimension. The arithmetic mean student score in the research sub-dimension that included 3 items was 8.95. This sub-dimension score (8.95/3=2.98) was average, demonstrating that the students' critical reading self-efficacy levels in the research sub-dimension were lower when compared to other sub-dimensions. The arithmetic mean score in the difficulty sub-dimension that included 4 items was 16.09. The sub-dimension score (16.09/4=4.02) was high, demonstrating that the students' critical reading self-efficacy levels were at the desired level in the difficulty sub-dimension. Finally, the mean overall scale score was 71.94 (71.94/19=3.79) and high, demonstrating that SACs students exhibited high critical reading self-efficacy skills.

In the study, independent samples t-test was conducted to determine the response to "Is there a significant difference between the critical reading self-efficacy levels of SAC' students based on grade" research question. The findings are presented in Table 3.

Table 3. Critical reading self-efficacy level based on grade

Grade	N	x̄	S	sd	t	p
5th	137	72.12	11.78	297	0.26	.80
6th	162	71.78	10.47			

As seen in Table 3, there were no significant differences between the critical reading self-efficacy levels of the students based on grade (p=.80 > .05). It could be suggested that there was no significant difference between the critical reading levels of BYF 1 students attending the 5th grade and the BYF 2 students attending the 6th grade.

To test the research problem that "Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on gender," independent samples t-test was conducted. The findings are presented in Table 4.

Table 4. Critical reading self-efficacy level based on gender

Gender	N	x̄	S	sd	t	p
Female	138	73.11	10.55	297	1.71	.90
Male	161	70.93	11.44			

As seen in Table 4, the mean score of the female students (x̄=73.11) was higher than the mean score of the male students (x̄=70.93); however, the difference was not statistically significant (p=.90 > .05). In other words, the gender variable was not effective in the critical reading self-efficacy skills of BİLSEM students.

The next research question was "Is there a significant difference between the critical reading self-efficacy levels of BILSEM students based on household income?" To test this problem, one-way analysis of variance (One-Way ANOVA) was conducted. The findings are presented in Tables 5 and 6.

Table 5. Household income descriptive statistics

Household income (TL-monthly)	N	x̄	SS
15.000 or lower	90	72.38	1.06
15.000-40.000	171	71.06	0.85
40.000 or higher	38	74.84	2.05

According to the table, the income level of most of the students is medium. The number of students with high income is at the lowest level.

Table 6. Critical reading self-efficacy level based on household income

Source of the variance	Sum of Squares	sd	Mean Squares	F	p
Inter-group	470.169	2	235.085	1.930	.147
Intra-group	36055.623	296	121.810		
Total	36525.793	298			

Analysis results demonstrated that there was no significant difference between the critical reading self-efficacy levels of the students based on household income (F(2, 296)=1.930; p=0.147 > 0.05). In other words, the critical reading self-efficacy level of the students was not affected by household income.

To respond to the next research question, "Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on parental education level," both the mother's and father's education levels were determined. To test this problem, one-way analysis of variance (One-Way ANOVA) was conducted. The findings are presented in Tables 7, 8, 9 and 10.

Table 7. Descriptive statistic for maternal education level

Maternal Education Level	N	$\bar{x}$	ss
Primary School	9	72.00	9.46
Junior High School	10	71.50	11.56
High School	59	71.17	11.39
Undergraduate	151	72.13	11.69
Graduate	50	72.88	10.22
PhD	20	70.55	8.42

Table 8. Critical reading self-efficacy based on maternal education level

Source of the variance	Sum of Squares	sd	Mean Squares	F	p
Inter-group	125.407	5	25.081	0.202	.692
Intra-group	36400.386	293	124.233		
Total	36525.793	298			

Analysis results demonstrated that there was no significant difference between the critical reading self-efficacy levels of the students based on maternal education level ($F(5,293)=0.202$; $p=0.692 > 0.05$). In other words, the critical reading self-efficacy level of the students was not affected by the maternal education level.

Table 9. Descriptive statistic for paternal education level

Maternal Education Level	N	$\bar{x}$	ss
Primary School	10	70.20	13.88
Junior High School	12	74.25	9.53
High School	37	74.92	7.98
Undergraduate	166	70.71	11.83
Graduate	57	71.46	9.75
PhD	17	74.18	9.81

Table 10. Critical reading self-efficacy based on paternal education level

Source of the variance	Sum of Squares	sd	Mean Squares	F	p
Inter-group	1236.454	5	307.291	2.573	.432
Intra-group	34989.338	293	119.418		
Total	36525.793	298			

Analysis results demonstrated that there was no significant difference between the critical reading self-efficacy levels of the students based on paternal education level ($F_{(5,293)}=2.573$; $p=0.432 > 0.05$). In other words, the critical reading self-efficacy level of the students was not affected by the paternal education level.

The next research question was "Is there a significant difference between the critical reading self-efficacy levels of SACs' students based on library ownership?" This problem was tested with the independent samples t-test. The findings are presented in Table 11.

Table 11. Critical reading self-efficacy based on library ownership

Library Ownership	N	$\bar{x}$	S	sd	t
Yes	265	72.59	10.83	297	2.90
No	34	66.82	11.73		

As seen in Table 11, there was a significant difference between the critical reading self-efficacy levels of the students based on library ownership ($t_{(297)}=2.90$; $p=.00<.05$). The mean scores of library owners ($\bar{x}=72.59$) was higher than the mean score of those who did not ($\bar{x}=66.82$). This finding demonstrated that students who owned a library had higher critical reading self-efficacy when compared to those who did not.

Another research question was the following: "Is there a significant correlation between the daily reading time and critical reading self-efficacy skills of SACs students?" To test this problem, one-way analysis of variance (One-Way ANOVA) was conducted. The findings are presented in Tables 12 and 13.

Table 12. Descriptive statistics for daily reading time

Daily Reading	**N**	**x̄**	**SS**
I do not read daily (I)	10	60.10	8.75
10-30 min (II)	123	70.52	10.94
30 min-1 hour (III)	130	73.38	9.98
1 hour or more (IV)	36	74.86	13.27

Table 13. Critical reading self-efficacy level based on daily reading

Source of the variance	Sum of Squares	sd	Mean Squares	F	p
Inter-group	2225.357	3	741.786	6.380	.000
Intra-group	34300.436	295	116.273		I between
Total	36525.793	298			II-III-IV

As seen in Table 13, there was a significant difference between the critical reading self-efficacy level of the students based on daily reading time (F(3,295)=6.380; p=000<.05). The difference was between the students who did not read daily and students who read for 10-30 minutes, 30 minutes-1 hour, and 1 hour or more daily. The mean scores of the students who read for 10-30 minutes daily (x̄=70.52), who read for 30 minutes-1 hour (x̄=73.38), and who read for 1 hour or more (x̄=74.86) were higher when compared to the students who did not read daily (x̄ =60.10), and the differences were statistically significant. In other words, the critical reading self-efficacy levels of students who read for a certain period every day were higher than students who did not read daily.

The types of books read by SACs' students are presented in Table 14.

Table 14. The types of books read by SACs' students

Book Type	**f**	**%**
I do not read	2	0.66
Literature	32	10.70
History	37	12.37
Science	69	23.07
Arts	25	8.36
Science-fiction	171	57.19
Others	112	37.46

As seen in the table, SACs' students mostly read science fiction books (57.19%), followed by science (23.07%), history (12.37%), literature (10.70%), and art books (8.36%).

Conclusion and Discussion

The present study aimed to determine the omit critical reading self-efficacy levels of SACs' students and the effects of certain variables on critical reading self-efficacy level. The maximum score possible in the critical reading self-efficacy scale was 95. The mean critical reading self-efficacy score was x̄=71.94. In the present study, it could be suggested that the critical reading self-efficacy levels of gifted students was high. In the limited number of studies on critical reading skills of the students, only two included gifted students. These two studies were conducted by Ogurlu (2014) and Kilic (2019). The critical reading skills of gifted students were investigated, and it was reported that the critical reading skills of gifted students were high (Ogurlu, 2014). In the studies conducted on students with typical development, Guven and Aktas (2014) reported that the critical reading skills of 5th grade students were high, while most studies conducted on students with typical development reported that the critical reading skills of the students were moderate (Ozdemir, 2017; Unal, 2006; Demir and Kan, 2017; Akar, Basaran and Kara, 2016). Based on the findings reported in the present study and the study conducted by Ogurlu (2014) and Kilic (2019), it could be suggested that the critical reading skills of gifted students were higher when compared to the students with typical development. Certain studies reported that reading attitudes were higher among gifted students when compared to the students with typical development (Ley & Trentham, 1987; Anderson, Tollefson & Gilbert, 1985). This could be explained by certain factors such as the

development of the reading habit at an early age among gifted students, their curiosity towards learning, and their desire for research. These factors could lead them to exhibit positive attitudes towards reading, improving their reading skills.

In the study, no significant difference was determined between the critical reading self-efficacy levels of the students based on grade (RIT1 and RIT2). No previous study was conducted to determine the variations between the critical reading skills of gifted students based on grade. In a study conducted by Ozmutlu et al. (2014) on students with typical development, it was reported that there was no significant difference between critical reading skills based on grade. However, other studies reported contradicting findings. A study conducted by Yalınkilic and Celik (2011) on the critical reading skills of 6th, 7th and 8th grade students reported that the critical reading skills of 6th and 7th grade students were higher when compared to 8th grade students. The sample included 5th and 6th graders in the present study. These students attend 6 hours of Turkish language course at the school. Since the weekly course hours were similar, the students could have developed similar critical reading self-efficacy skills.

In the present study, the effect of the gender variable on critical reading self-efficacy skills was also investigated. The data revealed that gender did not affect the critical reading self-efficacy level. No similar study was conducted with gifted students. However, previous studies were conducted on students with typical development. The studies conducted by Yayli and Ulper (2011), Gunduz (2015), Emiroglu (2014), Altunsoz (2016) and Ozdemir (2017) reported that the gender variable did not affect the critical reading skills. However, other studies in the literature reported higher critical reading skills for female students (Guven & Aktaş, 2014; Yalinkilic & Celik, 2011; Ozmutlu et al., 2014).

In this study, the impact of household income and parental education level on critical reading self-efficacy level was also investigated. The study findings demonstrated that these did not affect the critical reading self-efficacy of the students. This finding was consistent with previous reports on students with typical development (Sadioglu & Bilgin, 2008; Gunduz, 2015; Kilic, 2019). However, certain studies reported that critical reading skills increased with the increase in household income (Guven & Aktas, 2014; Inan, 2005).

In the study, the effect of library ownership on critical reading self-efficacy level was also addressed. The findings demonstrated that students who owned a library scored higher in the critical reading self-efficacy scale. Library ownership would ensure the number of books that the student could read regularly and positively affect the critical reading self-efficacy skills. Gifted students should have access to a variety of reading material during education to develop their potential (Kilic, 2019).

It was also observed in the present study that students who read a book every day for a certain period of time had higher critical reading self-efficacy skills when compared to the students who sis not read daily. Thus, there was a correlation between the habit of reading and critical reading self-efficacy. Critical reading skills reflect the highest level of literacy (Ozdemir, 2009). An individual should make reading a habit to improve critical reading skills. Because, in a study conducted by Ogurlu (2014), it was reported that reading improved critical reading skills of gifted students. Similar results were reported in studies conducted on students with typical development (Ozdemir, 2017; Guven & Aktas, 2014; Ozmutlu et al., 2014; Orhan, 2007).

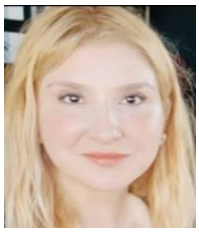
Finally, the types of books that gifted students read was investigated in the study. It was observed that students preferred science fiction and scientific books the most. In a study conducted by Ogurlu (2014), it was reported that gifted students read predominantly science fiction and fantasy books. Previous studies reported that reading science fiction and fantasy books was popular among gifted students (Swanton, 1984; Halsted, 1988; Larsen, 1999). The self-perception, perceptions about the environment and the world of the student are directly associated with critical reading skills. Thus, critical reading should not be reduced to a class activity or reading time. Critical literacy is about world perception and interaction with the world, and it describes the desires and dexterity that an individual acquires in the analysis of the society and the world as an ordinary part of one's life (Ateş, 2013). Currently, critical reading skills and acquisition of these skills are extremely important for the students. Based on the present study findings, the following could be recommended:

- Critical reading workshops should be organized for gifted students in Science and Arts Centers. These courses should provide complex, difficult and visual texts for the students when compared to their peers.

- The value and urgency of critical reading in science should be recognized and the studies in the field should not be limited to social sciences (Literature, Philosophy, History, etc.). The proliferation of interdisciplinary texts and discussions for gifted students would contribute to the cognitive and intellectual development of these students.

Biodata of Authors

Eren Agın received his M.S. degree from Lifelong Education Program at Ankara University in 2008. His M.S. thesis was about the relationship between alternative media and adult education in Turkey. After receiving his M.S. degree, he continued with his Ph.D. studies at Economic of Education and Planning in Institute of Education Sciences, Ankara University. His Ph.D. thesis was about the critical analysis of disciplinary practices at one of the secondary schools in Ankara. Along with his academic works, his research interests focus on sociology of education, philosophy of education, educational policies and qualitative research methods. Affiliation: Şehit Hüseyin Gültekin SAC E-mail: erenagin@gmail.com ORCID: 0000-0001-8497-2197



Elif Oznur Tokgoz graduated from Gazi University, Department of Science Teaching in 2006. She worked as a science teacher in different regions of Turkey for 17 years. Now, she has working for 4 years in schools called SAC where gifted students is educated. In 2017, she completed her master's degree with thesis in Gazi University Science Education. In 2022, she obtained her PhD in Science Education in Gazi University. She has articles educational sciences in national and international journals. Affiliation: Sincan SAC, Ankara, Turkiye. E-mail: elifoznurtokgoz@gmail.com ORCID: 0000-0001-8028-9251

Ozlem Ortak Kilinc graduated from Middle East Technical University, Faculty of Education, Elementary Science Education Department. She has been working as science teacher for 18 years. She still works in Science and Art Center where gifted students are educated. She has attended many competitions with students as Ankara Chamber of Commerce International Climate Change Summit Animation Category, European Space Agency Moon Camp Challenge Competition, First Lego League ' The journey of Hydrodynamic Water, Design for Change Project Ankara Social Science University. She attended international training programs as Inquiry Based Science Education Amgen Teach Foundation in Brussels, Making science more attractive course in U.K, Project Management Training Course in Italy/Bologna. Affiliation: Şehit Hüseyin Gültekin SAC E-mail: ozlm.kilinc@gmail.com ORCID: 0000-0002-4852-4036

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Research Article

Identification of the academic differences of gifted children from the perspective of parents: needs assessment for differentiation

Serkan Demir[1]

MoNE Beşiktaş Science and Art Center, Istanbul, Turkiye

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Abstract

The identification of the developmental characteristics of gifted students, determination of their educational needs, and preparation of educational programs based on the acquired findings are essential. This study aims to ascertain to what extent parents of gifted children define their children's developmental characteristics, identify the challenges they face, and assess their thoughts regarding their educational needs. A qualitative research method was employed in the study, utilizing a phenomenological design. The study group consisted of 252 parents newly enrolled in a Science and Art Center (BİLSEM) where gifted students take supportive education located in Istanbul, Turkiye. Data for the study were obtained through interviews, using a semi-structured form developed by the researcher in accordance with the research design. According to the findings, participating parents indicated that their gifted children learn faster and think more quickly compared to their peers. They also noted that gifted children excel in self-expression, demonstrate creative thinking, and achieve high academic success in mathematics and science courses. Furthermore, parents expressed the need for their gifted children to receive education in technology, science, and mathematics fields, as well as in foreign languages, arts, and robotics-coding.

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Introduction

Gifted children are at risk of going unnoticed from an early age, being raised with misguided attitudes, or following inappropriate educational programs. Another risk factor they experience is their awareness of the unique traits that set them apart from their peers, leading them to conceal their abilities in an effort to be accepted by their peers. Considering the developmental characteristics of gifted children, their emotional development can be adversely affected when they lack the necessary stimuli and appropriate responses. This can give rise to unexpected failures and instances of depression (Watters & Diezmann 2003).

Gifted children can contribute to society to the extent that their developmental needs are fully met, and they can harness their potentials. In this context, in the year 2000, the National Association for Gifted Children (NACG) established criteria for guidance and counseling programs to support the socio-emotional development of gifted children. These programs aim to provide differentiated curricula and guidance strategies to support areas where students are at risk. In 1993, a report presented to the U.S. Department of Education by Richard Riley stated that the country's most valuable resource is gifted children, and addressing their needs is a national issue (Afat, 2013).

[1] Dr., Classroom teacher for gifted, Besiktaş Science And Art Center, Istanbul, Turkiyr. E-mail: serkandemir4@gmail.com ORCID: 0000-0002-2331-98612197

In Turkey, however, comprehensive studies for determining the educational needs of gifted students are lacking. Determining these needs from the perspective of families, rather than teachers, is an effective method for identifying educational needs in a more objective and rational manner. In the study conducted by Yılmaz (2018) in Turkey, it was found that there were no studies specifically focusing on the education of gifted children in early childhood and the effectiveness and efficiency of such education. Only a limited number of studies were found that dealt with the identification of gifted children and the development of appropriate assessment tools. This situation is attributed to the fact that in our country, the identification of gifted individuals starts from primary school, and there is no specific program for early childhood education. Determining these needs from the axis of families instead of teachers is a very effective method in determining educational needs more objectively and rationally.

One of the long-standing issues in Turkey is the identification of the educational needs of gifted children and the implementation of an educational plan tailored to their needs. To achieve this, it is essential for parents, teachers, schools, and other stakeholders to accurately define the characteristics of gifted children from early childhood and be aware of the necessity for early intervention. Güler (2012) states that the most significant benefit of knowing the developmental characteristics of children is the ability to determine which attitude to adopt in response to their behavior, leading to more positive outcomes. Additionally, it is argued that when parents are unaware of the developmental characteristics of their children, they struggle to provide the necessary support and are uncertain about what actions to take. In studies conducted on families of gifted children by Watters & Diezmann (2003), it has been determined that parents who prioritize learning-oriented approaches, problem-solving, and advanced cognitive skills over mere performance and accumulation of knowledge exert significant influences on their children.

Analyzing the relevant literature, it is evident that parents play a crucial role in the emergence and development of the innate potentials of children diagnosed with giftedness (Bloom, 1985; Csikszentmihalyi et al., 1993; Olszewski-Kubilius, 2000; Smutny, 1998; Sowa & May, 1997; Subotnik et al., 2003). However, on the other hand, research indicates that parents of gifted children require support concerning their children's developmental characteristics and their education (Dangel & Walker, 1991; Morawska & Sanders, 2009; Silverman, 1993). Moreover, parents have expressed that they feel inadequately prepared to cope with the problems and challenges related to raising gifted children (Strom et al., 1994). Karakuş (2010) conducted a study revealing that parents of gifted children in our country encounter difficulties regarding their children's questions, personality traits, communication skills, formal education, and study habits. Additionally, Ruf (2005) found through interviews with parents of gifted children that they struggle to find reliable information to support their children's development. Davaslıgil (1990) argues that raising awareness among parents of gifted children is of utmost importance.

It is observed that it is extremely challenging for families without access to special education to create an enriched environment for their identified children amidst their daily struggles (Akarsu, 2004). Parents and teachers must make a collaborative effort with other stakeholders to create an educational environment that caters to the needs of gifted children and ensure that their children benefit from such environments.

Research Objective

For a long time, one of the educational issues in Turkey has been the identification of the educational needs of gifted/exceptionally talented children and the implementation of an educational plan tailored to these children's needs. To achieve this, it is crucial for parents, teachers, and other stakeholders to accurately define the characteristics of gifted students. After the proper identification of the characteristics of gifted children, the necessary efforts need to be made.

Many researchers acknowledge the significant role of families in fostering the development of special talented children's abilities and potentials. Families are responsible for bringing forth and nurturing the inherent potentials that gifted children possess, facilitating appropriate learning experiences aligned with their developmental levels, and guiding them in accordance with their educational needs. Moreover, it is the families who are often present to address the challenges that these children encounter in their daily lives. Saranlı (2011) pointed out that a considerable portion of families are unfamiliar with the definition of giftedness, and they lack knowledge about whether their children are gifted, let alone what actions to take in such circumstances. Their sole awareness in this matter is that their children are

somehow different from their peers. However, when these children are not supported using proper methods, this distinction can lead to unfavorable outcomes for the children and become a problem for the families. Kurtulmuş (2010) highlighted that families experience a range of emotions upon learning that their children have been identified as gifted. The rationale behind this stems from the notion that having a gifted child is not only an exciting prospect but also a challenging one. Furthermore, during the initial period of their children receiving this identification, families primarily worry about their happiness and social integration. Subsequent phases involve concerns about finding a suitable school, enrolling them early, and researching practices such as acceleration.

Upon reviewing the relevant literature, it is evident that gifted children often face challenges in their socio-emotional development compared to their peers, and these challenges are attributed to the influences of family and environmental factors. To effectively address these challenges, meet their needs, and guide their potentials appropriately, families must be actively involved in the process. Inclusion of families in this process necessitates the identification of their characteristics, emotional experiences, and requirements.

This study aims to determine the extent to which parents of gifted children define their children's developmental characteristics, identify the challenges they face, and assess their thoughts regarding their educational needs. Through this research, the existing situation will be identified, and appropriate actions will be taken. The literature review reveals a scarcity of research specifically focusing on the characteristics of gifted children, with existing studies mostly centered around the expectations and perspectives of families related to Science and Art Centers.

There is a limited amount of research that reveals the viewpoints of parents concerning gifted individuals. Additionally, the inclusion of a significant number of families in this study is deemed important for capturing diverse perspectives on the subject. This study is expected to guide the decisions made and implemented concerning the education of gifted children. In line with these objectives, the research problem and its subproblems are presented below:

Problem of Study

What are the viewpoints of parents of gifted children in Turkiye regarding their children's educational needs?

Subproblems:

- What are the viewpoints of parents of gifted children in Turkiye regarding their children's strengths and talents?
- What are the viewpoints of parents of gifted children in Turkiye regarding the challenges they face during their children's education process?
- What are the viewpoints of parents of gifted children in Turkiye regarding their children's areas of interest?
- What are the viewpoints of parents of gifted children in Turkiye regarding the additional educational support their children receive?
- What are the viewpoints of parents of gifted children in Turkiye regarding the educational needs they believe their children require?

Method

Research Model

In this study, a qualitative research method was employed to reveal and understand parents' personal perceptions, experiences, and perspectives related to the subject matter. Qualitative research utilizes a research design that forms the scientific research approach and ensures the consistency of research steps. In this study, a phenomenological design was used. The phenomenological design focuses on phenomena that are commonly observed but not deeply understood or explored (Yıldırım & Şimşek, 2008).

Study Group

The study group consisted of 252 parents whose children are newly enrolled in a Science and Art Center in Istanbul. The participants' children were students in grades 2, 3, and 4 at the Science and Art Center. The demographic characteristics of the study group are presented in Table 1.

Table 1. Demographic characteristics of the study group

Variables		**f**	**%**
Parent	Mother	148	58.73
	Father	104	41.26
Education Level	Primary School	17	6.74
	Middle School	13	5.15
	High School	76	29.76
	University	119	47.61
	Postgraduate Degree	27	10.71

As shown in Table 1, the study group comprised 148 mothers and 104 fathers. Moreover, 17 parents had completed primary school, 13 had completed middle school, 76 had completed high school, 119 had a university, and 27 had a postgraduate degree.

Data Collection Tools

Data were collected through a semi-structured interview form in line with the qualitative research method. Prior to the research, a review of the relevant literature was conducted to identify suitable questions to include in the semi-structured interview form, aligned with the subproblems of the study. As a result of this process, five items were included in the interview form. To ensure the content validity of the data collection instrument, the questions in the interview forms were reviewed by two experts from the Department of Educational Programs and Instruction at Yıldız Technical University, as well as three teachers working at the Science and Art Center (BILSEM). The semi-structured interview form was revised by the researcher based on the feedback received from the experts. The experts shared similar viewpoints within the scope of the study.

Process

Data were collected through the use of semi-structured interviews, following the principles of the qualitative research method. A semi-structured interview form was developed for data collection. To ensure the validity of the study, one of the methods employed was prolonged engagement. Yıldırım and Şimşek (2008) state that participants initially may be influenced by the researcher during interviews, and to mitigate the negative effects of this situation, the duration of interviews needs to be extended. Prolonging the duration of interviews increases participants' trust in the research and the environment, leading to the collection of more reliable data. Thus, the interviews were conducted with each group for an average of two hours, with the durations extended as much as possible. Additionally, the collected data were summarized and confirmed by the participants to enhance the validity of the research.

Data Analysis

The data collected through the semi-structured interview form, the data collection instrument of the study, were analyzed using content analysis method. The data from the interview forms were coded and thoroughly examined. Each subproblem was presented in themes. Within the scope of the validity and reliability of the research, the data were examined by three different experts, and consensus was reached among the experts regarding the codes and themes (Yıldırım & Şimşek, 1999). To determine the agreement between the researcher and the experts, Miles and Hubermann's (1994) formula for reliability was applied as follows: "Reliability = ((Agreement)/(Agreement + Disagreement)) x 100." The calculated result showed a 94% agreement, indicating a high level of consistency. This value being above 0.90 ensures the reliability of the research (Saban; 2008).

Findings

Theme 1. Findings Related to Strong-Talented Areas

For the first subproblem, the parents in the study group were asked the question "In which subjects do you think your children are talented due to their performances?" The answers given by the parents to this question are presented in Table 2.

Table 2. The characteristics that parents consider their children as talented in subjects

Subjects	f	%
Quick learning compared to peers	79	31.34
Quick thinking compared to peers	63	25.00
Creative thinking	41	16.26
Expressing themselves	38	15.07
Advanced imagination	27	10.71
Be curious	20	7.93
Imagination developed	18	7.14
Success in mathematics	15	595
Interest in science subjects	13	5.15
Leadership	9	3.57
Strong visual memory	8	3.17
Musical talent	5	1.98

As shown in Table 2, 79 of the participating parents believed that their children were talented because they learned quickly compared to their peers, while 63 parents considered their children talented because of their quick thinking. Additionally, 41 parents believed their children were talented due to their success in creative thinking, and 38 parents thought their children were talented because they expressed themselves better than their peers. One parent expressed their thoughts by saying, *"My child thinks much faster than his classmates*," while another parent stated, "*My child's quick and different thinking used to worry me at first, but I learned it was a characteristic of gifted children, so I felt relieved.".* With this, 27 parents considered their children talented in drawing, 20 parents believed their children's curiosity had developed, and 18 parents thought their children had a strong imagination, making them talented. One parent said, "*My child draws beautifully, and when I compare it to his peers, he draws different things, which often surprises us."* Another parent mentioned, "*We've always found it impressive how he daydreams and puts them on paper."*

As shown in Table 2, 15 parents believed their children were talented in mathematics, 13 parents thought their children were interested in science subjects, and 5 parents believed their children had an interest in music, making them talented. Additionally, 9 parents observed their children's desire to be leaders in class, and 8 parents thought their children could be gifted due to their strong visual memory. One parent stated, "*His favorite and most successful subjects at school are science and mathematics, which we associate with him being gifted."* Furthermore, another parent said, "*His visual memory is excellent; he can describe something he saw before very well."* Lastly, one parent shared, "*He loves playing the piano and dreams of attending a conservatory."*

Theme 2. Findings Related to Challenges in the Educational Process

For the second subproblem, the parents in the study group were asked the question "What challenges do your children face during their development process?" The answers given by the parents to this question are presented in Table 3.

Table 3. Challenges experienced by parents in their children's development process

Challenges	f	%
Communication problems with peers	64	25.39
Intense emotionality	47	18.65
Attention problems	38	15.07
Thinking differently from peers	27	10.71
Constant desire to be a leader	25	9.92
No problems	25	9.92
Desire to spend time with older children	17	6.74
Impatience	9	3.57
Lack of motivation	5	1.98
Shyness	3	1.19

As shown in Table 3, 64 of the participating parents reported that their children had communication problems, especially with their peers, while 47 parents mentioned that their children experienced intense emotionality.

Additionally, 38 parents stated that their children had attention problems, 27 parents believed their children thought differently from their peers, and 25 parents mentioned that their children's leadership behavior caused relationship problems. One parent expressed their thoughts by saying, "*At home, my child is constantly complaining that his friends don't understand him, which makes him unhappy, and I think it's because he's gifted.*" Another parent mentioned, "*My child is very emotional; even the smallest incidents affect him intensely, and sometimes I feel sorry for him being upset over things.*"

As shown in Table 3, 25 parents stated that their children did not face any problems during their development process. On the other hand, 17 parents reported that their children wanted to spend more time with older children than with their peers. Of the participating parents, 9 parents observed impatience in their children when they were doing something, and 5 parents believed their children lacked motivation. Additionally, 3 parents mentioned that their children exhibited shy behaviors in public. One parent shared, "*I haven't faced any challenges due to my child's exceptional situation; it always seemed normal to me.*" Another parent said, "*He is very impatient, and this condition exhausts both me and his father.*" Lastly, one parent expressed their thoughts by saying, "*When I compare my son with his sister, I observe that he is more timid, although I would like him to express himself more comfortably, even if not as much as his sister.*"

Theme 3. Findings Related to Areas of Interest

For the third subproblem, the parents in the study group were asked the question "Which subjects do you think your children excel in at school?" The answers given by the parents to this question are presented in Table 4.

Table 4. Subjects in which parents think their children excel at school

Successful Areas	**f**	**%**
Mathematics	74	29.36
Science	61	24.20
Art	43	17.06
English	27	10.71
Computer / Technology	18	7.14
Music	14	5.55
Manual Skills	9	3.57
Sports	7	2.77
Astronomy	5	1.98

As seen in Table 4, 74 of the participating parents believed that their children excelled, especially in mathematics lessons at school, while 61 parents mentioned that their children excelled in science lessons, and 43 parents thought their children excelled in art lessons. Furthermore, 27 parents believed their children excelled in English lessons, and 18 parents believed their children excelled in lessons that involved the use of computers and technology. One parent stated, "*I observe that my child is more successful than his peers in numerical lessons.*" Another parent expressed, "*I consider my child talented in drawing; in fact, I want him to take the art department entrance exam for the science and art center this year.*"

As shown in Table 4, 14 parents believed their children excelled in music lessons, while 9 parents believed their children excelled in lessons that involved manual skills. Additionally, 7 parents thought their children excelled in sports, and 5 parents believed their children excelled in astronomy. One parent shared, "*We have other family members who are interested in music; I think it is a hereditary condition.*" Another parent said, "*He is very interested in astronomy; he answers all the questions we ask him immediately and constantly asks us space-related questions.*"

Theme 4. Findings Related to Supportive Educational Trainings Received

For the fourth subproblem, the parents in the study group were asked the question "What types of training have you provided for your gifted children to develop their special talents?" The answers given by the parents to this question are presented in Table 5.

Table 5. Trainings provided by parents for their gifted children

Trainings	f	%
Mind games training	109	43.25
Chess	52	20.63
Musical instrument	35	13.88
No training received	29	11.50
Art course	17	6.74
Coding	14	5.55
Sports	12	4.76
English	10	3.96
Drama	5	1.98
Mental arithmetic	3	1.19
Dance	2	0.79

As seen in Table 5, 109 of the participating parents provided their gifted children with mind games training to develop their existing talents. Additionally, 52 parents enrolled their children in chess courses, and 35 parents provided their children with musical instrument lessons. One parent expressed, "A mind and intelligence game course opened at school, and we enrolled our child there." Another parent mentioned, "He loves playing chess, and we couldn't provide him enough support, so we registered him for a chess course." With this, 29 parents stated that their children did not receive any training related to their special talents. On the other hand, 17 parents sent their children to art courses, and 14 parents enrolled their children in coding classes. One parent shared, "*I didn't think my child was gifted, or rather, I didn't know, so I didn't send him to any course.*" Another parent said, "*I registered him for coding classes due to the future professions mentioned in the news.*"

As shown in Table 5, 12 parents directed their children to participate in a sports branch, and 10 parents sent their children to English courses. Additionally, 5 parents enrolled their children in drama courses, 3 parents in mental arithmetic courses, and 2 parents in dance courses. One parent expressed, "He loves playing tennis, so I registered him for a course, even though the course is just across the street, he eagerly attends." Another parent mentioned, "We sent him to a mental arithmetic course to improve his performance in mathematics; I don't know if we did the right thing."

Theme 5. Findings Related to Needed Supportive Educational Trainings

To reach the findings related to the fifth subproblem of the study, parents were asked the question "Which trainings do you think your gifted children need to develop their special talents?" The responses of the parents to this question are presented in Table 6.

Table 6. Parental views on the educational needs of gifted children

Trainings	f	%
Trainings they want and will be happy with	67	26.58
Trainings related to science subjects	43	17.06
Mathematics support	36	14.28
Art education	29	11.50
Robotics education	27	10.71
Coding Education	21	8.33
Artistic disciplines	19	7.53
Foreign language	16	6.34
Music education	12	4.76
Chess	9	3.57
Scientific workshop trainings	6	2.38
Sports education	4	1.58

As shown in Table 6, 67 parents stated that they wanted to provide their children with the trainings they desired and would be happy with. Additionally, 43 parents expressed the need for trainings related to science subjects. Moreover, 36

parents expressed their desire to provide mathematics support for their children, and 29 parents expressed the need for art education. One parent said, *"What matters is my child's happiness, so I would like to provide him with the training he will be happy with."* Another parent mentioned, *"We believe that mathematics is essential in life; that's why we want to provide him with mathematics lessons."*

As seen in Table 5, 27 parents expressed the need for robotics education, and 21 parents expressed their desire to provide coding education for their children. Furthermore, 19 parents stated that they wanted to provide their children with education related to artistic disciplines, and 16 parents expressed the need for foreign language education. Additionally, 12 parents expressed their desire to provide their children with music education, and 9 parents mentioned the importance of chess training. One parent expressed, *"He is very interested in robotics and coding; when I find a suitable course around, I want to enroll him."* Another parent mentioned, *"Adequate science and especially experimental activities are not carried out at school; my child conducts experiments at home, but I think it is not sufficient. Therefore, I am looking for a course with science and scientific activities."* With this 6 parents expressed the need for scientific workshop trainings, and 4 parents expressed their desire to provide sports education for their children. One parent shared, *"We are interested in tennis; that's why I want to enroll him in a course even though he is just across the street."*

Discussion and Conclusion

Based on the data obtained in the study, the parents in the research group stated that gifted children have the characteristics of learning faster and thinking more quickly than their peers. They also mentioned that gifted children excel in expressing themselves, possess creativity, and perform well in mathematics and science subjects. However, it was observed that the parents evaluated the characteristics of gifted children based on their academic performance and did not consider their emotional, social, and psychomotor development. Clark (1997) and Silverman (1993) emphasize that children diagnosed as gifted are empathetic, emotionally deep, and have a high level of awareness of others' feelings and thoughts, especially with a conscience and moral values. Therefore, it is considered that the participating parents did not take into account the characteristics identified in the literature.

Saranlı (2011) stated that the majority of families are not familiar with the concept of giftedness and are unsure whether their children are gifted or not. Consequently, their only knowledge is that their children are different from other children. However, when these children are not supported through appropriate methods, this difference can create negative consequences for them and become a significant problem for their families.

The parents participating in the study mentioned that gifted children face various challenges during their development. They struggle to communicate with their peers and social environment, think differently from their peers in response to events, experience intense emotions, have a tendency for their attention to be easily distracted, and desire to be leaders in their groups. Karakuş (2010) conducted a study on the difficulties encountered by parents of gifted children and found that parents often face challenges in communicating with their children. Stuart & Beste (2008) argue that gifted children have difficulties in communicating with others due to their emotional and sensitive nature, leading them to withdraw into their own world of thoughts and emotions and prefer solitude. Koçal et al. (2009) assert that gifted children experience difficulty in being understood in both home and school environments, and thus, they need guidance support to develop healthy communication skills. According to Davaslıgil (2000), having expectations from others can lead to problems. If gifted children are overly focused on others, it can often lead to unrealistic expectations, disappointment, and even resentment.

Parents mentioned that their gifted children excel in mathematics, science, English, and computer/technology courses in schools. Moreover, parents provided their children with training in mind games, chess, playing musical instruments, art, and sports to develop their special talents. Sak (2012) states that the priority of parents of gifted children is for their children to succeed in central exams and be placed in good schools and universities. Consequently, parents may consider project work, participation in artistic activities, and efforts to reveal and develop their children's potential as meaningless and unnecessary in the educational institutions where their children study. Additionally, Çamdeviren

(2014) expresses that parents do not find their children's extraordinary achievements sufficient and envision their children being perceived at the highest level.

In conclusion, the findings of the study reveal that parents recognize the unique characteristics and talents of their gifted children. However, there are some misconceptions and challenges faced by parents in understanding and supporting their gifted children adequately. It is crucial for parents, educators, and professionals to be well-informed about the characteristics and needs of gifted children to provide appropriate support and create a nurturing environment for their optimal development. Further research and collaboration between parents and schools can help in better understanding and meeting the needs of gifted children effectively.

When reviewing the relevant literature, it is emphasized that parents need to engage in enrichment activities as a family. Enrichment activities for gifted children may include activities that focus on their interests, talents, and individual differences, as well as collaborative educational practices. Ersoy and Avcı (2001) state that enrichment programs involve adding different subjects or learning areas and various materials to the curriculum. The concept of enrichment activities is often misunderstood, and parents tend to associate it with material things that can be purchased with money, such as toys, objects, or paid educational opportunities. In reality, enrichment learning activities aim to enrich experiences. In other words, it allows students to interact with different places and stimuli, providing them with essential experiences for their development. Research has shown that parents of gifted children direct them towards activities such as reading, mind games, and interesting trips, which are different from their peers (Sternberg, 2007).

In this study, the parents of gifted children stated that their children need technology education, science and mathematics education, foreign languages, art, coding, and robotics training. It was observed that these training programs were considered to support their children's special talents. Kıncal et al. (2013) found in their study that gifted students showed a high interest in technology and astronomy topics. It is recommended that the education of gifted students should include training that supports their existing abilities, creative thinking skills, curiosity and interest in science, and their inclination towards arts, sports, etc., alongside technology competency (Tortop, 2015). Aktamış and Ergin (2006) argued in their research that students with creative potential require an environment that allows them to develop their potential. They believe that every child is born with creative potential, but school experiences should allow them to explore events and situations with creative thinking, view daily life problems from different perspectives, and generate new solutions.

Recommendations

In studies related to the education of gifted individuals, collaboration with parents is essential. However, for this collaboration to be effective, parents need to have a correct understanding of their gifted children's developmental characteristics. Different perspectives should be considered concerning both the developmental characteristics and the education of gifted children. Additionally, parents should be provided with basic information about the characteristics of enrichment activities in the education of gifted children. Awareness-raising activities should be conducted to encourage families to engage in enrichment activities not only at school but also at home.

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Research Article

Investigation of the relationship between gifted students' attitudes to collaborative learning and their perfectionist structure[1]

Şefika Doğan [2] and Şirin Yılmaz [3]

Faculty of Education, Istanbul Aydin Universty, Istanbul, Turkiye

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Abstract

The aim of this study is to examine the relationship between gifted students' attitudes towards cooperative learning and their perfectionist structures and to investigate the views of gifted students on perfectionism and cooperative learning. This research is a mixed method research. Relational survey design was used in the quantitative part of the study. The relationship between the perfectionism levels of gifted students and their participation in cooperative learning environments was examined. In the qualitative part of the study, case study was used. By making more detailed examinations with semi-structured interview questions, it is aimed to touch on the perfectionist structures of gifted students and the reasons underlying the basic thoughts that affect whether they want to participate in cooperative learning environments or not. The sample of the research consists of 5th grade 242 gifted students studying at Science and Art Centers in Istanbul. In data collection, the Attitude Scale of Gifted Students towards Cooperative Learning and the Compatible-Incompatible Perfectionism Scale to determine their level of perfectionism. As a result of the research, it can be stated that students' attitudes towards cooperative learning are high, adaptive perfectionism is high, and maladaptive perfectionism is low. In the study, it was determined that there was a weak, positive and significant relationship between students' adaptive perfectionism and their attitudes towards avoidance and cooperative learning. It was determined that there was a moderate, positive and significant relationship between students' adaptive perfectionism and disposition. Accordingly, it can be said that as adaptive perfectionism increases, attitudes towards avoidance, disposition and cooperative learning increase. It was determined that adaptive perfectionism was a significant predictor of students' attitudes towards cooperative learning scale avoidance and disposition sub-dimension and attitude scores towards cooperative learning. According to this result, it can be said that the avoidance sub-dimension scores in their attitudes towards cooperative learning can be predicted by examining the adaptive perfectionism scores or situations of the students. Findings obtained semi-structured interview questions show that students have positive and negative attitudes towards cooperative learning and perfectionism. In line with the findings, suggestions are presented.

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Introduction

Throughout history, one of the most important skills that humanity has used to find solutions to problems and meet

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[2] Elemantary Teacher, Master Student, MoNE, Istanbul Aydın University, Istanbul, Türkiye. E-mail: sefika.dogan@hotmail.com, ORCID: 0000-0002-0827-2313.
[3] Corresponding Author: Assistant Professor, Istanbul Aydin University Faculty of Education, Istanbul, Türkiye. E-mail: sirinyilmaz87@gmail.com ORCID: 0000-0002-0238-8550.

their needs is undoubtedly working in cooperation. Among the elements that have not changed in the development processes of civilizations, it is seen that the habit of human beings to cooperate has not changed. It is not possible for a human being to meet all his/her needs alone. In primitive times, people acted in cooperation even to meet their food needs. As technology developed and the world changed, they continued to work in cooperation to meet their different needs. This is actually the basis for the formation of professions. The development of societies has again paved the way for the emergence of needs. This has further increased the importance of cooperation.

Individuals who work collaboratively put their knowledge, skills and experience to work together for a common goal. During collaborative work, important trials such as becoming a member of the group in cooperation and solidarity and becoming aware of it are experienced (Johnson & Johnson, 1987). Among these individuals who work together for the same purpose, individuals who have different perspectives, are solution-oriented, think differently and impose their leadership on the group come to the forefront. This is because these individuals have different foresights, perspectives and abilities and they make you feel that they are different. Students who think differently, question, offer different solutions to problems, produce and grow up with the importance of development are of great importance for societies (Tanık Önal & Büyük, 2020). Talent is the performances exhibited in mental, musical, artistic, physical and social fields. It is observed that talented individuals are successful in their field. It is also observed that individuals with high IQ levels have high levels of talent. Therefore, it has been observed that individuals with high levels of talent also have high IQs. Based on this understanding, the discourses of "giftedness" and "giftedness" have been gathered under a single heading as "giftedness" (Bıçakçı, 2021). A gifted individual is someone who learns more quickly than his/her peers of the same age, has artistic, creative and leadership qualities, has academic talent in his/her field of interest, likes to act individually and independently, and performs at a high level (Ministry of National Education [MoNE], 2017). From pre-school to high school level, they are children who are intellectual, creative, have leadership qualities, and are highly talented in visual and applied fields (Bildiren, 2013: 22).

Contributing to the cognitive, affective, social and psychological development of gifted students by providing them with the necessary education is undoubtedly one of the goals of educators. When we look at developed societies, it is seen that future leaders, scientists, artists and athletes are formed by giving gifted students the opportunity to receive the necessary education (Grand National Assembly of Turkey [TBMM], 2013). Students who think differently, question, offer different solutions to problems, produce and grow up with the importance of development are of great importance for societies (Tanık Önal & Büyük, 2020). The fact that future generations are strong, highly educated and well-equipped will make a great contribution to the development of the country in technological, economic, political and military terms. These individuals, whom we define as gifted individuals, have always been remarkable within the group. However, if this difference is present in more than one member of the group, can the collaborative working environment really continue in accordance with its purpose? The expectation of this gifted individual, who stands out with his/her differences, to do a perfect job may create an environment of unrest in the group by facing the disapproval of the ideas of other individuals. Gifted students, who have a perfectionist structure, confuse the concept of being perfect with the effort to do their best. While trying to achieve their goals, they may exhibit behaviors such as withdrawing themselves, giving up, and not participating in the environment at all with the thought of "if I cannot achieve the desired result" (Davis, 2006). Anxiety about being perfect in the work to be done may cause an emotional burden on the person and a state of being closed to different ideas. Or, thinking that other members of the group have a more perfect structure than him/her maycause the gifted individual to stay away from these environments. As a result of all these, the group dynamics may be negatively affected.

Science and Art Centers (SAC [Bilim Sanat Merkezi-BILSEM]) affiliated to the Ministry of National Education (MoNE) are special education institutions where gifted students who perform at a higher level than their peers in intelligence, creativity, art, leadership and other academic fields receive education in line with their abilities and needs. The centers were established in 1992 by the General Directorate of Special Education, Guidance and Counseling Services of MoNE (Baykoç Dönmez, 2004). One of the aims of the institution is to increase students' creativity, scientific work discipline, interdisciplinary thinking skills, questioning and the capacity to offer solutions for needs, and to enable

them to participate in project production and development activities. Activity programs prepared by taking interdisciplinary approaches into account are presented to students in an enriched form. In order for the student to actively participate in the process, learning by doing and experiencing is taken as a basis. The activities are based on project generation and development activities. There are also workshops where students can choose and receive training according to their interests and abilities (Science and Art Center Directive, 2019). One of the most important advantages of SACs is that it allows students to receive education in SACs outside of school without leaving their friends at school (Science and Art Center Directive, 2019).

The individual who opens his/her eyes to life at birth is exposed to constant, endless warnings by the adults around him/her in order to be ready for life and to stand on his/her own feet. The effort to teach the good and the right by parents in early childhood and by teachers in school may cause some individuals to raise their standards too high. It may cause the individual to strive to be perfect, sometimes under the influence of his/her parents and social environment, and sometimes as a result of the evolution of his/her own personal characteristics in that direction. As can be understood from the definition of this concept called perfectionism, individuals with perfectionist attitudes have goals that are difficult to achieve. If they fail to achieve these goals, they may have to cope with negative emotions such as guilt, insecurity, feeling of failure, and anxiety (Gökkaya, 2016; Leana Taşçılar et al., 2014).

Cooperative learning can be defined as a method of learning a subject by dividing students into small groups and working together for a common purpose in order to solve a problem or fulfill a task (Demirel, 2002). In cooperative learning environments, students try to solve the same problem by helping each other or getting help. They strive to produce a common product. Each individual has a responsibility in cooperative learning environments. Each individual tries to do his/her best to contribute to the group. During cooperative work, important trials such as helping a groupmate, learning from friends, and the pleasure of belonging to a group are experienced (Johnson & Johnson, 1987). Students in cooperative learning environments enjoy working together for a common goal. Students who realize that learning with their groupmates, completing their deficiencies, helping others, and being united will be able to gain the habit of supporting others or working by accepting the contribution of others in their future lives. "Strength comes from unity." With this understanding, they will gain the ability to fight against the difficulties they face in life.

In order for gifted students, who stand out more than their peers in every sense, to be in cooperative learning environments and to exhibit effective studies in this environment, the measures that can be taken against the problems they experience in cooperative learning environments should be among the main objectives of education and teaching. It should be ensured that they receive the necessary support against the difficulties and pressures they experience under the anxiety of being perfect. In order to direct students to cooperative learning environments, emotional and psychological guidance should be provided and educational environments should be organized according to their needs.

Importance of Research

Perfectionism is a way of thinking that wears the individual out with its "all or nothing" way of thinking. Individuals with this mindset tend to have high standards. In the perfectionism found in gifted students, they attach more importance to every situation than necessary with the obsession of doing the best in their work and responding to the expectations of their social environment at the highest level.This situation creates anxiety in the individual. When this anxiety reaches a high level, it is inevitable to encounter some negative situations. Unfortunately, this excess can sometimes manifest itself in the form of failure or not starting the work that needs to be done or not being present in that environment. Because there is no such thing as an individual being perfect all the time. A gifted child who works at a high level to be the best in everything they do may give up trying and working as soon as they realize that they cannot always be perfect as a result of this effort (Davis, 2006).

Cooperative learning is defined as a method of learning a subject by students who are divided into small groups to solve a problem situation or fulfill a task, working together for the same purpose (Demirel, 2002). There is group work in cooperative learning. Students work in interaction with each other by distributing tasks and taking responsibility. Thanks to group dynamics, students can share this burden as a group instead of facing the positive or negative consequences of their work alone. As students work by doing-living and communicating, learning becomes effective

and enjoyable. Using the cooperative learning method, which is so important, in the educational environment is a very preferable method for us teachers.

In this direction, the participation of gifted students in collaborative learning environments and their perfectionist structures have been examined in national and international literature.

Within the framework of the studies, it is seen that the focus is on the perfectionist structures of gifted students (Kahraman & Pedük, 2014; Leana Taşçılar et al., 2014). There are no examples in the literature on whether the perfectionist structures of gifted students affect collaborative learning.

In the context of this information and the gap in the literature, examining the relationship between the perfectionist structures of gifted students and their attitudes towards collaborative learning environments and finding out how perfectionist structures predict their attitudes towards collaborative learning will pave the way for the organization of the educational environments of gifted students and planning to ensure that they receive support in this direction.

In addition to contributing to the literature as a different study, it will pave the way for SAC teachers to organize trainings on ways of coping with perfectionism and ensuring the participation of gifted students in collaborative learning environments while planning seminars and in-service trainings.

The purpose of this study is to examine the relationship between gifted students' attitudes towards cooperative learning and their perfectionist constructs, and the views of gifted students towards cooperative learning and perfectionism.

Studies in the Literature

In this part of the study, national and international studies on gifted students, cooperative learning and the perception of perfectionism in gifted students are included.

National Studies

In this part of the study, national studies on gifted students, cooperative learning and perfectionism in gifted students are presented in chronological order.

National research on gifted students

In the study titled "Special Talented Student Workshop" (Akbüber et al., 2019), the problems of specially talented students were discussed and what can be done to find solutions to these problems were discussed. 168 Science and Art Center' students from 48 provinces participated in the study. At the end of the workshop, it was seen that gifted students were able to offer solutions to their own problems. In this way, it was concluded that these workshops for gifted students can be used as a method in academic studies.

Ünal and Sak (2020) study titled "The Extraordinary Ones: Lonely Adolescents with Special Talents", the study focused on the reactions of gifted students in the educational environment and in their classrooms and whether these reactions push them to loneliness. At the end of the research, it was shown that gifted students are exposed to reactions such as jealousy and exclusion by their peers because they think differently from their peers, have higher level skills, and are more successful and talented. As a solution to this problem, it was concluded that gifted students should be brought together with other gifted individuals on a full-time or part-time basis to provide more opportunities for socialization.

In their study conducted by Epçaçan and Oral (2019) investigated the issue of "Opinions of Gifted Students on Teaching Practices in Bilsem". 56 gifted students participated in the study. As a result of the research, it was concluded that the education students received from SACs improved their self-confidence, increased their problem-solving skills, and contributed to their desire to research and discover.

Çetin and Ünsal's (2020) study titled "Understanding the Gifted Student" is a case study. Observation, interview and document analysis methods were used in the study data. The study focused on the identification process of a gifted student, his/her characteristics, the reflection of these characteristics on education and what the teacher can do for his/her development. At the end of the study, it was observed that gifted students learn faster and easier than their peers, ask more questions, are more curious and inquisitive, and have higher level cognitive skills. They were also found to be environmentally sensitive, attentive, responsible and rule-abiding students. Differently, it was concluded that they

overreacted to failures and were ambitious. In the educational environment, it was concluded that they competed for power with their teachers, led their friends, tried to direct them, and were the students who attracted attention and were envied in the classroom. It was concluded that the teacher should make the student feel valuable with questions and activities that will attract his/her interest in the educational environment.

In their study conducted, Ataş and Sirem (2020) examined the peer relations of gifted students in terms of teacher views. Eight teachers teaching at SACs in 2019-2020 participated in the study. Semi-structured interview questions were used as data collection tools in the study. As a result of the research, it was concluded that gifted students are in the ambition to win, spoiled, adherence to rules, leadership, desire to be understood, and desire to be the best in friendship relationships. It was found that female students were more active in social relationships than male students.

Nacaroğlu (2020) conducted a study titled "Investigation of 21st Century Skills of Students with Special Talents and Normal Development". 201 gifted and 300 normally developing students participated in the study. "Multidimensional 21st Century Skills Scale" was used in the research conducted with quantitative research method. At the end of the study, it was concluded that 21st century skills were higher in gifted students compared to children with normal development.

National studies on cooperative learning

Bilgin and Gelici (2011) conducted a research study on "Introduction of Cooperative Learning Techniques and Investigation of Student Opinions" with 116 7th grade students. Activities related to cooperative learning techniques were organized throughout the research. At the end of the research, open-ended questions were asked to get the opinions of the students and used as a data collection tool. As a result of the research, the students concluded that the lessons taught with cooperative learning techniques were more enjoyable, facilitated learning, improved their social skills more and that cooperative learning techniques should be applied in all lessons.

Kaya (2013) conducted a research titled "The Effects of Cooperative Learning and Peer Assessment on Academic Achievement, Metacognitive Ability and Helping Behaviors". 64 6th and 7th grade students attending a primary school in 2011-2012 academic year participated in the study. At the end of the research, it was seen that cooperative learning practices positively affected students' course achievement. It was also concluded that peer assessment had a positive effect on metacognitive ability in the activities in which peer assessment supported cooperative learning method was used. In addition, peer assessment did not have a positive or negative effect on expressing help expectations in cooperative learning method. Apart from peer assessment, cooperative learning environments are also considered useful because they provide students with the opportunity to ask for help.

Bilgin, Aktaş and Çetin (2014) conducted a study on "A Comparative Investigation of Teacher and Student Views on Cooperative Learning Techniques". The sample of the study consisted of 191 5th grade students and 6 classroom teachers. Student and teacher opinion forms were used as data collection tools. At the end of the study, it was concluded that cooperative learning environments increase students' achievement, motivation, attitude towards the lesson, social skills and self-confidence.

Genç and Şahin (2012) conducted a study on "The Effect of Cooperative Learning on Achievement and Attitude". The study group of the research consisted of 74 8th grade students. The students to whom activities and questionnaires were applied were divided into experimental and control groups. At the end of the research, while the effect of cooperative learning on academic achievement created a significant difference, there was no significant difference in attitude towards the course.

The study on "The Effect of Cooperative Learning Method on Scientific and Social Skills" was conducted by Arslan and Zengin (2016). In the study, the traditional method and cooperative learning method were compared in order to observe the development of scientific and social skills in the science teaching laboratory course to university students consisting of a group of 99 students. A pretest-posttest control group experimental design was used in the study. Data were collected through observation forms and semi-structured interview questions. At the end of the study, it was determined that the cooperative learning technique had a positive effect on social skills and scientific skills.

In the study titled "The Effect of Problem Solving Strategies Used with Cooperative Learning on Student Achievement" conducted by Yazlık and Erdoğan (2016), an experimental and control group of 71 9th grade students

were formedIn the experimental group, the subject of "Problems" was taught in a cooperative learning environment. In the control group, the same subject was taught with the traditional method. As a result of the study, it was concluded that cooperative learning environments have positive effects on mathematics course and problem solving.

National studies on perfectionism

In a study conducted to evaluate the perfectionism dimension in gifted and talented children (Leana Taşçılar et al., 2014), gifted students between the ages of 10-13 were included in the study. While collecting the data, "Personal Information Form" was applied to determine the extent to which the children found themselves, their teachers and their parents to be perfectionists. In addition, the study was completed with the "Child Adolescent Perfectionism Scale" in order to determine the level of perfectionism. As a result of the study, it was observed that male students have higher scores than female students in the social-based sub-dimension. It was also concluded that the students found themselves and their families perfectionist.

A research study was conducted by Kahraman and Pedük (2014) to determine the perfectionism levels of 6th, 7th and 8th grade students. 181 students participated in the study. As a result of the study in which Positive and Negative Perfectionism Scale and Personal Information Form were used, it was concluded that the positive perfectionism level of female students was higher. In addition, it was observed that positive perfectionism increased as age and grade level decreased and negative perfectionism increased as age and grade level increased. Finally, it was seen that the education level of the father, but not the mother, did not affect the level of positive perfectionism.

Kaçmaz and Yıldız Demirtaş (2020) conducted a study to investigate to what extent self-regulated learning and self-efficacy affect adaptive perfectionism in gifted students. 187 gifted children participated in the study. As a result of the research using relational survey model, it was seen that self-regulated learning and self-efficacy significantly affected adaptive perfectionism.

Tamul (2019) investigated whether there is a relationship between perfectionism in gifted students and the attitudes of parents while raising children. Parenting Attitudes Scale and Multidimensional Perfectionism Scale were used in the study. As a result of the research, it was concluded that the perception of the father's acceptance/affection attitude decreased the level of perfectionism in the child, while the perception of the mother's excessive control and strict supervision attitude increased the level of perfectionism in the child.

Akgül and Nuhoğlu (2020) investigated whether perfectionism levels affect the math anxiety of gifted students. A total of 121 students attending the 3rd and 4th grades of primary school participated in the study. As a result of the research conducted with quantitative research method, it was concluded that sensitivity to errors and conditional self-esteem, which are sub-dimensions of perfectionism, significantly affect anxiety towards mathematics course, which has a very important place in our lives.

International Studies

International research on gifted students

Jeong (2010) conducted a research study on teachers' prominent perceptions and misconceptions about gifted children and the differences between these misconceptions. 119 teachers participated in the study. A 25-question questionnaire was used as a data collection tool. The results of the study showed that most teachers had acorrect understanding of the perceptions about gifted students. However, it was concluded that teachers had uncertainties about misconceptions. It was concluded that professional development should be continuous in order to eliminate misconceptions and understand research-based practices in gifted education.

Mofield and Peters (2019) investigated to what extent the characteristics of gifted and talented successful and unsuccessful students in terms of achievement attitudes, mindsets and dimensions of perfectionism are effective in their success. The sample of the study consistedof 264 gifted middle school students. As a result of the study, it was found that unsuccessful gifted students did not make efforts to achieve their goals and lacked self-regulation. On the other hand, it was concluded that both successful and unsuccessful students had confidence in their abilities. When they looked at the dimensions of perfectionism, it was seen that unsuccessful students had lower Positive Striving Perfectionism.

International research on cooperative learning

Gull and Shehzad (2015) investigated the effects of cooperative learning on students' academic achievement. The sample of the study consisted of 63 female students attending 12th grade. As a result of the research, it was concluded that cooperative learning increased students' academic achievement at a positive level.

Teacher training in cooperative learning and its impact on inclusive education (Munoz-Martinez et al., 2020) conducted research on educators' perceptions of cooperative learning. 29 teachers and two counselors participated in the study. Data were collected using discussion groups, interview questions, questionnaires and documents. At the end of the study, it was concluded that the cooperative learning method positively affected individuals' emotional intelligence and social relationships.

International research on perfectionism

Fletcher and Speirs Neumeister (2012) conducted a study on how perfectionism in gifted students affects their academic achievement. As a result of the research, it was concluded that perfectionism causes feelings such as anxiety, depression, worry about mistakes and fear of failure in gifted students. Wang, Chu-Chun, and Rice (2012) studied the relationship between perfectionistic dissonance and academic achievement and life satisfaction in gifted students. The sample of the study consisted of 144 gifted individuals attending 6th through 12th grades. As a result of the study, it was concluded that havin high learning goals positively affected academic achievement.

Christopher and Shewmaker (2010) examined perfectionism in terms of affective variables in gifted students. As a result of the study, it was found that perfectionism may cause a tendency towards depression. It was concluded that it can cause problems such as loss of energy, insomnia, appetite problems and anxiety. It was suggested that teachers should receive different trainings in order to support the emotional development of gifted students.

In conclusion, when we look at the national and international literature on "giftedness", "cooperative learning" and "perfectionism", we see that gifted students' high level of perfectionism and their negative perfectionism attitudes increase as they grow older, causing them to face problems such as anxiety, stress and depression. In addition, the fact that gifted students, who think differently from their peers and have more talent, attract attention in their environment and have higher level achievements causes them to be envied and excluded by their peers. It is seen in the research results that the cooperative learning method facilitates learning in the educational environment and is a very useful method to strengthen social relations between students.

Research Question

What is the relationship between gifted students' attitudes towards cooperative learning and their perfectionist structure and what are their views on cooperative learning and perfectionist structure?

Based on this main research question, the following sub-research questions were included.

Sub-questions

- At what level are gifted students' attitudes towards cooperative learning and their congruent-incongruent perfectionism?
- Do the congruent-incongruent perfectionism scores of gifted students differ significantly according to gender?
- Do the attitude scores of gifted students towards cooperative learning differ significantly according to gender?
- Does adaptive- maladaptive perfectionism significantly predict gifted students' attitudes towards cooperative learning?
- Is there a relationship between gifted students' attitudes towards cooperative learning and their maladaptive perfectionism?
- Does adaptive- maladaptive perfectionism significantly predict gifted students' attitudes towards cooperative learning?
- What are the views of gifted students towards perfectionism and collaborative learning according to their attitude scores towards collaborative learning?
- What are the views of gifted students towards perfectionism and collaborative learning according to their congruent-incongruent perfectionism scores?

Method

Research Design

This study, which examines the relationship between gifted students' attitudes towards cooperative learning and their perfectionist constructs, is a mixed methods research. Mixed methods research is defined as combining qualitative and quantitative methods, approaches and concepts and using them together (Creswell, 2003; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 1998). In this study, explanatory sequential design from mixed method research was used. When using explanatory sequential design, the aim is to strengthen or explain the data collected by quantitative method with the data collected by qualitative method (Yıldırım & Şimşek, 2013). The research was carried out in two stages and quantitative data were collected in the first stage and then qualitative data were obtained with the participant group selected using quantitative data.

In the quantitative part of the study, the relational survey design was utilized. Relational survey model is used to determine the existence and level of relationship between more than one variable (Karasar, 2016). The relationship between the perfectionism levels of gifted students and their attitudes towards participating in cooperative learning environments was examined. In the qualitative part, case study was used. According to Gerring (2007), a case study is an in-depth study of an existing situation in order to explain the situation in more detail. In the research, semi-structured interview questions were used to examine in more detail and the basic problems underlying the psychology of the student that affect the perfectionist attitudes of gifted students and their willingness to participate in cooperative learning environments were addressed. It is important to support the quantitative data obtained with qualitative data in order to support in-depth exploration of student views.

Study Group

The population of the study consists of 5th grade gifted students who continue their education in Istanbul in the 2022-2023 academic year. The sample of the study consists of 5th grade gifted students studying in Science and Art Centers in Istanbul. While determining the sample of the study, the *convenience sampling method* was adopted. In cases where it is difficult to use other sampling methods, the *convenience sampling method* can be used (Fraenkel and Wallen, 2009). Since this study was conducted with a special group, 5th grade students studying at Science and Art Centers in Istanbul were selected as the sample.

Based on the quantitative data, qualitative data were collected by using the interview method with the students selected with the maximum diversity sampling method, which is one of the purposeful sampling methods. The aim of maximum diversity sampling is to create a relatively small sample and to reflect the diversity of individuals who may be a party to the problem situation being studied at a high level (Yıldırım & Şimşek, 2013).

Participants

The distribution of the students to whom the scales were applied to obtain the quantitative data of the study according to gender and school type is given in Table 1.

Table 1. Characteristics of the students who participated in the study

Features		N	%
Gender	Female	117	48.35
	Male	125	51.65
School Type	State	101	41.74
	Special	141	58.26
Total		242	100

When Table 1 is analyzed, it is seen that 117 (48.35%) of the students are female (48.35%), 125 (51.65%) are male (51.65%), 101 (41.74%) continue their education in public schools and 141 (58.26%) in private schools.

The gender distribution of the students who were identified using the quantitative data obtained from the scale according to the maximum diversity sampling method within the framework of purposeful sampling used in qualitative research methods is given in Table 2.

Table 2. Characteristics of the students who participated in the qualitative data analysis

Levels					
Scales-Level	**Gender**	**Low**	**Middle**	**High**	**Total**
Compatible	Female	-	-	S4	1
Perfectionism Scale	Male	S6	S5	-	2
Maladaptive Perfectionism	Female	S9	S8	S7	3
Scale	Male	-	-	-	0
Collaborative Learning	Female	-	S2	S1	2
Attitude Towards Attitudes Scale	Male	S3	-	-	1
Total		3	3	3	9

Three students with high, medium and low attitudes according to the results of the IPSAS scores were named as T1, T2, T3. According to the results of the scores obtained from the NPTS, the 3 students with high, medium and low scores with compatible perfectionism were named as T4, T5, T6 and the 3 students with high, medium and low scores with incompatible perfectionism were named as T7, T8 and T9.

When Table 2 is examined, semi-structured interviews were conducted with a total of 9 gifted students, three of whom were at the lowest, middle and highest levels according to the results of quantitative measurements of the scores of compatible perfectionism and maladaptive perfectionism, attitudes towards cooperative learning scale, which are among the substructures of the NQS. Qualitative data were collected from 6 female and 3 male students. Each student was coded as shown in the table.

Data Collection Tools

In the data collection process in this study, two different types of data collection, qualitative and quantitative, were used. The Attitudes of Gifted Students towards Cooperative Learning Scale and the Agree-Disagree Perfectionism Scale were used to collect quantitative data. Semi-structured interview questions were used to collect qualitative data.

Attitude Scale Towards Cooperative Learning (AGSCLS)

The Attitudes of Gifted Students towards Cooperative Learning Scale (AGSCLS) was developed by Güler and Doğan (2022). The scale was developed to determine the attitudes of gifted students at the 4th and 5th grade level towards cooperative learning. The scale was developed in Likert type. This scale consists of a total of 23 items, 10 and 13 items in total, consisting of predisposition and avoidance sub-dimensions, respectively. The scale has no negative items. For the original scale, Cronbach's Alpha internal consistency coefficient was 0.89 for the total scale, 0.87 for the 1st Factor and 0.84 for the 2nd Factor. The lowest score that can be obtained from the AGSCLS is 23 and the highest score is 115. The Cronbach's alpha coefficient calculated for the predisposition and avoidance sub-factors are 0.86 and 0.89, respectively. The reliability coefficient of the whole scale was calculated as 0.93. This coefficient means that the measurements obtained from the scale have a high degree of reliability.

The subscales, scale numbers and sample items from the scale developed by Güler and Doğan (2022) are presented in Table 3.

Table 3. Subscales, scale numbers and sample scale ıtems of the AGSCLS

AGSCLS	Subscales	Scale Numbers	Sample Articles
	Predisposition	1-2-3-4-10-15-17-18-20-22	Article 3 It is easy to work in a cooperative learning environment
	Avoidance	5-6-7-8-9-11-12-13-14-16-19-21-23	Article 9 Cooperative learning is boring

Agree-Disagree Perfectionism Scale (ADPS)

This scale, which consists of obsessive behavior, conditioned self, sensitivity to errors and need for approval sub-factors, consists of a total of 25 items, 6, 6, 9 and 4 items respectively. Consisting of 2 sub-dimensions, the sub-dimensions of the scale are named as congruent and incongruent perfectionism. While the sub-factors of adaptive perfectionism are

obsessive behavior and conditional self-esteem, the sub-factors of maladaptive perfectionism are sensitivity to errors and need for approval. The lowest score that can be obtained from the adaptive perfectionism construct is 12, while the highest score is 48. The lowest score that can be obtained from the maladaptive perfectionism construct is 13 and the highest score is 52. In this 4-point Likert-type scale, the ratings are 1.00- Completely Different from Me, 2.00- Not Very Similar to Me, 3.00- Somewhat Similar to Me and 4.00- Completely Similar to Me. The reliability coefficients for the congruent and incongruent perfectionism constructs were calculated as 0.70 and 0.79, respectively. The results of the calculations prove that the scale has a good level of reliability.

According to the NPTS, it is pointed out that the sub-dimensions of sensitivity to errors and need for approval reflect the negative aspects of perfectionism, while the sub-dimensions of obsessive behavior and conditional self-esteem reflect the partially positive aspects of perfectionism (Rice, Ashby & Preusser, 2002). Stoeber and Rambov (2007) state that the concept of adaptive perfectionism is associated with positive characteristics and outcomes in individuals who strive to be perfect.

The subscales, scale numbers, and sample items from the scale adapted by Baş (2010) are presented in Table 4.

Table 4. Subscales, scale numbers and sample ıtems from the NTSS

ADPS	Subscales	Scale Numbers	Sample Articles
	Obsessive behavior	3-6-9-13-21-23	Article 3 I like things to be always in order
Compatible M.			
	Conditional self-esteem	1-7-10-17-20-25	Article 7 I am satisfied when I do something well
	Sensitivity to errors	2-5-8-12-14-16-19-22-24	Article 2 I am afraid of making mistakes
Misfit M.			Article 4
	Approval requirement	4-11-15-18	I like to be praised for what I do because then other people want to be like me.

Semi-structured Interview Form

In this part of the study, qualitative research method was used to obtain in-depth information. Data were collected through semi-structured interview questions. In semi-structured interview questions, the researcher prepares the questions he/she plans to ask in advance. During the interview, the researcher can ask sub-questions in order to get clearer answers from the questions by sticking to the flow. He/she can ensure that the participant gives detailed answers. In the semi-structured interview technique, the fact that the researcher has prepared the questions in advance ensures that the interview continues in a systematic order. This is one of the conveniences offered by this technique (Yıldırım & Şimşek, 1999).

Semi-structured interview questions were prepared to collect qualitative data. The interview questions were prepared in order to examine the relationship between cooperative learning and perfectionism more deeply. During the preparation of the questions, the opinions of two academicians who are experts in their fields were utilized. As a result of the feedback received, the questions were finalized and applied to the students. The interviews were conducted away from external stimuli and noise, in environments where students could focus, and after obtaining the consent of the students.

Process

Before starting the research process, ethics committee from the university and legal permissions from the relevant National Education Directorate were obtained. The scales were administered by the researcher in the Science and Art Center where the students were located under the supervision of school administrators and teachers. The necessary explanations about the scales were given to the students verbally and in writing. The application of the scales took

approximately 15 minutes. In order for the data obtained to be unbiased, the names of the students were not included in the scale, and a coding and pseudonym system was used. The gender of the students was taken as demographic information. Semi-structured interview questions were audio-recorded and each student's interview lasted approximately 6 minutes. The audio recordings were then transcribed into written form.

Data Analysis

Quantitative Data Analysis

The quantitative data of the study were analyzed in SPSS 25.0 program. Descriptive analysis, independent samples t test, simple correlation and simple linear regression analysis were used to analyze the quantitative data. In the descriptive analysis, the arithmetic mean obtained from the Attitudes Towards Cooperative Learning Scale, which was applied in 5-point Likert type, was calculated as 1.00-1.79 very low, 1.80-2.59 low, 2.60-3.39 medium, 3.40-4.19 high, 4.20-5.00 very high, and the arithmetic mean obtained from the 4-point Likert-type Agree-Disagree Perfectionism Scale was interpreted as 1.00-1.74 very low, 1.75-2.49 low, 2.50-3.24 high, 3.25-4.00 very high. Independent samples t test was used to determine whether the scale scores differed according to gender. The assumptions for this test were checked and it was determined that the normality of the data was ensured. Simple correlation and simple linear regression were used to determine the relationships between students' scale scores. For simple correlation analysis, the normal distribution of the two continuous variables was tested and Pearson product-moment correlation coefficient was used. In simple linear regression analysis, the normal distribution of continuous variables measured on an equal interval scale was tested and assumptions were met. In the correlation analysis, the correlation coefficient was interpreted according to the values suggested by Hopkins (1997). These values are as follows. .00-.10 is negligible; .10-.30 is small; .30-.50 is medium; .50-.70 is high; .70-.90 is very high; .90-1.00 is excellent. The values suggested by Cohen (1988) were used to interpret the regression coefficient as effect size. These values are as follows. Regression coefficient value .0196 was interpreted as small, .1300 as medium and .2600 as large effect size. Analyses were conducted at p=0.05 significance level and interpreted accordingly.

Qualitative Data Analysis

In this part of the study, the qualitative data obtained as a result of the interviews with the students were analyzed by categorical analysis, one of the types of content analysis. The main purpose of content analysis is to reach concepts and relationships that can explain the collected data (Yıldırım & Şimşek, 2013). A systematic grouping method for determining the codes and categories of the written documents is called content analysis (Karasar, 2009). Categorical analysis is the grouping of the response first into units and then into categories according to predetermined criteria (Tavşancıl & Aslan, 2001).

According to the results of the IPSAS scores, the 3 students with high, medium and low attitudes were named as T1, T2, T3. According to the results of the scores obtained from the NIMS, 3 students with high, medium and low scores with compatible perfectionism were named as T4, T5, T6 and 3 students with high, medium and low scores with incompatible perfectionism were named as T7, T8 and T9. All of the data collected by recording from a total of 9 gifted students were transcribed. The transcribed data were read repeatedly and possible codes were tried to be determined. The codes were meaningfully classified under the categories determined by considering the interview questions. As a result of the categories, tables were obtained in which the opinions of each student could be analyzed separately.

Findings

Findings Related to Quantitative Data

Findings Related to the First Research Question

The arithmetic mean and standard deviation scores of the students according to their responses to the Attitude Scales for Congruent-Discordant Perfectionist and Attitudes Towards Cooperative Learning are presented in Table 5.

Table 5. Descriptive statistics of the attitudes towards congruent-discordant perfectionist and cooperative learning scales

Scales	Sub Dimensions		S
	Obsessive Behavior	2.43	0.57
Adaptive Perfectionist	Conditional Self-respect	3.24	0.55
Maladaptive Perfectionist	Sensitivity to errors	2,15	0.62
	Approval Requirement	2.36	0.83
Towards Cooperative Learning Attitude	Predisposition	3.94	0.67
	Avoidance	4.04	0.66
Compliant Perfectionist		2.84	0.46
Maladaptive Perfectionist		2.21	0.56
Towards Cooperative Learning Attitude		4.00	0.63

When Table 5 is examined, it can be stated that students' attitudes towards cooperative learning are at high level, their congruent perfectionism is at high level and their maladaptive perfectionism is at low level. When the variability in scale scores was examined, it was determined that the least variability was found in adaptive perfectionism and the most variability was found in attitude towards cooperative learning scores. In addition, when the sub-factors of the scales are examined, it is seen that students' obsessive behavior, sensitivity to errors and need for approval scores are low, conditional self-esteem scores are high, and predisposition and avoidance scores are high. In addition, when the variability in the scores of the students was examined, the sub-factor with the highest variability was determined as need for approval and the sub-factor with the lowest variability was determined as conditional self-esteem.

Findings Related to the Second Research Question

T-test results of students' compatible and maladaptive perfectionism scores according to gender are given in Table 6.

Table 6. T-test results of agree-disagree perfectionism scale scores according to gender

Sub Factor	Gender	N	$\bar{\bar{X}}$	S	Sd	t	p
Adaptive Perfectionism	Female	117	34.69	5.40	240	1.836	0.068
	Male	125	33.39	5.61			
Maladaptive	Female	117	29.53	7.97	240	1.571	0.117
Perfectionism	Male	125	28.06	6.52			

According to Table 6, students' congruent perfectionism and maladaptive perfectionism scores do not differ significantly by gender, t(240)=0.836 and t(249)=1.571, p>.05. Female students' congruent (X=34.69) and maladaptive (X=29.53) perfectionism scores are higher than male students' congruent (X=33.39) and maladaptive (X=28.06) perfectionism scores.

Findings Related to the Third Research Question

The t-test results of students' attitude scores towards cooperative learning according to gender are given in Table 7.

Table 7. T-test Results of attitude towards cooperative learning scale scale scores according to gender

Gender	N	$\bar{\bar{X}}$	S	Sd	t	p
Female	117	91.23	15.20	240	0.690	0.491
Male	125	92.52	13.88			

According to Table 7, students' attitude scores towards cooperative learning did not differ significantly according to gender, t(249)=1.690, p>.05. Male students (X=91.23) had higher attitude scores towards cooperative learning than female students (X 92.52).

Findings Related to the Fourth Research Question

'Is there a relationship between the attitudes of gifted students towards cooperative learning and their congruent and incongruent perfectionism?' The results of the correlation analysis of Attitude Towards Cooperative Learning, the attitude towards cooperative learning scale sub-dimensions of predisposition and avoidance, and congruent and incongruent perfectionism are given in Table 8.

Table 8. Correlation between attitude towards cooperative learning, disposition, avoidance and congruent and maladaptive perfectionism

		Avoidance	Predisposition	Cooperative Learning Attitude Towards
Compatible Perfectionism	Pearson Correlation	,235**	,336**	,294**
	p	,000	,000	,000
	N	242	242	242
Incompatible Perfectionism	Pearson Correlation	-,173**	-,056	-,129*
	p	,007	,386	,046
	N	242	242	242

Table 8 shows that there is a weak, positive and significant relationship between students' adaptive perfectionism and their attitudes towards avoidance and cooperative learning (r=0.235, r=0.294, p<.05). In addition, there is moderate, positive and significant relationship between adaptive perfectionism and predisposition (r=0.336, p<.05). It was determined that the highest to the lowest relationship with adaptive perfectionism was predisposition, attitude towards cooperative learning and avoidance, respectively. Accordingly, it can be said that as adaptive perfectionism increases, avoidance, predisposition and attitude towards cooperative learning increase. When the coefficients of determination were analyzed (r=0.06, r=0.11, r=0.09), it can be said that 6%, 11% and 9% of the total variance in avoidance, predisposition and attitude towards cooperative learning, respectively, were caused by adaptive perfectionism.

There is a negligible, negative relationship between students' maladaptive perfectionism and predisposition (r=-0.056, p<.05). There is also a small, negative and significant relationship between students' maladaptive perfectionism and avoidance and attitude towards cooperative learning (r=-0.173, r=-0.129, p<.05).

Does adaptive- maladaptive perfectionism significantly predict gifted students' attitudes towards cooperative learning? The results of regression analysis related to the prediction of adaptive perfectionism on attitude towards cooperative learning are presented in Table 9.

Table 9. Regression analysis results of adaptive perfectionism predicting attitude towards cooperative learning

Model	Standard scores	Standardized Points			
	B	SH	BETA	t	p
Fixed	65.639	5.580		11.764	.000
Compatible Perfectionism	.772	.162	.294	4.767	.000

Dependent Variable: Attitude towards Cooperative Learning, R^2 =0.09, F=22.729 When Table 9 is analyzed, it is seen that adaptive perfectionism is a significant predictor of students' attitude towards cooperative learning, [r=0.294, r=0.09, F(1,240)=22.729, p<.05]. It can be stated that 9% of the total variance related to the attitude towards cooperative learning is explained by the students' adaptive perfectionist structure. According to the calculated regression coefficient value, it can be said that the effect size obtained is close to the medium level. According to the results of the regression analysis, the regression equation or mathematical model for predicting the attitude towards cooperative learning is given below.

Attitude Towards Cooperative Learning = 65.639 + 0.772. adaptive perfectionism

According to this model, it can be said that a 1-point change in students' adaptive perfectionism sub-dimension causes a 0.772 point change in their attitudes towards cooperative learning.

The results of the regression analysis related to the prediction of adaptive perfectionism's prediction of the attitude towards cooperative learning scale sub-dimension avoidance are given in Table 10.

Table 10. Regression analysis results of adaptive perfectionism predicting avoidance subscale of attitude towards cooperative learning scale

Model	Standard scores	Standardized Points			
	B	SH	BETA	t	p
Fixed	40.065	3.368		11.894	.000
Compatible Perfectionism	.367	.098	.235	3.754	.000

Dependent Variable: Attitudes Toward Cooperative Learning Scale Avoidance Subscale, R^2 =0.06, F=14.090

When Table 10 is examined, it is seen that adaptive perfectionism is a significant predictor of the avoidance sub-dimension of the students' attitude towards cooperative learning scale, [r=0.235, r=0.06, F (1,240)=14.090, p<.05]. It can be stated that 6% of the total variance related to the avoidance sub-dimension of the attitude scale towards cooperative learning is explained by the students' adaptive perfectionist structure. According to the calculated regression coefficient value, it can be said that the effect size obtained is between small and medium level.

According to the results of the regression analysis, the regression equation or mathematical model for predicting the avoidance sub-dimension of the attitude towards cooperative learning scale is given below.

Attitudes Toward Cooperative Learning Scale Avoidance Subscale= 40.065 + 0.367adaptive perfectionism.

According to this model, it can be said that a 1-point change in the adaptive perfectionism sub-dimension of the students causes a score change of 0.367 in the avoidance sub-dimension of the attitude towards cooperative learning scale.

The results of the regression analysis related to the prediction of adaptive perfectionism's prediction of the predisposition of the attitude towards cooperative learning scale sub-dimension are presented in Table 11.

Table 11. Regression analysis results regarding the prediction of adaptive perfectionism on the attitude scale towards cooperative learning subscale predicting disposition

Model	Standard scores	Standardized Points			
	B	SH	BETA	t	p
Fixed	25.575	2.525		10.129	.000
Compatible Perfectionism	.405	.073	.336	5.528	.000

Dependent Variable: Attitudes Toward Cooperative Learning Scale Disposition Subscale, R^2 =0.11, F=30.555

When Table 11 is examined, it is seen that adaptive perfectionism is a significant predictor of the predisposition sub-dimension of the students' attitude towards cooperative learning scale, r=0.336, r=0.11, F (1,240)=30.555, p<.05. It can be stated that 11% of the total variance related to the predisposition sub-dimension of the attitude towards cooperative learning scale is explained by the students' adaptive perfectionist structure. According to the calculated regression coefficient value, it can be said that the effect size obtained is close to the medium level.

According to the results of the regression analysis, the regression equation or mathematical model for predicting the predisposition sub-dimension of the attitude towards cooperative learning scale is given below.

Attitudes Towards Cooperative Learning Scale Disposition Subdimension= 25.575 + 0.405 . adaptive perfectionism

According to this model, it can be said that a 1-point change in students' adaptive perfectionism sub-dimension causes a score change of 0.405 in the predisposition sub-dimension of the attitude towards cooperative learning scale.

Findings Related to Qualitative Data

Findings Related to the Fifth and Sixth Research Questions

In this section, the analysis of the answers given to the interview questions are presented in tables respectively.

Question 1: "How would you define a perfectionist?"

Participants' responses to Question 1 are presented in Table 12.

Table 12 . Analysis results of participants' responses for question 1

Theme	Code	Frequency
Detail oriented	The desire to achieve the best	5
	Willingness to do it completely	5
Superiority	Self-righteousness	3
	Criticizer	7
Stressed	Repetitive work	3
	Constantly fixing bugs	2
Helpful	Helping others	2
Successful	Admired	2
	Receiving praise	2

* One student used more than one definition in his/her explanation.

When gifted students were asked about the characteristics of perfectionist individuals, their answers were combined under 5 themes: detail-oriented, superiority, stressful, helpful and successful. When the answers are checked, it is seen that there are different definitions under each theme heading.

Some of the answers given under the themes on how they define a perfectionist person are as follows:

Detail oriented:

"He does his job correctly by thinking about all the d e t a i l s . He plans everything by thinking." (S5)

"He keeps his work at a very high level, sets high level limits." (S3)

"He always strives for the best." (T1)

"They are people who always want their work to be complete and thorough." (S4) Self-Complacent:

"He wants to do everything his way. He always values his own ideas.

"He does not care much about the opinions of his teammates." (S1)

"He says things like 'Oh, you did it like this, you could never do it. He considers his own superior." (T1)

"They may constantly criticize and dislike the work of others." (S4)

"Since they do everything very well, they may not like the work of others even if it is good." (S9)

"I would describe a perfectionist as arrogant. Because not everyone is as perfectionist as he/she is. He thinks he is the best." (S2)

Stressful:

".... are people who try to do the work they cannot do over and over again." (S3)

"They stress themselves at the slightest mistake and aim to never make mistakes." (S7) "They are the people who immediately correct even the slightest mistake they make." (S4) Helpful:

"Perfectionist people give positive feedback to other people to give them hope. They help those who ask for help" (S5)

"They motivate their friends." (S6) Successful:

"Everything is perfect." (S9)

"He gets praise where he is. He has high ranks. He is good at what he does." (S6)

"I respect perfectionist people." (S3)

Question 2: **"Do you consider yourself a perfectionist, can you explain?**"

Participants' answers to Question 2 are presented in Table 13.

Table 13. Analysis Results of Participants' Responses for Question 2

Theme	Code	Frequency
I am a perfectionist	Check again and again	1
	Willingness to do it completely	2
	Attention to detail	2
	Stress	1
I am not a perfectionist	There are no perfect people	3

* One student used more than one definition in his/her explanation

Some of the answers given under the themes about whether gifted students find themselves excellent or not are as follows:

I am a perfectionist:

"I am interested in many arts. I try to do it very carefully. When I make mistakes, I try to correct them and look at them again and again." (S9)

"I get stressed while doing my homework. I think it should be complete and not incomplete. When it is incomplete, I get very stressed and tire myself a lot." (S4)

"I want everything to be complete, if it's incomplete or incomplete I get upset for a few days.

I would be very happy if I do it in the expected capacity." (T1)

"Getting even one question wrong in the exams would make me very unhappy." (S7)

I am not a perfectionist:

"No human being is perfect or flawless. I just do the best I can do. I don't see myself as perfect." (S6)

"Perfection is the friend of beauty, but if you try to be perfect, you will not find time for anything. Making something perfect is not a great achievement." (S2)

Question 3: "What are the benefits of being a perfectionist?"

Participants' responses to Question 3 are presented in Table 14.

Table 14. Analysis Results of participants' responses for question 3

Theme	Code	Frequency
Success	Good work	6
	Being in the first rows	2
	Pride	2

* One student used more than one definition in his/her explanation.

As a result of the answers given by the participants regarding the benefits of being a perfectionist, it is seen that they are united under a single theme. Some of the answers given are as follows:

"The benefits are many. They can come to good places, have good friends. They can be in the first places in some places." (S6)

"They can do everything very well and above expectations. They have a lot of responsibility, but they do everything well. This is a positive thing." (T1)

"Their work goes well because they do most things well." (Ö8)

"In some important jobs, in competitions, doing everything in detail, dealing with details brings you better results. Making it perfect makes you proud." (S2)

Question 4: "What are the challenges of being a perfectionist?"
Participants' responses to Question 4 are presented in Table 15.

Table 15 Analysis Results of Participants' Responses for Question 4

Theme	Code	Frequency
Exhausting	Failure to meet deadlines	2
	Don't get stressed	2
	Print	2
Social relations	Exclusion	2
	Self-esteem	2

* One student used more than one definition in his/her explanation.

As a result of the answers given by the participants about the difficulties of being a perfectionist, they were combined under the themes of exhausting and social relationships. Some of the answers given are as follows:

Tiring:

"For example, I am doing a project assignment, time is tight and I need to finish it. When it is incomplete, I get stressed. I tire myself a lot." (S4)

"You are perfect, everyone knows you, they don't leave you to do what you want. This creates pressure on the person." (Ö5)

"One has to make mistakes. You get angry when you can't do something. You act as if you should never fall below that limit. This is very tiring." (S7)

Social relations:

"Since perfectionist people see themselves as superior and different from others, this can cause them trouble." (S8)

"Perfectionist people boast too much about themselves and this creates problems in friendship relationships." (S9).

"He is ostracized by his friends because he always cares about his own ideas and does not like the ideas of others." (S1)

Question 5: "How do you feel when you are in cooperative learning environments?"
Participants' answers to Question 5 are presented in Table 16.

Table 16. Analysis Results of Participants' Responses for Question 5

Theme	Code	Frequency
Belonging	Being part of a group	2
	Task sharing	3
	Enjoyable	5
	At ease	2
Anxious	Seeing mistakes	1

* One student used more than one definition in his/her explanation.

Some of the answers given under the themes that emerged about how the participants felt when they were in cooperative learning environments are as follows:

Belonging:

"I feel happy to be a part of the group." (S1)

"I like cooperative learning environments very much, I feel comfortable, working with people I like makes me happy. We share the responsibility." (S4)

"Cooperative learning environments are very fun for me, I feel very enjoyable in those environments." (S2)

"I like being with my friends very much." (S6)

"Cooperative learning environments are easier for me because I don't have to do anything on my own. Also,

when I work with my groupmates, I feel closer to them." (S9)

"Cooperative learning environments are good, there is no pressure, I feel more comfortable."(S8)

Concerned:

"I feel anxious in cooperative learning environments. Everyone looking at me gives me stress. The fact that my mistakes are seen by everyone makes me anxious. The fact that people may not forget that mistake afterwards stresses me." (S5)

Question 6: "Do you prefer group work or individual work when studying a certain topic? Why?"
Participants' responses to Question 6 are presented in Table 17.

Table 17. Analysis results of participants' responses for question 6

Theme	Code	Frequency
Group Work	Sharing responsibility	4
	Completing the shortcomings	4
	Socializing	2
	Different ideas	2
	Better business	3
Individual Study	Disrupting work	1
	Interference in your work	1

* One student used more than one definition in his/her explanation.

Some of the answers given under the themes regarding whether the participants prefer group work or individual work are as follows:

Group work

"It would be better to do group work if we can meet at a common point. They can give ideas that I cannot give and better works can emerge." (S7)

"I mean, if we work individually, no one can interfere with you, you can do anything you want, but your job will be difficult. In a collaborative environment, we can share ideas and socialize. You have control over a part of it, but your friends have control over a large part, you share ideas, I prefer group work more." (S5)

"We can complete each other's deficiencies in this way." (S3)

"I don't like to be in a large group because there is not enough division of labor. I like working in small groups." (Ö1)

Individual work:

"I prefer to work alone because I don't want others to mess up very important jobs." (S6)

Question 7: "How does it make you feel when your colleagues you work in collaboration with are missing or make mistakes during the work?"
Participants' responses to Question 7 are presented in Table 18.

Table 18. Analysis Results of Participants' Responses to Question 7

Theme	Code	Frequency
Being stressed	Irritation	2
	Don't complain	1
	Warning	7
Sadness	Providing assistance	2
	Correction	1

* One student used more than one definition in his/her explanation.

The emotions that the participants felt about their colleagues' shortcomings or mistakes during the study were combined under the themes of being stressed and being upset. Some of the answers given are as follows:

Being stressed

"If he/she doesn't do it, sometimes I get angry inside myself, I try not to show it outwardly as long as the other person doesn't exaggerate." (S1)

"I feel bad, I warn my friend first because this work is not only his/her work." (S2)

"I warn them and ask them to do better next time." (S3)

"I give warnings, if I cannot, I get angry." (S7)

"If he/she does not pay attention to my warnings, I will complain to the person who gave the work." (S6)

"I get very stressed because we cannot do it completely." (S4)

To be sad:

"I tell my friend 'you should also contribute here'. If there is something she cannot do, I help her." (T1)

"I explain myself to my friends, I get upset if what I say is not taken into consideration."(S9)

"I feel sorry for my friends who make mistakes in such situations. They can also make mistakes." (S5)

"We can correct it if we have time to correct it." (S4)

Question 8: "As a result of cooperative learning, group success is at the forefront. Do you prefer group success or individual success?

Participants' responses to Question 8 are presented in Table 19.

Table 19. Analysis results of participants' responses for question 8

Theme	Code	Frequency
Group success	Socialization	3
	Support	3
	Enjoyment	2
	Undeserved reward	3
Individual success	Sense of self	3
	Feeling special	1

* One student used more than one definition in his/her explanation.

It is seen that there are different definitions under the themes regarding whether the participants prefer group success or individual success. Some of the answers given are as follows:

Group success:

"A common award received at the end of a work that you all work together makes the person happier. It is much more beautiful to have a friend next to you to throw your arm than to be alone in an award photo." (S2)

"I like cooperation and being together more." (S3)

"In individual work, all the work belongs to you, in group work, different people also contribute. Your friendship ties develop." (S5)

"I prefer group work if everyone works in the same way." (S6)

"I prefer the success of a small group. In groups of many people, some people may try to stand out because I tried the hardest. In small groups, it becomes clear who is working and who is not." (S1)

Individual success:

"In group work, even those who don't really work hard are considered successful because they are in the group. If I am alone, it is my success. "(Ö4)

"Individual success makes you feel special." (S9) "I would be happier if they just congratulated me." (Ö7)

Conclusion and Discussion

In the data analysis of the first sub-research question of the study, which was the attitudes of gifted students towards cooperative learning and the level of their congruent and incongruent perfectionism, it was concluded that students' attitudes towards cooperative learning and their congruent perfectionism were at a high level, while their incongruent perfectionism was at a low level. Considering that the concept of adaptive perfectionism is a positive characteristic (Stoeber & Rambow, 2007), the fact that the gifted student has the drive to succeed, aims for high standards, and approaches his/her studies with an understanding of quality and excellence supports Renzulli's findings that are effective in determining the characteristics of gifted individuals (Özkan, 2013). The fact that there are studies in the literature (Chan, 2007; LoCicero & Ashby, 2000; Schuler, 2000) showing that congruent perfectionism scores are high supports this view.

Parker (2000), in his experimental studies on the perfectionism levels of gifted students, concluded that, contrary to popular belief, gifted students have low levels of negative perfectionism tendencies. This is a study that supports the low level of maladaptive perfectionism tendencies. It was concluded that the effort to be perfect in gifted students is a force that encourages success (Parker, 2000). The high level of attitudes towards cooperative learning shows that there are studies that support the result of the research with the statement that both success and friendship relations are positively affected in classes where cooperative learning method is used (Baş, 2012; Doymuş, Şimşek, & Karaçöp, 2009; Doymuş, Şimşek, & Bayrakçeken, 2004).

It can be stated that students' obsessive behavior scores, which are sub-dimensions of adaptive perfectionism, are low, conditional self-esteem scores are high, sensitivity to errors and need for approval scores, which are sub-dimensions of maladaptive perfectionism, are low, and predisposition and avoidance scores, which are sub-dimensions of attitude towards cooperation, are high. The high level of conditional self-esteem, which includes task performance and self-evaluation, supports students' setting high standards in their studies and striving to be perfect (LoCicero & Ashby, 2000). Similarly, the high level of students' predisposition and avoidance scores towards cooperative learning may sometimes show differences in the reasons why students want to be in cooperative learning environments. The use of talented and successful students as locomotives in cooperative learning environments emphasizes the view that students learn best while teaching. The thesis that highly talented students learn better in cooperative learning environments with the role of teacher (Açıkgöz, 2002).

In the study, it was determined that there was a weak, positive and significant relationship between students' adaptive perfectionism and their attitudes towards avoidance and cooperative learning. There was a moderate, positive and significant relationship between adaptive perfectionism and disposition. The highest to the lowest relationship with adaptive perfectionism was found to be predisposition, attitude towards cooperative learning and avoidance, respectively. It can be said that 6%, 11% and 9% of the total variance in avoidance, disposition and attitude towards cooperative learning, respectively, is caused by adaptive perfectionism. It can be stated that predisposition sub-dimension has a large effect, while the avoidance sub-dimension and attitude towards cooperative learning have a medium effect.

It was determined that adaptive perfectionism was a significant predictor of students' attitude towards cooperative learning scale avoidance and predisposition sub-dimension and attitude towards cooperative learning scores. According to this result, it can be said that students' avoidance and predisposition sub-dimension scores in their attitudes towards cooperative learning can be predicted by examining their adaptive perfectionism scores or situations. Based on these results, it is thought that determining the compatible perfectionism levels of gifted students can provide information about their attitudes towards participating in cooperative learning environments. It was determined that there was a negligible, negative relationship between students' maladaptive perfectionism and predisposition.

The responses of gifted students to the question "How would you define a perfectionist?" were grouped under five themes: detail-oriented, superiority, stressful, helpful and successful. They defined perfectionists as individuals who strive for everything to be the best, always care about their own ideas, criticize other people, are stressed, cannot tolerate making mistakes, and try to be successful by constantly receiving praise. In the interviews, six out of nine students

defined themselves as perfectionists, saying that they paid too much attention to details, were stressed, and wanted to do everything completely. These data support obsessive behavior and conditional self-esteem, which are sub-dimensions of adaptive perfectionism. Three of the nine students expressed the idea that there is no perfect person, every person has deficiencies.

The gifted students, who stated that being a perfectionist has more harms than benefits, identified as a positive characteristic that perfectionism brings success as a result of the work done. As for the negative characteristics of perfectionism, they think that it is tiring and disrupts social relations, that they are excluded by their friends, and that they are under pressure from the social environment where they feel that they have to do everything in the best way.

The fact that gifted students who feel happy and belong to the relevant group in cooperative learning environments argue that being part of the group, sharing responsibilities, being in closer communication with their friends, and having less stress in task distribution support the predisposition sub-dimension of the attitude towards cooperative learning. The fact that students who feel anxious in cooperative learning environments think that their mistakes will be noticed immediately in the group and that these mistakes will not be forgotten supports the sensitivity to mistakes sub-dimension in the maladaptive perfectionism scale.

When students were asked which they would prefer between group work and individual work, the majority of students preferred group work. Easier completion of deficiencies, high responsibility sharing, and more socialization are among the reasons why gifted students prefer cooperative learning environments. This data also supports their attitudes towards cooperative learning environments. On the other hand, students who preferred individual work stated that they could disrupt the work of their groupmates, that they could not do it the way they wanted, and that they did not like being interfered with. From this discourse, it can be said that the perfectionist structure negatively affects the participation in cooperative learning environments, albeit to a lesser extent.

When the students were asked how they felt as a result of their groupmates' mistakes or deficiencies during the collaborative work, seven of the nine students stated that they were stressed, angry and made warnings. Two students said that they felt sorry for their friends and helped them to correct their mistakes. Based on this data, it is seen that gifted students support the sensitivity to errors sub-dimension of maladaptive perfectionism. According to the results of the scale, it can be said that the data (It was determined that there was a negative relationship between students' maladaptive perfectionism and predisposition at a negligible level) is at a level that cannot be ignored.

When the students were asked whether they preferred group success or individual success as a result of collaborative work, six out of nine students preferred group success and three students preferred individual success. The students who preferred group success stated that they enjoyed receiving awards with their friends, that they socialized, and that it was a good feeling to support each other. On the other hand, the students who preferred individual achievement stated that some of their friends in the group might receive an award even though they did not deserve it, that some of them wanted to stand out, and that they would be happier if they received an award on their own. This data supports the need for approval sub-dimension in the maladaptive perfectionism scale.

Recommendations

In this study, the relationship between gifted students' attitudes towards cooperative learning and their perfectionism and their views on cooperative learning and perfectionism were examined. In this part of the study, the discussion of the results obtained and the suggestions that emerged are given.

- It is suggested that considering these characteristics of gifted students with high cooperative learning and adaptive perfectionism scores and organizing educational environments accordingly may be beneficial for the academic and psychological development of students.
- Considering the advantages of the cooperative learning method in education and training environments, it is suggested that enabling these students, who have the same characteristics as their peers, to carry out collaborative work by combining different areas of talent will pave the way for the emergence of good works.
- It is suggested that combining the high level of adaptive perfectionism of gifted students with collaborative

learning environments will create opportunities for the development of the country and the discovery of inventions.

- It is suggested that students with high avoidance attitudes towards cooperative learning can develop solutions to this problem by determining the reasons underlying this attitude.
- It is suggested that individual therapies can be applied to students with high maladaptive perfectionism scores from the school guidance and psychological counseling department for the ways of thinking and living.
- It is suggested that it may be useful to include more activities in which cooperative learning method will be used in the curricula in BİLSEMs where gifted students are educated.
- It is suggested that it may be useful to organize practical trainings about cooperative learning techniques and cooperative learning activities for teachers working in BİLSEMs.
- Since there is no study investigating the relationship between the perfectionist structures of gifted students and cooperative learning in the literature, it is suggested that it may be useful to increase the number of schools where project-based and cooperative teaching methods can be used to develop these students' perfectionist structures in a positive way.
- It is thought that the fact that gifted students, who mostly define themselves as perfectionists, say that perfectionism is more harmful than beneficial and that being a perfectionist is a stressful and pressurizing situation negatively affects their lifestyles. It is suggested that taking these situations of the students into consideration and developing solutions for them would be beneficial for the personality development of the students.

Limitations of the Study

- In this study, 242 5th grade gifted students who receive education in BİLSEMs in Ataşehir district of Istanbul province in Turkey participated in the study and the results obtained as a result of the study can be generalised to individuals with the same characteristics.
- This research is limited to the applications of the Attitude Scale towards Cooperative Learning, Adaptive-Defiant Perfectionism Scale and Semi-Structured Interview Questions of Gifted Students.

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Research Article

A survey on college students' cybersecurity awareness and education from the perspective of China

Hongbo Guo [1] and Hasan Tinmaz[2*]

General graduate school, Woosong University, Daejeon, South Korea

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Abstract

As people increasingly rely on information and communication technology (ICT), a variety of cyber security issues are emerging, making improving cyber security awareness (CSA) an important topic. This quantitative study focuses on a group of college students from eight local public universities in China (n=1710) and aims to investigate their CSA and education levels using a 32-question questionnaire. Descriptive statistics and cross analysis were used to analyze the current situation related to cybersecurity in college. The results showed that nearly 50% of students spend more than four hours online, with female students spending more online time than males. Smartphones are currently the most popular devices, and spam is the most common issue they encounter. Descriptive statistics, independent samples t-test, and One-way ANOVA test were used to analyze the levels of CSA and education. For CSA, all students are still weak in their password practices. Male students have higher CSA levels in usage habit related to device and HTTP use, but female students perform better in social media. Majors do not make a significant difference in CSA, and freshmen perform better than juniors in device and HTTP application. Regarding cybersecurity education, almost all students believe that colleges need to strengthen information security education. Male students are more familiar with cybersecurity laws, and there are differences in the education methods chosen by students in different majors. Students majoring in computer-related fields prefer more specialized knowledge. This study not only provides valuable insights into the prevailing state of CSA among college students but also offers effective recommendations for enhancing cybersecurity education practices in colleges. The findings underscore the importance of addressing weaknesses in password practices and emphasize the need for comprehensive educational approaches that encompass various facets of cybersecurity. Institutions should consider tailoring their instructional strategies to meet the unique needs of students from diverse academic disciplines. Moreover, fostering awareness of cybersecurity laws and regulations is crucial for all students, regardless of their major.

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Introduction

With the rapid advancement of information technology and the widespread adoption of network systems, individuals have become increasingly dependent on the Internet, which has permeated various aspects of daily life, including education, public services, payments, social interactions, and entertainment. According to the 49th Statistical Report on

[1] PhD Candidate, General graduate school, Woosong University, Daejeon, South Korea. School of Information Engineering, Yulin University, Yulin, China E-mail: forestway@163.com ORCID: 0000-0001-9048-3656
[2] Corresponding Author: Assist. Prof., Endicott College of International Studies, AI & Big Data Department, Daejeon, South Korea. E-mail: htinmaz@endicott.ac.kr ORCID: 0000-0003-4310-0848

Internet Development in China, published by the China Internet Network Information Center (CNNIC) in February 2022, the number of Internet users in China had surpassed 1.032 billion by the end of 2021, with a penetration rate of 73.3%, and 35% of these users were under the age of 29 (CNNIC, 2022). While the Internet has brought immense convenience and revolutionized global lifestyles, it also carries potential negative consequences if misused (Annansingh & Veli, 2016). The instability and insecurity prevalent in cyberspace pose significant threats to both individuals and organizations (Li, Tsigkanos, Jin, Hu & Ghezzi, 2020).

The widespread adoption of the Internet has introduced numerous cyber-related risks, including cyber addiction, personal information exposure, and online fraud (Ratten & Vanessa, 2015). The CNNIC reported that many Chinese Internet users experienced network security problems in 2021, with 22.1% of all netizens experiencing personal information leakage, 16.6% encountering online fraud, 9.1% suffering from viruses or Trojan horses on their devices, and 6.6% having their account numbers or passwords stolen in the past six months (CNNIC, 2022).

It is observed that as the age of the youth group increases, the proportion of cyber security incidents also increases. College students are more prone to cyber events compared to primary and secondary school students as they use the internet more widely, and hence face more security problems. Combatting silent privacy invasion through CSA and basic information security skills is found to be an effective strategy for most internet users. For college students, this not only helps in personal data protection on campus but also prepares them to cope with cyber threats in their future workplace. Al-Ghamdi (2021) states that having a good understanding of cyber security can help detect all kinds of malicious incidents and make accurate decisions on the internet. Al-Janabi and Al-Shourbaji (2016) emphasize that good CSA plays an essential role in protecting sensitive information from cyber-attacks.

The emphasis on CSA by Rahim et al (2015) is to equip internet users with the basic ability to detect and deal with cyber threats rather than scare or create apprehension. Although college students' awareness of cyber security may be higher than the average level, previous studies show that they lack adequate information security education to identify potential risks in practical applications (Sarathchandra, Haltinner & Lichtenberg, 2016). The cybersecurity level is considered as a touchstone to measure a country's cyber strength, which reflects a country's strategic political status among other countries (Gamreklidze, 2015).

The Chinese government has made cyber security a part of its national strategy, and various industries spend a considerable amount on network security construction annually. Most colleges are also gradually improving their network security infrastructure and offer information security courses for computer-related majors. However, universities in China have not given much attention to their students' cybersecurity training and education. Therefore, improving the cyber security level of every student is an important and meaningful question for higher education.

To address the issues mentioned above, it is necessary to explore the current level of CSA and the existing problems faced by college students. This paper focuses on the CSA and the basic defense ability of university undergraduates. By issuing a questionnaire to students in a local university and analyzing the data, the study aims to understand the actual situation of CSA and the protection ability of local university students in China. Additionally, the study intends to provide reasonable suggestions for improving students' CSA and protection skills in local universities.

Literature Review

Related Studies

With the widespread application of information technology and the frequent occurrence of cyber threats, a lot of research literature on network security has emerged. In the last few decades, most academic research in this field has focused on cybersecurity technology, which has been summarized into different research communities such as cryptography, identity authentication, and so on (Katsikeas, Johnson, Ekstedt & Lagerström, 2021). However, there has been a gradual increase in research interest on CSA, which is also known as ISA in recent years (Corallo, Lazoi, Lezzi & Luperto, 2022). This phenomenon shows that information security is no longer just the business of professionals, but also closely related to users' ISA. As approximately every world citizen is an internet user nowadays, only hardware or software technology cannot guarantee information security. Therefore, we can say that improving users' ISA and training their basic network security skills is essential in every industry today.

Most of the existing literature related to ISA has focused on assessing and promoting ISA among individuals, organizations, and countries. Others were mainly interested in exploring interconnections between behavior habits, psychological activities, and people's ISA. This paper divides all the relevant literature into three categories based on their research objectives and scope.

The first literature category focuses on CSA among individuals in society and employees in organizations. Okesola et al (2016) used quantitative methods to assess an individual's level of awareness of cybersecurity risks in southwest Nigeria and found that most users of social networks, especially female users, have low CSA. Grassegger and Nedbal (2021) stated that focusing only on technical measures is not enough to ensure the information security for the organizations, and improving ISA for all employees is also essential. From the perspective of activity theory, Ho and Gross (2021) proposed a conceptualization of cyber defense as an activity system, offering a transformative approach to enhancing organizational cyber awareness. Some scholars also suggest that organizations should provide specially designed electronic or board games to train and improve their employees' ISA (Hart, Margheri, Paci & Sassone, 2020).

The second literature category focuses on the investigation and education of teenagers' ISA. Maennel et al (2019) believe that it is far from enough to put ISA education at the college level. Both the awareness and ability of cybersecurity should be taught and developed as an essential skill among children. Kritzinger et al. (2017) analyzed the current level of ISA and existing measures of school learners in the South Africa and United Kingdom, compared the differences between developing and developed countries in the construction of ISA, and finally gave suggestions for the two countries respectively. Annansingh and Veli (2016) discussed the Internet risks awareness and e-safety needs of children and gave some suggestions to parents and relevant government departments. Elbedour et al (2020) discussed the negative impact of cyberbullying on society and then, from the perspective of prevention and intervention, believe that school psychologists and counselors play an important role in this aspect and provide the corresponding practical methods to solve the problem. Quayyum et al. (2021) reviewed all the literature from 2011 to 2021 focusing on the analysis of the sources of network risks for children and found a lot of cyber risk exits everywhere on the Internet.

The third literature category focuses on the intersection of 'college or university' and 'CSA or ISA', which has a similar scope to this paper. However, some of these studies have different objectives and directions. Alqahtani (2022) assessed ISA among university students using a quantitative research method, finding that knowledge of password security, browser security, and social media activity had a significant impact on students' ISA. Senthilkumar and Easwaramoorthy (2017) surveyed college students to investigate their level of network security awareness and believed that perfect ISA could help students better protect themselves from hacker attacks. Al-Janabi and Al-Shourbaji (2016) investigated the ISA level of students and staff in educational environments in the Middle East and found that comprehensive ISA training programs could remedy the lack of necessary knowledge and understanding of information security. Garba et al (2020) surveyed students about their basic knowledge of ISA in Yobe State University (Nigeria) and suggested that corresponding ISA programs should be established gradually. The study also found that female students are more likely to be victims of cyber-attacks, and college students are enthusiastic about learning more about cybersecurity.

Limited research exists on college students' ISA or CSA in China. Xu et al (2019) analyzed the ISA level and protection skills of postgraduates in nine universities in Beijing and found that their education in this field needs to be strengthened. Liu and Chen (2021) identified weak awareness of personal information security and insufficient education subjects' publicity as the main problems in information security protection of college students from the perspective of telecom fraud.

Significance of the Study

Numerous scholars have conducted research on cyber security risks, primarily focusing on cyber security technologies. However, in today's digital age, where nearly everyone is an internet user, relying solely on technology for protection against cyber threats is insufficient (Al-Janabi & Al-Shourbaji, 2016). Therefore, enhancing users' awareness and skills is crucial to effectively address cyber security threats, which are as important as information technology for individuals and organizations. Specially, as future professionals, university students need to possess fundamental cyber security skills to meet the demands of the network age.

Regrettably, there is a significant dearth of quantitative research in this field in China. Therefore, this study aims to bridge this gap by conducting a quantitative investigation on CSA among college students. The findings of this study can offer valuable insights for local universities in China (or similar cases outside of China) to develop and enhance students' CSA and information security practices. Furthermore, this study holds reference value for examining CSA in other organizations or industries.

Conceptual Framework

This research intends to analyze the cyber security levels of college students from the perspectives of awareness and education. Regarding the cybersecurity awareness assessment, this study used the three aspects of password management, usage habit, and social media since these topics are most relevant to college students' daily network operation and are widely employed in similar studies (Alharbi & Tassaddiq, 2021). Since the password is one of the most important components in data and information security (Alqahtani, 2022), it is also risky because it is susceptible to attack.

This study investigates the cybersecurity awareness of usage habits from the perspectives of http and device usage, as they are typical Internet user activities. According to Okesola et al (2016), even though the good function of social media for many activities has continued to develop in recent years, malicious users and hackers have also continued to utilize them as a covert means of assaulting and abusing unwary and ignorant individuals. In terms of cybersecurity education, the purpose of this study is to evaluate college students' perspectives and evaluations of the cyber security education provided by their colleges and institutions. In conclusion, this study creates four dimensions to assess the level of cybersecurity awareness and education possessed by college students.

Research Questions

This study specifically focuses on college students in the Chinese higher education context. Its main objectives are to investigate the current state of cybersecurity, assess the level of awareness and education regarding cybersecurity, and examine the differences in various dimensions of cybersecurity among students based on their gender, grade levels, and majors. The specific research questions addressed in this study are as follows:

Q1: How much time do students usually spend online? What devices do they use daily? What cyber threats do they often encounter?

Q2: Is there any statistically significant difference(s) between male and female students about the online time?

Q3: What kind of cybersecurity education methods do the students like, and is there any difference(s) in the choice of cyber security education methods among students of different majors?

Q4: What is the overall level of cyber security of college students and the performance of various dimensions of password, device and http use, social media, and cyber security education?

Q5: Is there any statistically significant difference(s) between male and female students in each dimension of cyber security and if any, what gender makes the difference?

Q6: Is there any statistically significant difference(s) among students of different majors in each dimension of network security and if any, which major(s) make the difference?

Q7: Is there any statistically significant difference(s) among students of different grades in each dimension of cyber security and if any, which grade(s) make the difference?

Method

Research Model

The researchers utilized cross-sectional research model where the study data collected from participants at a single point in time to analyze further differences and relationships. To serve that purpose, an online quantitative survey was administered to students via WeChat groups, email, and the teaching software platform with the help of university teachers. It is worth mentioning that students were not compelled to complete the questionnaire and participated voluntarily. Data collection was conducted from June to August 2022, which lasted for nearly two months.

Participants

This study initiated by collecting data from undergraduate students at eight public universities in China, which are primarily comprehensive universities with a diverse array of majors and comparatively lower rankings in the country. Convenience sampling was utilized as a non-probability sampling method to collect data from participants who were easily accessible to the researchers, either physically or through the internet. This approach is commonly used and allows for greater practicality in obtaining data (Edgar & Manz, 2017).

Table 1. Demographic information of respondents

Variable	Items	n	%
Gender	Male	774	45.30
	Female	936	54.70
Grade	Freshman	571	33.40
	Sophomore	610	35.70
	Junior	292	17.10
	Senior	237	13.90
Major category	Liberal arts	675	39.50
	Science & Engineering	819	47.90
	Computer related	216	12.60

Finally, a total of 2116 questionnaires were collected, after excluding 406 questionnaires with too short response time and invalid answers, the final sample size has become 1710. According to the data presented in Table 1, there was a relatively equal distribution of male and female respondents, among which 774 were female (45.3%) and 936 were male (54.7%), the participants were mainly freshmen (33.4%) and sophomores (35.7%), which indicates that lower grade students are more active in participation or interested in the topic of cyber security. Regarding the major, 675 participants (39.5%) were from liberal arts, physical and art majors, 819 participants (47.9%) were from science and engineering (non-IT related) majors, and 216 participants were from computer related majors, which is acceptable and consistent with the population of the college students where the questionnaire was issued.

Data Collection Tools

The college students' cybersecurity awareness questionnaire was used in this study comprised 32 items, including 25 scale items are used for measuring the four factors of password, usage habit, social media, and education, as established in previous studies (Alqahtani, 2022; Alharbi & Tassaddiq, 2021), they were assessed using a 5-point Likert scale, ranging from 1 (strongly agree) to 5 (strongly disagree). The remaining 7 items pertained to demographic information, such as gender, grade, major, online time, web device, cyber threats, and education status (Sun, 2018). To facilitate a more comprehensive analysis of cybersecurity education, students were classified into three major categories, namely liberal arts (including art and physical education), science and engineering (excluding IT-related majors), and computer science (Xu, Zeng, Wang, & Zhang, 2019).

The measurement items were originally created in English and later translated into Chinese. Prior to distribution, the initial version of the questionnaire underwent a review by experts in the English language, minor adjustments and modifications was conducted based on expert feedback. This step also functioned as a measure of content validity.

Cronbach's alpha reliability was used to examine the internal consistency of the questionnaire. The Cronbach's alpha coefficient of the twenty-five items was 0.85 (n=1710), which indicates that the reliability of the data is at a good level.

Table 2. The Cronbach's alpha of four dimensions

Dimension	*M*	*SD*	Cronbach's alpha
Password	3.01	0.60	0.73
Device and http use	3.39	0.81	0.83
Social media	3.46	0.82	0.80
Education	3.53	0.71	0.86

Table 2 displays the Cronbach's alpha values for each dimension. These values range from 0.73 to 0.86 and are all greater than 0.70, indicating that the Cronbach's alpha values for each dimension satisfied the requirements for the research. (Morrison 2019).

Results

Descriptive statistics of the online time, devices daily used and cyber threats experienced

In this study, descriptive statistics were used to investigate how much time college students usually spend online, the devices they use on a daily basis, and the types of cyber threats they usually face. All of these factors are frequently connected to the users' level of cybersecurity awareness. In addition, the methods of education in cybersecurity that were found to be most popular among students were investigated in this section.

As shown in Table 3, almost 50% of college students spend more than 4 hours online, with only 8.1% spending less than 2 hours online. The remaining 2-3 hours and 3-4 hours account for 20% and 22%, respectively. In terms of internet devices, smartphones are the most widely used, accounting for 62%, while desktops account for only 1.9%. Based on the analysis, it can be deduced that there is a growing trend of students dedicating more time to online activities. Smartphones have emerged as the favored device, while desktop computers are gradually losing popularity among young individuals in their everyday routines.

To explore numerous cybersecurity issues that most students have encountered, the questionnaire included the special question "What network security threats have you encountered so far?". As presented in Table 3, spam was the most common issue encountered, accounting for 27.3%. Information leakage was also prevalent, accounting for 16.4%. Other network security incidents with high incidence were false rumors (12.4%), online fraud (11.1%), and pornographic information (10.2%). Financial theft, consumer disputes, and cyberbullying were rare among college students. Some students reported not encountering any incidents in this field.

To investigate the education methods that most college students preferred in cybersecurity education, a special question “Which types of education methods that you like to improve your cybersecurity awareness” was proposed in the study. According to Table 3, network media publicity is the most popular education technique selected by students, accounting for 32.4%. Display board or window advertising is another effective method for promoting cybersecurity education in higher education, which accounts for 20.5%. Classroom teaching (16.3%), community activities (14.5%), and special lectures are also popular among students (13.7%). Furthermore, other approaches account for 2.6 percent of the total.

Table 3. Online habits and cyber security issues encountered

Variable	Items	n	%
Online duration	1-2 hours	139	8.10
	2-3 hours	342	20.00
	3-4 hours	377	22.00
	Above 4 hours	852	49.80
Popular device	Smart phone	1674	61.30
	Tablet	271	9.90
	Desktop	53	1.90
	Laptop	735	26.90
Cyber security issues	Virus attacks	524	11.70
	Information leakage	738	16.40
	Spam	1228	27.30
	Financial theft	93	2.10
	Online fraud	499	11.10
	Consumer disputes	153	3.40
	Pornographic	459	10.20
	Cyberbullying	126	2.80
	False rumors	556	12.40
	Others	115	2.60
Education method	Classroom teaching	544	16.30
	Special lecture	458	13.70
	Display board or window publicity	685	20.50
	Community activities	484	14.50
	Network media publicity	1081	32.40
	Others	85	2.60

Cross analysis between gender and online time

To examine the relationship between gender and online time, this study conducted a cross-analysis of the corresponding data. As shown in Table 4, there were gender differences in the time spent on the internet by college students. The significance value of the Chi-Square test was 0.00<0.05 ($\chi 2 = 81.53$, $df = 3$), indicating that the effect of gender on time spent online was significant, with female college students spending more time online than male students.

Table 4. Cross analysis of gender and online time

Gender		Time spent online each day			
		1-2 hours	2-3 hours	3-4 hours	More than 4 hours
Male	n	100	196	137	341
	%	12.90	25.30	17.70	44.10
Female	n	39	146	240	511
	%	4.20	15.60	25.60	54.60

Cross analysis between Major category and education method

For the cybersecurity education, an important objective of this study is to investigate whether students from different majors have varying preferences for educational methods. A specific question about this topic was included in the demographic section of the questionnaire, asking participants to select their preferred method of receiving CSA education from a list of options including classroom teaching, special lectures, and others. Table 5 indicates that there are differences in the choices made by students from different major groups. To further investigate the existence of these differences, the sample size of each major category and the frequency of each education method were considered. The results of the Chi-Square test show a significance value of 0.02 ($\chi 2 = 28.43$, $df = 10$), which is below the threshold of 0.05, indicating that students from different majors indeed have different preferences when it comes to cybersecurity learning methods.

Table 5. Cross tabulation of major category and education method

Major category		Education method					
		Classroom teaching	Special lecture	Display board or window publicity	Community activities	Network media publicity	Other
Liberal arts	n	214	162	291	174	427	38
	%	16.4%	12.4%	22.3%	13.3%	32.7%	2.9%
Science and Engineering	n	248	211	328	244	525	40
	%	15.5%	13.2%	20.6%	15.3%	32.9%	2.5%
Computer related	n	82	85	66	66	129	7
	%	18.9%	19.5%	15.2%	15.2%	29.7%	1.6%

Analysis of the Survey

Table 6 displays the mean scores and standard deviations for each scale item, the results show that the item with the highest mean score is 3.97, suggesting that most students believe that their university should enhance the cultivation of their cybersecurity skills. The second highest mean score is 3.80, indicating that most students do not prefer sharing or sending passwords with their classmates. The third highest mean score is 3.79, which implies that most students think it is essential to set a complex password. On the other hand, the lowest mean scores are all related to passwords. The three questions with the lowest mean scores are 2.24, 2.32, and 2.47, which reveal that more than half of the students use a strong or previous password for different websites and accounts, and almost half of them feel frustrated to have a long and complex password for each website and account. For the four dimensions, the education obtained the highest mean score, while the password was the lowest.

Table 6. The basic statistics of survey questions (n=1710)

Dimension	Survey questions	*M*	*SD*
Password Management	P1. I believe that all passwords should include upper and lower characters, numbers, and symbols.	3.79	1.10
	P2. I change my password periodically.	2.55	1.24
	P3. I use previously used passwords.	2.32	1.15
	P4. I use one strong password for across different websites and accounts.	2.24	1.16
	P5. I feel annoyed to have a long and strong password for each website and account.	2.47	1.18
	P6. I do not mind sharing or sending passwords with my friends.	3.61	1.23
	P7. I do not mind sharing or sending passwords with my family.	3.30	1.27
	P8. I do not mind sharing or sending passwords with my classmates.	3.80	1.18
Usage Habit	U1. The web browser should be updated regularly.	3.52	1.06
	U2. I update my computer regularly.	3.33	1.12
	U3. I install the updates of my phone regularly.	3.55	1.12
	U4. I avoid installing extensions from third-party websites.	3.64	1.06
	U5. I check the security settings and configurations of the web browser periodically.	3.24	1.11
	U6. I check the browser history and find suspicious activities.	3.06	1.15
Social Media	S1. It is ok to accept friend requests from unknown people.	3.56	1.09
	S2. It is acceptable to post personal pictures on social media.	3.30	1.16
	S3. There is no problem with sharing my current location publicly on social media.	3.54	1.1
	S4. There is no problem to add all personal information to social media platforms.	3.77	1.09
	S5. I know how to report any threat or suspicious activity on social media.	2.89	1.07
Education in College	E1. I am familiar with various cyber security laws and regulations issued by the state.	3.23	0.91
	E2. I have developed the ability to deal with common network security threats.	3.33	0.92
	E3. It is necessary for colleges to strengthen the cultivation of college students' cyber security ability.	3.97	0.9
	E4. My college attaches importance to cyber security education.	3.63	0.95
	E5. My college often carries out cyber security education activities.	3.51	0.94
	E6. The effect of network security education in our school is very good.	3.53	0.94

Comparative tests

To analyze the difference in the four dimensions of the survey questions between male and female students, independent samples t-test was conducted. Firstly, the significance of Levene's test was checked for the equality of variances, and then the significance value of independent samples t-test was checked. Table 7 shows that the significance of the password dimension is 0.43, which is higher than 0.05, indicating that there is no significant difference in password behavior between genders of university students. However, the p-values of the other three dimensions are all much less than 0.05, which means that there are significant differences in usage habit, social media, and cybersecurity education between different genders.

Table 2. Independent sample t-tests on gender vs four dimensions

Dimension	Levene's Test		Independent samples t-test		
	F	***p***	***t***	***df***	***p***
Password	0.86	0.35	0.78	1708.00	0.43
Usage habit	19.93	0.00	4.65	1546.22	0.00
Social media	18.34	0.00	5.97	1483.44	0.00
Education	29.30	0.00	2.52	1525.21	0.01

Combining the results of Tables 8, it is obvious that male students' CSA level are higher than female students in the use habit and education. On the other hand, female students scored higher than male students in the social media.

Table 3. The basic statistics of genders in four dimensions of cyber security

Dimension	Gender	n	M	SD
Password (*not significant*)	Male	774	3.00	0.62
	Female	936	3.02	0.58
Usage habit	Male	774	3.49	0.86
	Female	936	3.31	0.75
Social media	Male	774	3.33	0.90
	Female	936	3.57	0.73
Education	Male	774	3.58	0.77
	Female	936	3.49	0.66

To further examine the source of the difference in cybersecurity education between male and female students, additional independent samples t-tests were conducted on each question of the education dimension. As shown in Table 9, the p-values for the first and second questions are both below 0.05, indicating that there are statistically significant differences between genders on these questions.

Table 4. Independent samples t-tests on the items of education dimension

Education item	Levene's Test		Independent samples t-test		
	F	***p***	***t***	***df***	***p***
E1	34.37	0.00	6.13	1590.25	0.00
E2	28.11	0.00	5.43	1583.52	0.00
E3	14.00	0.00	-0.86	1581.06	0.39
E4	19.24	0.00	-0.13	1546.79	0.90
E5	17.56	0.00	0.50	1551.14	0.62
E6	12.68	0.00	0.84	1572.13	0.40

Regarding to the two significant questions, Table 10 demonstrates that male students have more familiarity with legal aspects of cybersecurity and feel more skilled in finding solutions to cyber security problems.

Table 5. The basic statistics of genders in education dimension

Education item	Gender	n	M	SD
E1	Male	774	3.37	0.94
	Female	936	3.10	0.87
E2	Male	774	3.46	0.95
	Female	936	3.22	0.87
E3	Male	774	3.95	0.95
	Female	936	3.99	0.86
E4	Male	774	3.63	1.01
	Female	936	3.63	0.88
E5	Male	774	3.52	1.00
	Female	936	3.50	0.88
E6	Male	774	3.56	0.99
	Female	936	3.52	0.89

The one-way ANOVA test was utilized by the researchers to determine whether there were differences in each measurement dimension of the study for different majors. Equality of variances was indicated by Levene's test of homogeneity of variances, and Tukey post-hoc tests were then conducted. As presented in Table 11, no significant differences were found among majors in the dimensions of password, usage habit, and social media. However, in the education dimension, the first major group was found to be significantly different from the other two groups, while the difference between the other two groups was found to be insignificant. Interestingly, the mean scores of liberal arts students in cybersecurity education were found to be higher than those of students from the other two majors.

Table 11. One-way ANOVA tests on major groups vs four dimensions

Dimensions	Levels*	*n*	*M*	*SD*	*F* (df=1709)	*p*	*Tukey post-hoc test results***
Password	Group 1	675	3.03	0.58	1.125	0.325	NS
	Group 2	819	2.99	0.61			
	Group 3	216	2.98	0.59			
Usage habit	Group 1	675	3.44	0.79	2.687	0.068	NS
	Group 2	819	3.35	0.81			
	Group 3	216	3.34	0.81			
Social media	Group 1	675	3.43	0.82	0.865	0.421	NS
	Group 2	819	3.46	0.82			
	Group 3	216	3.51	0.79			
Education	Group 1	675	3.59	0.72	4.799	0.008	Group 1> Group 2 Group 1 > Group 3
	Group 2	819	3.50	0.70			
	Group 3	216	3.44	0.70			

* Group 1: Liberal arts, physical education and art - Group 2: Science and Engineering (non-IT related) - Group 3: Computer related

**NS: Non-significant

Furtherly, in order to identify the sources of differences in the education of cybersecurity among students from various majors, the study conducted additional One-Way ANOVA tests on each question of the education dimension. Levene's test of homogeneity of variances indicated equal variances, and Tukey post-hoc tests were then conducted. As shown in Table 12, there were no significant differences among majors in E 1, E3, E4, and E5 of the education dimension, while significant differences were observed in E 2 and E6.

Regarding the two questions that exhibited notable distinctions, it was observed that the first main group demonstrated a significant difference from the other two groups, whereas the disparity between the remaining two

groups was not deemed significant. It is noteworthy that the mean scores for the liberal arts category surpassed those of the other two major categories in relation to these two questions.

Table 12. One-way ANOVA tests on different majors vs six items of education dimension

Education item	Levels*	*n*	*M*	*SD*	*F* (df=1709)	*p*	*Tukey post-hoc test results***
E1	Group 1	675	3.27	0.92	2.456	0.086	NS
	Group 2	819	3.22	0.88			
	Group 3	216	3.11	1.00			
E2	Group 1	675	3.43	0.91	6.712	0.001	Group 1> Group 2 Group 1 > Group 3
	Group 2	819	3.29	0.88			
	Group 3	216	3.20	1.02			
E3	Group 1	675	4.01	0.88	2.962	0.052	NS
	Group 2	819	3.91	0.92			
	Group 3	216	4.05	0.90			
E4	Group 1	675	3.68	0.94	2.326	0.098	NS
	Group 2	819	3.62	0.94			
	Group 3	216	3.52	0.95			
E5	Group 1	675	3.57	0.94	3.251	0.039	NS
	Group 2	819	3.48	0.93			
	Group 3	216	3.40	0.94			
E6	Group 1	675	3.62	0.94	5.844	0.003	Group 1> Group 2 Group 1 > Group 3
	Group 2	819	3.49	0.93			
	Group 3	216	3.41	0.94			

* Group 1: Liberal arts, physical education and art - Group 2: Science and Engineering (non-IT related) - Group 3: Computer related

**NS: Non-significant

To investigate whether there were statistically significant differences for each dimension across different schooling levels, a one-way ANOVA test was performed. Since Levene's test of homogeneity of variances indicated equal variances, Tukey post-hoc tests were used to determine which group(s) differed among the four levels. As presented in Table 13, there were no significant differences in password, social media, and education dimensions among different school levels. Regarding usage habit that is represented by device and HTTP use, freshmen were found to be significantly different from juniors, but not from the other two levels, and there were no significant differences between the other school levels. Surprisingly, the mean score of freshmen in the usage habit was higher than those of juniors.

Table 13. One-way ANOVA tests on different school levels vs four dimensions

Dimensions	Levels	*n*	*M*	*SD*	*F* (df=1709)	*p*	*Tukey post-hoc test results**
Password	Freshman	571	3.06	0.61	2.449	0.062	NS
	Sophomore	610	2.99	0.57			
	Junior	292	2.95	0.59			
	Senior	237	3.01	0.65			
Usage habit	Freshman	571	3.46	0.78	3.900	0.009	Freshman>Junior
	Sophomore	610	3.39	0.82			
	Junior	292	3.27	0.78			
	Senior	237	3.36	0.87			
Social media	Freshman	571	3.41	0.86	1.485	0.217	NS
	Sophomore	610	3.46	0.80			
	Junior	292	3.50	0.76			
	Senior	237	3.53	0.85			
Education	Freshman	571	3.55	0.72	2.404	0.066	NS
	Sophomore	610	3.51	0.75			
	Junior	292	3.48	0.58			
	Senior	237	3.63	0.75			

*NS: Non-significant

Discussion

To answer the first research question, it needs to investigate the college students' online duration, device daily use and cyber threats encountered. The results of demographic information showed that nearly half (49.8%) of college students spend more than 4 hours, with spam being the most common cyber threat. False rumors, online fraud, and pornographic content also had high incidence rates among undergraduates in China. Smartphones were the most popular device for online activities, with 61.3% of participants using them. These findings are consistent with a previous study conducted by Sun (2018), in which he found that 42% of college students spend more than four hours online per day, and identified spam as the number one online threat students face. Comparing the online duration between this study and the research of Sun (2018), we can infer that the Internet is more widely used than before with the rapid development of ICT. Regarding Internet access devices, Ahmed et al. (2017) also found that most of the participants (69%) preferred smartphones, which is also similar to the result of this study.

To answer the second research question, the difference between male and female students' online duration was examined. The results of the cross-analysis demonstrated that female college students spend more time online than male students. However, no similar analyses have been conducted in previous studies. This result can potentially be attributed to female students' inclination towards engaging in online activities such as online shopping, social media, and video consumption.

To answer the third research question, it needs to explore the preferred methods of cybersecurity education among students, as well as the variations observed among students from different majors. The study applied cross-analysis again, and the results demonstrated that students of different majors have different preferences in the learning methods of cybersecurity. Students of computer-related majors are more willing to accept professional education methods such as classroom teaching and special lectures, but non-computer majors prefer general education methods such as display boards and window publicity. Interestingly, most students majoring in liberal arts, physical education, or art do not like such a practical educational method as community activities. This result may be caused by the different knowledge backgrounds of different majors. Therefore, considering the knowledge background of students of different majors in the implementation of cybersecurity education is crucial for higher education institutes.

To answer the fourth question, the cybersecurity level of college students and their performance of each cybersecurity dimension including education were assessed. The study found that the overall cybersecurity level of college students is relatively high, which is in line with the findings of the study conducted by Alharbi and Tassaddiq (2021). However, the mean of the password dimension is relatively low compared with the other three dimensions. Specifically, most students can update applications regularly, pay attention to the safe use of devices and browsers, and protect personal privacy on social media. In addition, it is noteworthy that almost half of the participants expressed unfamiliarity with the process of reporting threats or suspicious activities on social media. This finding contrasts with the results of Alharbi and Tassaddiq's (2021) study, where over 70% of respondents claimed knowledge of reporting threats they encountered. This disparity could be attributed to the differences in the sample's countries or cybersecurity education levels. Regarding cybersecurity education, most students believe that colleges should strengthen their cybersecurity education. This finding aligns with previous literature. Garba et al. (2020) found that over 95% of respondents had the desire to learn more about cybersecurity, and it is necessary to teach students how to secure their internet connection. Password protection remains a significant problem and needs to be improved, which is consistent with previous literature. Moallem (2018) discovered that while most students recognize the importance of CSA, but they still do not pay much attention to security practices such as using strong passwords for different websites or avoiding weak passwords. Alharbi and Tassaddiq (2021) found that 60.7% of students found strong and long passwords annoying and used the same password for all their accounts and websites. The researchers believe that students lack sufficient cybersecurity knowledge, particularly in regards to passwords, or may not have experienced password incidents that directly caused trouble, causing them to undervalue the importance of passwords in their daily online activities. This finding underscores the potential for a gap between practicing good security measures and possessing adequate knowledge and understanding (Rajesh Chandarman & Brett Van Niekerk, 2017).

To answer the fifth question, it needs to examine the differences between male and female students in each measurement dimension of cyber security. The results of the independent samples t-test demonstrated that students of different genders exhibit significant differences in usage habits, social media, and education, but not in password. Male students' CSA is higher than female students' in usage habits and education, but female students perform better in social media, indicating that female students pay more attention to personal privacy protection, while male students attach more importance to practice. Regarding the differences in cybersecurity education, male students are familiar with legal issues of cybersecurity and feel more skillful in the solutions of network security issues. This is similar to the conclusion that males have better knowledge of cybersecurity than females found by Garba et al. (2020).

To answer the sixth research question, the differences among students of different majors in each measurement dimension were examined. The results of the One-way ANOVA test showed that the major category has no significant difference in password, usage habits, and social media. Surprisingly, computer major students' level is equal to other majors, although they have learned more IT knowledge from their professional courses. This finding is in line with the view that participants who show good IT knowledge in the survey are still weak in practice (Alotaibi et al., 2016). However, the first major group (liberal arts) is significantly different from the other two groups in education. Interestingly, the average mean of students in liberal arts is higher than that of students in the other two major categories in cybersecurity education, which is very consistent with the research of Sun (2018). To further explore where the differences exist, each question of education was tested. Interestingly, the results showed that students in liberal arts have great confidence in their cybersecurity ability and satisfaction with college education in cybersecurity. The study believes that the result may be due to differences in knowledge structure. Students majoring in liberal arts lack sufficient computer knowledge and understanding, so they think the knowledge is simple, and the skill is easy to master in the cybersecurity field.

To answer the last research question, the differences among students of different grades were examined by the One-way ANOVA test. The study found that school levels do not make a significant difference in CSA except for education. Similarly, the research of Matyokurehwa et al. (2020) reported that there is no statistically significant association between age and CSA. Surprisingly, the study found that freshmen perform better in usage habits of HTTP and devices, which

indicates that students' CSA levels do not improve or may even decrease during college in certain cybersecurity practices. The reason can be attributed to the fact that the university did not provide continuous cybersecurity education, so the education must be strengthened in higher education. On the other hand, students in higher grades think they are already proficient in using network applications, so they may think it is no longer necessary to attach importance to cyber risks.

Conclusion and Implications

In the context of limited literature on cybersecurity awareness and education for college students, this study utilized a quantitative approach and collected data through a survey instrument from ten local universities in China. Firstly, the study investigated students' online habits and the cybersecurity incidents they encountered, revealing that nearly half of the students spend more than 4 hours online daily, and female students tend to spend more time online than male students. Secondly, by analyzing data from the perspective of three cybersecurity dimensions: password, usage, and social media, the study found that most students have good awareness but weak practical skills, and gender, grade, and major also influence CSA. Lastly, through analyzing the participants' responses to education data, most students considered cybersecurity education necessary for colleges, and students of different majors had certain differences in the choice of cybersecurity education methods and self-evaluation of cybersecurity. Overall, despite having a certain level of awareness and knowledge of cybersecurity, college students still need to improve their practice skills, and colleges and universities should strengthen cybersecurity education.

Implications for Practice

The study is useful for researchers engaged in college students' cybersecurity education, especially in the design of questionnaires, analysis methods, and comparison of results. The analysis method of this paper can also serve as a reference for university network security investigators to obtain accurate evaluations of people's CSA. Moreover, this study has practical significance for cybersecurity education in universities, and three recommendations are outlined below.

First, it is crucial to strengthen the basic cybersecurity knowledge of all students, especially female students. The content should include daily applications such as passwords and responses to common cyber security threats. Although most participants have good knowledge of cybersecurity, such as passwords, they do not pay much attention to practice and continue to use the same passwords for different websites, indicating that they lack the knowledge to protect themselves and do not fully understand the importance of passwords in practice. In particular, liberal arts majors lack the necessary knowledge of network security, which results in their blind confidence.

Second, continuous cybersecurity education during college is necessary. This study found that students' cybersecurity levels did not increase but decreased in college due to the lack of readily available education (Hunt, 2016). In addition, colleges and universities should not solely rely on classroom teaching to improve students' CSA; instead, diversified education methods need to be explored.

Third, adopting appropriate cybersecurity education methods based on the knowledge structure of students of different majors is crucial. This study found that computer-related majors should offer more specialized courses and lectures, while non-computer majors need to adopt a universal approach. Additionally, network media publicity is a useful education method that cannot be ignored in cybersecurity education today.

Study Limitations and Further Work

Future research on cyber security awareness (CSA) among college students should consider including students from a wider range of higher education institutions to improve sample representativeness. While the survey questions used in this study were designed based on previous research and professional experiences, they may not be sufficient to comprehensively assess the level of CSA among college students. Future studies should also consider including additional variables such as physical security, Internet of Things security, mobile terminal security, and more, to gain a more comprehensive understanding of the current CSA level of college students. This information can then be used to develop more effective cybersecurity education programs tailored to the needs of different groups of students based on their grade

level and majors. In addition, future research could benefit from combining qualitative research methods, such as interviews, with the quantitative methods used in this study to generate more practical results.

Declarations

Conflict of interest the authors declare that they have no conflict of interest.

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Biodata of Authors

Hongbo Guo completed his undergraduate studies at Xi'an University of Science and Technology (Xi'an, China) in the School of Communication and Information Engineering in 2007; he received M.S degree from the same university majoring communication and information system in 2010. He is currently a Ph.D. candidate in General graduate school, Woosong University (Daejeon, South Korea) majoring IT management. Likewise, he is also an associate professor in School of Information Engineering, Yulin University (Yulin, China). His research areas are management information system, supply chain informatization, business data analysis, information security and Industry 4.0.

Hasan Tinmaz completed his undergraduate studies at Middle East Technical University (Ankara, Turkiye) in the Faculty of Education, Computer Education Department in 2001; he graduated from the same university's Graduate Program in Curriculum and Instruction in 2004. Having completed his doctoral studies with his thesis on the uses, gratification and integration of social media in Middle East Technical University, Computer Education and Instructional Technologies program, he still works as an Assist. Professor in AI & Big Data department of Endicott College of International Studies, Woosong University (Daejeon, South Korea). His research areas are social media, educational technology, curriculum and instruction design, technology management, psychological and sociological issues in technology, technology planning, Industry 4.0, Artificial Intelligence and Metaverse.

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Research Article

Investigation of the effects of secondary school students' psychological resilience and academic grit levels on mathematics achievement

Barış Demir [1]

Department of Mathematics Education, Education Faculty, Kocaeli University, Kocaeli, Turkiye

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Abstract

The aim of the study is to examine the achievement of secondary school students in mathematics courses based on psychological resilience and academic grit. In the research, descriptive survey model, one of the quantitative research methods, was used. In this context, data were collected from 204 students studying in secondary schools in the district of Görükle, Bursa, in the spring term of the 2022-2023 academic year. As a data collection tool "Brief Resilience Scale" adapted by Dogan (2015), "Academic Grit Scale" adapted by Sağkal et al. (2020) was used. In this study, students' mathematics achievement was determined according to the grades in the mathematics course at the end of the semester. While analysis of variance (ANOVA) and t-test were used for group comparisons, correlation analysis was used to determine the relationship between psychological resilience and academic grit levels. According to the research results, it was seen that the psychological resilience levels of the students were medium and their academic grit levels were medium. Although there was no statistically significant difference in the evaluations made in the context of mathematics course achievement, it was observed that the achievement of the course increased as the levels of psychological resilience and academic grit increased. In terms of different variables, it was seen that academic grit levels did not differ according to gender. It was determined that the psychological resilience levels showed a statistically significant difference according to the gender variable and the psychological resilience of male students was higher. It was observed that the levels of psychological resilience and academic grit did not differ according to grade levels. t was determined that there was a positive and moderate relationship between the mathematics course achievement of secondary school students and their levels of resilience and academic grit, and a positive and moderate relationship between their levels of resilience and academic grit.

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Introduction

It is very important to examine the factors affecting academic performance and achievement in school, which are considered to be an indicator of the quality of the education system and student goals. Academic achievement is an important criterion for determining the level of knowledge and skills acquired by students and is evaluated by various exams and applications at different educational levels from elementary school to university. Academic achievement, students, as well as their families, educators, managers, etc. It is an issue that is also cared about by. It is known that academic achievement is a determining factor on personal and professional development (Ateş, 2016; Ateş & Sağar,

[1] Corresponding Author: Dr., Department of Mathematics Education, Education Faculty, Kocaeli University, Kocaeli, Turkiye. E-mail: baris.demir@kocaeli.edu.tr. ORCID: 0000-0001-6997-6413

2021). Research provides information about self-concept, self-efficacy, motivation and study habits, intelligence, ability, personality and familial qualities, characteristics of school, study habits, exam anxiety, difficulty of lessons, teacher attitude, friend effect and other factors affecting academic achievement (Afemike, 1985; Al-Qaisy, 2011; Ateş, 2016; Chen et al., 1997; Goodman et al., 2011; Khan et al., 2012; Owoyele, 2009; Sharma & Sharma, 2018; Tabbodi et al., 2015; Taşlıyan, Hırlak & Harbaroğlu, 2015; Umoinyang, 1999; Yıldırım & Ergene, 2003). These factors are important factors that affect the academic achievement of students.

The problem of low achievement among students in mathematics, one of the core subjects of education, has become a growing concern among parents, teachers, researchers and society in general. According to research, many secondary schools report the same low math performance year after year. The measure of achievement or failure in mathematics is usually based on cognitive variables evaluated with intelligence (Umoinyang, 1999). Studies have shown that students' behavior, especially in science and especially in mathematics, is also greatly influenced by certain psychological or non-cognitive factors (Eduwem, Umoinyang & Otu, 2017). Afemike (1985) and Umoinyang (1999) found that psychological factors such as self-concept, attitude towards mathematics, gender-based stereotypes, study habits, confidence, test anxiety, motivation, interest in school, and problem-solving habits are associated with students' achievement. showed.

One of the reasons that enable students to be achievement both academically and socially in the school environment is psychological power factors. Psychological power factors gain more importance in academic research as they reveal the possibilities of coping with stress in individuals. An incompatible coping with stress emerges with a low level of psychological resilience, which causes dysfunctional work attitudes in individuals (Stainton et al., 2019). For this reason, it is thought that it is important to determine the psychological resilience and grit levels of the students.

Masten (2001) defines psychological resilience as seeing positive and positive results in the adaptation and development of the individual despite the serious negativities and great dangers that occur in his life. Rutter (2006), who defines psychological resilience as having a relatively good psychological outcome despite risk experiences that are expected to bring serious dangers, defines this situation as a feature that develops throughout life, emerges suddenly and becomes more evident in different periods of life, rather than a feature possessed by the individual considers it. Individuals with high psychological resilience have features such as producing alternative solutions to cope with difficulties, coping with stress, managing negative emotions, setting life goals, and establishing relationships that include social bonds. These features can increase students' interest and motivation in mathematics lessons and contribute to better learning results and academic achievement. Although psychological resilience depends on the individual's own characteristics, today and family should be evaluated together with the holistic situation that it constitutes (Dent & Cameron, 2003; Prince-Embury, 2010; Chen, Cheung, Fan & Wu, 2017).

The importance of grit is emphasized behind achievement in all other areas of life, from education to art, from politics to economy (Duckworth, 2006; Sarıçam, Çelik & Oğuz, 2016). Grit has been defined as the passion, effort and interest shown to achieve a long-term goal (Duckworth ,2006). Duckworth, Peterson, Matthews, and Kelly (2007) argue that grit is more important for the individual's academic, social, and professional achievement as well as their well-being than features such as cognitive ability, creativity, intelligence, charisma, and self-confidence. In recent years, studies aimed at measuring and examining academic grit rather than general grit have attracted attention. Academic grit can be defined as the ability of students to struggle with the difficulties they encounter in every environment and condition for achievement in education life, patience, endurance, and grit (Duckworth & Quinn, 2009). Academic grit can also be expressed as the desire and effort of students to reach their goals (Clark & Malecki, 2019). Since academic grit is defined as the power to overcome obstacles and difficulties, it is stated that it overlaps with the concept of resilience and even forms the basis of psychological resilience (Luthans, Luthans & Chaffin, 2019).

It is supported by research that the level of psychological resilience and academic grit levels have a positive effect on academic achievement. Psychological resilience has been associated with academic achievement and many studies have examined this relationship (Ateş & Sağar, 2022; Demir, 2023). These studies have shown that psychological resilience positively affects academic achievement. When the literature is examined, the variables of grit have a positive direction

with variables such as academic performance and academic achievement (Credé, Tynan & Harms, 2017; Çelik & Sarıçam, 2018; Hwang, Lim & Ha, 2018) have been found to be related. In a small number of studies conducted on adolescents as a concept of academic grit, it has also been concluded that academic grit significantly affects achievement (Clark & Malecki, 2019; Işıkçı & Çoklar, 2022).

Secondary school development periods are a period in which rapid developments are experienced in the field of physical, emotional, and interpersonal relations. During these periods, difficulties may be experienced in academic performance and social relations. At this level, the child's psychological resilience and academic grit can affect both academic and social achievement in the school environment. Due to its importance in determining mathematics achievement, the identification of students at risk of failure in the second level of primary education will contribute to teachers in terms of development and preventive studies. When the literature is examined, studies focus on studies examining the levels of resilience on teachers and university students (Ateş & Sağar, 2022; Demir, 2023; Credé, Tynan & Harms, 2017; Hwang, Lim & Ha, 2018). More research is needed to determine the effect of students' levels of psychological resilience and academic grit on their mathematics achievement. However, it is seen in the literature that the studies on secondary school students for mathematics lessons are limited. Therefore, this study is considered valuable and important in terms of the field. This type of study can help us better understand the effects of students' levels of psychological resilience and academic grit on their mathematics achievement. In addition, it is thought that determining the relationship between academic grit, which is stated to be the basis for psychological resilience in the literature, and the concept of psychological resilience will contribute to the field. The aim of this research is to examine the mathematics course achievement of secondary school students within the framework of their psychological resilience and academic grit levels. In this context, answers to the following questions were sought:

- What is the level of psychological resilience of secondary school students?
- What is the academic grit of secondary school students?
- Do the psychological resilience and academic grit levels of secondary school students differ according to the mathematics course achievement, gender, and grade variables?
- Is there a relationship between the psychological resilience, mathematics course achievement and academic grit levels of secondary school students?

Method

Research Model

In this study, descriptive survey model, one of the quantitative research methods, was used. Descriptive survey is a type of research that is carried out in the form of describing the situation of the living, existing ones, and experiences. Descriptive surveys are studies conducted on large groups, in which the opinions, competences and attitudes of individuals in the group about a phenomenon and event are taken, and the phenomena and events are tried to be described (Karakaya, 2012).

Participants

The research group is the 7th and 8th grades of secondary schools in Görükle district of Bursa province in the spring term of the 2022-2023 academic year. It consists of a total of 204 students, who are studying in their classes and who voluntarily participated in the research. In this context, the purposeful sampling method, which is one of the non-random sampling methods, was used in the research. Purposeful sampling method is a sampling method that enables the selection of rich situations related to the subject and collecting in-depth information in accordance with the purpose of the research (Fraenkel, Wallen & Hyun, 2012). In Table 1, descriptive data of the students are given.

Table 1. Demographic Information of Students

Variables	Groups	n	%
Gender	Female	112	54,9
	Male	92	45,1
Grade Level	7th grades	50	24,5
	8th grades	154	75,5
Mathematics Achievement Grade	Grade between 0-50	40	19,6
	Grade between 51-75	62	30,4
	Grade between 76-100	102	50,0
Total		204	100

According to Table 1, 112(54.9%) of the students participating in the research were female and 92 (45.1%) were male. When the distribution by grades is examined, it is seen that 50 (24.5%) students from 7th grades and 154 (75.5%) students from 8th grades participated in the research. For mathematics course achievement, 40(19.6%) of the students are academically achievement between 0-50, 62 (30.4%) between 51-75, 102 (50.0%) between 76-100.

Data Collection Tools

Two different measurement tools were used to collect data in the study. These measurement tools are short psychological resilience scale and academic grit scale, respectively. In addition, information about the sub-objectives of the research was obtained with a personal information form. In this study, the academic achievement of the students was determined based on the achievement of the mathematics course at the end of the semester.

Brief Psychological Resilience Scale (BRS)

In the study, the Brief Psychological Resilience Scale (BRS), developed by Smith, Dalen, Wiggins, Tooley, Christopher and Jennifer Bernard (2008) and adapted by Doğan (2015), was used to measure the resilience levels of students. The scale consists of one dimension and 6 items. Items 2, 4, and 6 on the scale are coded in reverse. The internal consistency coefficient for BRS was reported as 0.83. The expressions in the scale were used as "1= Not appropriate at all" and "5= Completely appropriate" and a 5-point Likert type scale.

Academic Grit Scale (AGS)

For academic grit, it was developed by Clark and Malecki (2019) and Sağkal and Özdemir (2020) "Academic Grit Scale" adapted into Turkish was used. The scale has a single factor structure and consists of 10 items. The Cronbach's Alpha coefficient for the reliability of the scale was expressed as .92, and the test-retest reliability as .90.

Analysis of Data

The data collected from the participants were analyzed with descriptive and inferential statistical methods. While calculating statistics such as mean and standard deviation as descriptive statistics, descriptive statistical methods were used to calculate skewness and kurtosis values for normality analyses. While analysis of variance (ANOVA) and t-test were used for group comparisons as inferential statistical methods, correlation analysis was used to determine the relationships between variables. All data analyzes were performed using the SPSS 23 statistical software program. As a result of the analysis, the ranges used when interpreting the average score obtained from the scales were determined as 1.00-1.80 “Very low”, 1.81-2.60 “Low”, 2.61-3.40 “Medium”, 3.41-4.20 “High”, 4.20-5.00 “Very high”.

Results

Descriptive Statistics for the Variables of the Research

In order to determine whether the variables have a normal distribution, skewness and kurtosis values, mean and standard deviation values were calculated.

Table 2. Definitional statistics of scores from scales

Variable	N	Cronbach	Min	Max	X	Ss	Skewness		Kurtosis	
							Value	Std.	Value	Std.
Psychological Resilience	204	,818	1,00	5,00	2,94	,968	-,021	,239	-,495	,474
Academic Grit	204	,866	1,00	5,00	3,40	,648	-,202	,239	,244	,474
Mathematics Achievement Grade	204		32,5	100	71,9	20,0	-,304	,239	-1,264	,474

Table2 when examined, it is seen that the skewness values of the variables are between -0.304 and - 0.021, and the kurtosis values are between -1.264 and 0.244. For the variables to have a normal distribution, the skewness and flatness values must be between +2 and -2 (George & Mallery, 2010). It was observed that the calculated values were included in the specified range, the assumption of normal distribution was met. The Cronbach alpha reliability values of the scales were calculated as 0.818 for the Brief Resilience Scale and 0.866 for the Academic Grit Scale these results show us that the scales used in the research are reliable.

Psychological Resilience

The first research question of the study, " What is the level of psychological resilience of secondary school students?". The findings regarding the sub-problem are given in Tables 3.

Table 3. Means and standard deviations of psychological resilience scale ıtems

Items	$\bar{X}$	S.D
I can recover quickly after difficult times.	2,97	1,315
I have difficulty coping with stressful events.	2,96	1,392
It doesn't take long for me to recover after stressful situations.	3,08	1,335
When something bad happens, it's hard for me to get over it.	2,97	1,374
I get through tough times with very little hassle.	2,69	1,288
It takes a long time for me to recover from the effects of negativity in my life	3,00	1,323
Total	2,94	0,968

When Table 2 is examined, it is seen that the psychological resilience levels of secondary school students are at a moderate level ($\bar{x}$ =2.94). When the environments are examined, the highest mean ($\bar{x}$ =3.08) is "It doesn't take long for me to recover after stressful situations." and the lowest mean ($\bar{x}$ =2.69) is "I get through tough times with very little hassle." was found to be.

Academic Grit

The second research question of the study, " What is the academic grit of secondary school students?". The findings due to the sub-problem are given in Tables 4.

Table 4. Means and Standard Deviations of Academic Grit Scale Items

Items	$\bar{X}$	S.D
I push myself at school to do my best.	3,47	,852
I will continue to work towards achieving my academic goals no matter how long it takes	3,42	,894
I try as hard as I can with my studies, even when I can do something more fun.	2,77	1,057
I complete my homework no matter how hard it is.	3,86	1,005
I try to do my best for my lessons.	3,81	,805
When I set a school-related goal, I try to overcome the difficulties that will arise.	3,56	,906
I can find a balance between making time for my hobbies and interests and studying hard.	2,93	1,171
Even if I have difficulties in school, I will continue to do my best.	3,44	1,000
I always try to do my best when it comes to finishing school work.	3,53	,908
I work hard at school to achieve difficult goals.	3,20	,968
Total	3,40	,648

When Table4 is examined, it is seen that the academic perseverance levels of secondary school students are at a high level ($\bar{x}$ =3,40). When the environments are examined, the highest average ($\bar{x}$ =3.86) is "I complete my homework no

matter how hard it is." and the lowest mean ($\bar{x}$ =2.77) is "I try as hard as I can with my studies, even when I can do something more fun." was found to be.

Differention of Psychological Resilience and Academic Grit

The third research question of the study, " Do the psychological resilience and academic grit levels of secondary school students differ according to the mathematics course achievement, gender and grade variables?". The findings regarding the sub-problem are given in Tables 5, Table 6 and Table 7.

Table 5. Independent sample t-test analysis of secondary school students' superior psychological resilience and academic grit scores in relation to gender variable

		$\overline{X}$	S.D	t	p
Academic grit	Female	3,39	,652	-0,81	0 ,936
	Male	3,40	,649		
Psychological Resilience	Female	2,75	,944	-2,234	0 ,028*
	Male	3,18	,955		

*p<0,05

When Table 5 is examined, it is seen that the academic grit scores of secondary school students do not differ statistically significantly according to the gender variable (p=0,936>0,05). In the analysis of psychological resilience levels according to gender variable, it was determined that there was a statistically significant difference in favor of male students(p=0,936>0,05).

Table 6. Independent sample t-test analysis of secondary school students' superior psychological resilience and academic grit scores in relation to grade level variable

		$\overline{X}$	S.D	t	p
Academic grit	7th grade	3,37	,662	0,238	0 ,810
	8th grade	3,41	,647		
Psychological Resilience	7th grade	2,92	,936	-0,648	0 ,458
	8th grade	3,02	1,077		

*p<0,05

When the total mean scores were examined, it was seen that there was no statistically significant difference between the academic perseverance and psychological resilience levels of secondary school students and the grade level variable. (ag-p=0,810>0,05/ pr-p=0,458>0,05). When the averages are examined in detail, it is seen that as the grade level increases, academic grit and psychological resilience levels increase.

Table 7. Analysis of variance of secondary school students' superior psychological resilience and academic grit scores according to mathematics course achievement variable

		$\overline{X}$	S.D	F	p
Academic grit	Grade between 0-50	3,26	,557	0,868	0 ,423
	Grade between 51-75	3,37	,732		
	Grade between76-100	3,47	,627		
Psychological Resilience	Grade between 0-50	2,68	1,083	2,198	0 ,116
	Grade between 51-75	2,87	1,053		
	Grade between76-100	3,13	,829		

*p<0,05

When the results in Table 6 are examined, it is seen that there is no statistically significant difference between the academic perseverance and psychological resilience levels of secondary school students and the mathematics course achievement variable (ag-p=0.810>0.05/ pr-p=0.458>0.05). When the averages are examined in detail, it is seen that as mathematics course achievement increases, academic grit and psychological resilience levels also increase.

Relationship between the Psychological Resilience, Mathematics Course Achievement and Academic Grit

The fourth research question of the study, " Is there a relationship between the psychological resilience, mathematics

course achievement and academic grit levels of secondary school students?". The findings regarding the sub-problem are given in Tables 7.

Table 7. Correlation results of secondary school students between academic grit, mathematics course achievement and psychological resilience

		Academic grit	Psychological resilience	Mathematics course achievement
Academic grit	r	1	0,308**	0,289**
	p	-	0,002	0,012
Psychological resilience	r	0,308**	1	0,394**
	p	0,002	-	0,000
Mathematics course achievement	r	0,289**	0,394**	1
	p	0,012	0,000	-

$^{**}p < 0,01$

According to the results in Table 7, there is a positive and moderate relationship between secondary school students' achievement in mathematics course and their levels of psychological resilience and academic grit (r = 0.394**, r = 0.289**). İn addition, statistically significant relationship was seen between students' psychological resilience and academic grit at a positive moderate level (r = 0.308**). In other words, as the self-efficacy scores increase, their academic grit also increase positively.

Conclusion and Discussion

In this study, the effects of secondary school students' levels of psychological resilience and academic grit on their mathematics achievement were examined. According to the results obtained, it was seen that the psychological resilience levels of the students were moderate and their academic grit levels were high. When the field is examined, it has been concluded that the psychological resilience levels are at a moderate level (Dikici, 2023; Erkoç & Danış, 2020; Hoşoğlu et al., 2018; Aslan, 2018; Çolak Sarı, 2018) in studies conducted at different levels and occupational groups. These results support the findings of our study. Studies with high (good) level of psychological resilience were also found (Ulukan, 2020; Güngörmüş et al., 2015; Yılmaz et al., 2008). A limited number of studies have been found in the literature on the emergence of academic grit levels. Soysal Işıkçı and Çoklar (2022), in their research examining the academic levels of high school students, reported a high level in parallel with the findings of our study.

As a result of the research, it was determined that the psychological resilience levels of secondary school students showed a statistically significant difference according to the gender variable, and the psychological resilience of male students was higher. It has been seen in the literature that there are studies supporting these research results (Bahadır, 2009; Sezgin, 2016; Hoşoğlu et al., 2018; Açıkgöz, 2016; Ernas, 2017; Güngörmüş et al.,2015; Önder & Gülay, 2008; Oktan, 2008; Cole et al..,2004). There are also studies in the literature in which the level of resilience does not differ according to gender (Aydın & Egemberdiyeva, 2018; Özer, 2013; Topçu, 2017; Varıcıer, 2019; Ulukan ,2020). In the findings of our study, it was determined that the academic levels of secondary school students did not show a statistically significant difference according to the gender variable. These results showed similarities with some studies in the literature (Gamel, 2014, Wallace, 2015; Ekinci & Hamarta, 2020; Kwon, 2018). It is seen in the literature that there are studies in which the level of academic grit differs according to gender (Soysal Işıkçı & Çoklar, 2022; Farroll, 2016; Clark & Malecki, 2019; Christensen & Knezek, 2014; Eskreis-Winkler et al., 2014; Oriol et al., 2017; Sağkal et al.., 2020).

It was observed that the levels of psychological resilience and academic grit did not differ according to grade levels.

In the study of Seçim (2020) and Gündaş (2015), a result in parallel with our study finding was found in terms of resilience levels according to grade levels. In Turgut's (2015) study, it was observed that levels of resilience differed significantly according to grade levels. Contrary to our study, it has been observed in the literature that the academic grit levels of the students differ significantly according to their grade levels (Işıkçı & Çoklar, 2022; Sağkal et al.,2020).

Although there was no statistically significant difference in the evaluations made in the context of mathematics course success, it was observed that the success of the course increased as the levels of psychological resilience and academic grit increased. When the literature was examined, it was found that the variable of perseverance was positively related to variables such as academic performance and academic success (Credé, Tynan & Harms, 2017; Çelik & Sarıçam, 2018; Hwang, Lim & Ha, 2018). A small number of studies on the concept of academic perseverance on adolescents have also concluded that academic grit significantly affects success (Clark & Malecki, 2019; Işıkçı & Çoklar, 2022).

In this study, it was determined that there was a positive, moderate relationship between mathematics course success, psychological resilience and academic grit levels. These results showed that resilience and academic grit positively affect academic achievement in mathematics. Studies examining the relationship between resilience and success in mathematics, either directly or indirectly, found similar results (Reis et al., 2004; Oktan, 2008; Allan, 2014; Ayyash-Abdo et al., 2016; Durmuş, 2016; Kaya et al., 2016; Bacchi & Licinio, 2017; Allan et al., 2014; Borman & Overman, 2004; Novotny & Kremenkova, 2016; Sakız & Aftab, 2019; Ateş & Sağar, 2022; Demir, 2023). In addition, Demir (2023) examined the psychological resilience of secondary school students and their academic resilience towards mathematics and concluded that psychological resilience positively and significantly affects students' academic resilience in mathematics. Contrary to these results, Yalçın (2020) reported that there is no significant relationship between psychological resilience and science and mathematics achievement grades in his study.

As a result, studies show that academic perseverance and resilience positively affect academic achievement. Students with high levels of psychological resilience and academic grit may exhibit better academic performance. For this reason, it is important for teachers and school administrators to use various strategies to support students' academic perseverance and psychological resilience. At the secondary school level, the psychological resilience and academic grit of the child can affect both academic and social success in the school environment. Due to its importance in determining mathematics achievement, it is necessary to identify students who are at risk of failure in the second level of primary education, and to carry out developmental and preventive studies for teachers. Educators can evaluate students' psychological resilience and academic grit levels by conducting one-on-one interviews with students and using scientific approaches. They can develop educational programs and strategies to increase students' resilience and academic grit. These approaches can be seen as an important turning point in increasing the academic success of students.

In addition to quantitative studies on different psychological factors in addition to the psychological resilience and academic perseverance variables of secondary school students, qualitative studies can also be conducted.

Limitations of Study

The research was carried out with a limited sample of 204 students studying in the 7th and 8th grades of secondary schools in the district of Görükle in Bursa. Repeating this study with more participants and examining different variables will increase generalizability. The study was carried out using purely quantitative data.

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Biodata of Author

Dr. **Barış Demir** is lecturer at Kocaeli University Faculty of Education. He holds a Ph.D. in Bursa Uludağ University, and a M.A. in mathematic education from Gazi University.His academic interests are mathematics education and mathematical modeling. He has articles and presentations on these topics. Affiliation: Kocaeli University, Faculty of Education, Kocaeli, Türkiye. E-mail: baris.demir@kocaeli.edu.tr ORCID: 0000-0001-6997-6413

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Research Article

Comparison of mathematics self-efficacy perceptions of gifted and normally developing primary school students

Ramazan Divrik [1]

Primary School Department, Trakya University, Edirne, Turkiye

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Abstract

This study aims to compare the mathematics self-efficacy perceptions of gifted and normally developing primary school students according to different variables (gender, grade, preferred course, being a gifted/normally developing student). For this purpose, the study was designed according to the survey design. The study group consisted of 63 gifted Science and Art Center students and 89 primary school students (3-4th grade). The study data were collected with the "Mathematics Self-Efficacy Perception Scale" and "Personal Information Form." Before analyzing the obtained data, the normality condition of the data was checked. An Independent Sample t-test was used to analyze the data that met the normality condition. In contrast, the Man Whitney U test was used to analyze the data that did not meet the normality condition. As a result of the data analysis, according to the class variable, the mathematics self-efficacy of 3rd-grade normally developing students differed significantly in the attitude sub-dimension and the whole scale compared to 4th-grade students. 3rd grade gifted students showed a significant difference in mathematics self-efficacy only in the motivation sub-dimension compared to their peers with normal development. According to the gender variable, it was determined that the math self-efficacy of gifted male students differed significantly in the motivation sub-dimension compared to their normally developing male peers. According to the variable of favorite course, it was seen that gifted students who preferred mathematics courses in the first place differed significantly in the attitude sub-dimension of mathematics self-efficacy and the whole scale compared to gifted students who did not prefer mathematics courses in the first place. The mathematics self-efficacy of normally developing students who preferred the mathematics course in the first place differed significantly in all three sub-dimensions (attitude, motivation, and practice) and the whole scale compared to their peers who did not prefer the course in the first place. The mathematics self-efficacy of gifted students who chose other courses in the first place differed significantly in attitude and motivation sub-dimensions compared to normally developing students who preferred other courses in the first place. According to the variable of being a gifted/normally developing student, the mathematics self-efficacy perceptions of gifted primary school (3-4th grade) students differed significantly only in the motivation sub-dimension compared to their normally developing peers.

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Introduction

Mathematics, which is vital as a branch of science and essential in explaining and interpreting the world we live in, is an

[1]Corresponding Author: Assist. Prof. Dr., Primary School Department, Faculty of Education, Trakya University, Edirne, Turkiye. E-mail: ramazandivrik@trakya.edu.tr. ORCID: 0000-0002-7126-7664

abstract concept with a systematic structure and includes sequential images and generalization principles (Cotton, 2008; Utanir, 2008). Since abstract concepts are difficult to learn, students have prejudices against this course; students experience fears such as "I can not do it," "I can not succeed," and "I can not overcome" (Ashcraft & Faust, 1994; Demir, 2017). One of the main reasons mathematics is complicated for students is due to the teachers who used to teach under strict discipline or the education system based more on memorization today. In addition, giving importance to students' cognitive development in mathematics and not giving the necessary extent to their affective development can also be shown among the main reasons for these fears (Utley, 2004; Yenilmez & Uygan, 2010). However, if teachers conduct their lessons with activities that emphasize the fun and relaxing aspect of mathematics, they can prevent this thought from occurring. Mathematics, which is taught systematically from the preschool period to the last years of primary school, contributes to students' scientific life and systematically produces solutions to the problems encountered in daily life. Due to this importance, the importance of teaching mathematics, which is emphasized at every level and in every subject from primary school to higher education programs, is increasing day by day, and it is noted that the necessary importance should be given to the affective characteristics of students as well as their cognitive characteristics (Alakoc, 2003; Altun, 2005; Yenilmez & Uygan, 2010).

Some essential concepts affect the affective characteristics of individuals towards a situation or event (Baypinar & Tarim, 2019). Among these concepts, self-efficacy appears before educators as an essential concept that affects individuals' behaviors. The concept of self-efficacy as the belief that a job can be done means the ability of a person to do a certain activity or to get a certain result (Zulkosky, 2009). Self-efficacy is the perception that individuals have the potential to perform the actions they need to fulfill specific tasks within a particular plan. Bandura (1986) defines the concept of self-efficacy as "a person's self-perception of whether an activity can be done or not." Unlu (2021) described this concept as "one's judgment about one's capacity to accomplish a task." Based on these definitions, self-efficacy is "the perception or belief that individuals can fulfill the requirements of any field, profession, job or discipline (Karali & Cosanay, 2022). Observations on self-efficacy perception show that individuals who do not struggle with the difficulties encountered or who give up immediately due to the stress they experience are known to have low performance (Pajares, 2002). On the contrary, it is known that individuals with high self-efficacy perception do not give up immediately in the face of the difficulties they face and try to overcome these difficulties by struggling (Pajares, 1996). Bandura (1986) stated that individuals with high self-efficacy perception finalize their performance in all conditions. While self-efficacy perception is a factor that positively affects individuals' performances, it also has positive effects on affective skills that play an important role in individuals' lives. Individuals with high self-efficacy can set high goals for themselves to accomplish a task and be motivated to fulfill this task without depending on external factors. Individuals with high self-efficacy perception who provide high-level motivation can improve their affective skills along with their cognitive processes (Akbas & Celikkaleli, 2006).

Although the definitions reveal that self-efficacy positively affects individuals' performance, it should not be forgotten that this concept is not the only factor for success. Because self-efficacy perception is not the performance of an individual in accomplishing a task but their belief that they can do this task (Spicer, 2004). Therefore, individuals with high self-efficacy make an evaluation in the face of the problems they face, decide whether they will complete this task successfully or not, and take action. As a result of this decision, they concentrate on the task for a long time and struggle without giving up until they complete the task successfully (Schunk, 1989). In addition, the abilities and interests of individuals cause this concept to be more prominent. For example, a student who has a talent for mathematics or likes this subject has a high mathematics self-efficacy perception. On the other hand, it is known that individuals with high mathematics self-efficacy perception are more successful in overcoming the obstacles they face to succeed. On the other hand, low self-efficacy perceptions of individuals with prejudice towards mathematics cause low achievement (Bandura, 1986; Margolis & McCabe, 2006). These explanations show that self-efficacy is an essential concept in mathematics education.

Mathematics self-efficacy perception is the students' general self-efficacy in mathematics-related subjects and their belief that they can overcome mathematical problems (Ozturk, 2017). The curriculum states, " *Students will be willing*

to learn mathematics. They believe that they can learn mathematics. They enjoy dealing with mathematics. They trust themselves in mathematics." The inclusion of these learning outcomes, such as "Students should have competence not only in cognitive skills but also in affective skills in mathematics", comes to the forefront (Ministry of National Education [MoNE], 2018). Therefore, besides having sufficient cognitive skills, students should also have practical skills in achieving the mathematics course outcomes. For example, suppose a student knows how to solve a mathematical problem but thinks that he/she cannot solve the problem or lacks self-confidence in problem-solving, he/she may not be able to solve the problem successfully. However, if they have the confidence that they can solve the problem and are willing to solve it, they can successfully solve the problem by trying to solve it.

Mathematics self-efficacy is an individual's perception of their abilities to complete the mathematics-related performance process (Ural et al., 2008). As a determinant of mathematics performance, mathematics self-efficacy perception enables students to approach complex problems calmly and logically, be aware of their mathematical skills, and believe that they will succeed. Students with high self-efficacy perception concentrate their attention on learning the subject during the lesson. In contrast, students with low mathematics self-efficacy are timid towards mathematics, think they cannot solve problems, are skeptical about the solution, and may fail (Ozturk & Sahin, 2015). In addition, students with high math self-efficacy have high academic achievement and low anxiety levels (Hackett & Betz, 1989; Schunk, 1989; Stevens et al., 2004).

Students' mathematics self-efficacy has been shown to increase in lessons that create positive student experiences (Hall & Ponton, 2005). Therefore, to improve students' mathematics self-efficacy perceptions, teachers should use fun methods in mathematics lessons, allocate enough time to students, and give students the necessary feedback (Gedik & Aykac, 2017). However, while teachers give more space to practices to improve students' cognitive performances in classroom activities, they offer less space to activities that develop affective skills, which are extremely important in developing well-rounded students (Karali & Cosanay, 2022). In this case, it should not be forgotten that the effort and determination of teachers to analyze the subject to be taught and to bring students to the desired goal have essential effects on students' self-efficacy (Pajares & Urdan, 2006). Teachers' inclusion of practical activities that motivate students and help them gain self-confidence by considering multidimensional students in their lesson plans affects students' better understanding of mathematical concepts, application skills, and attitudes toward learning (Ordonez-Feliciano, 2009). Crezo (2004) interviewed students from different schools and different grades who experienced problem-based learning and found that problem-based learning changed students' learning processes and increased their motivation. This method enabled students to learn more about the subject and created excitement about participating in the lesson. The creative drama method positively affected students' self-efficacy perceptions towards mathematics courses (Gedik & Aykac, 2017). It was determined that the scenario-based learning method significantly impacted self-efficacy perception (Tol & Cenberci, 2019).

Although teachers fulfill their duties by using different methods to improve students' mathematics self-efficacy perceptions, not all students' mathematics self-efficacy perceptions may be at the desired level. This is because the self-efficacy of students with different mental competencies and emotional characteristics (gifted students, normally developing students, and students with learning disabilities) may differ even though they are studying in the same class.

In the literature, there are studies in which students' self-efficacy at the primary school level was examined according to different variables (Altuntas 2021; Medikoglu, 2020), and the relationship between academic achievement, attitude, and mathematics self-efficacy was examined together (Akyurek Tay et al., 2020; Cavdar & Sahan, 2019). At the middle school level, studies were conducted to reveal the effects of different variables (Adal & Yavuz, 2017; Doruk et al., 2016; Haciomeroglu & Elmali-Erdem, 2021; Ozturk & Kurtulus, 2017; Sevgi & Yakisikli, 2020) and different practices (creative drama, scenario-based learning) on self-efficacy (Gedik & Aykac, 2017; Sevgi & Zihar, 2020). The effect of scenario-based education on mathematics self-efficacy perception at the ninth-grade level of high school was examined (Tol & Cenberci, 2019). The mathematics self-efficacy levels of senior high school students were analyzed according to some variables (Tasdemir, 2012). Studies were conducted on the self-efficacy perceptions of pre-service primary school teachers towards mathematics teaching (Arseven et al., 2015) and the effect of

mathematics self-efficacy perception of pre-service mathematics teachers on anxiety toward teaching mathematics (Ural, 2014). In addition, a study was conducted to reveal the effect of mathematics self-efficacy resources of gifted middle school students on their mathematics anxiety (Yurt & Kurnaz, 2015). Studies have shown that self-efficacy affects mathematics achievement, and students with high self-efficacy have high mathematics achievement (Callahan, 1971; Medikoglu, 2020; Nicolaidou & Philippou, 2003; Pajares & Miller, 1994). However, no study was found in which the mathematics self-efficacy of both gifted and normally developing students was examined in terms of different variables at the primary school level.

It is known that gifted students are highly capable of understanding and reasoning about mathematical ideas (Miller, 1990). These individuals are eager to study, highly motivated, and creative (Mingus & Grassl, 1999). These students, who can be flexible in mathematical operations and thinking, can produce alternative solutions by activating their skills of organizing and associating data in solving a problem. They can easily comprehend mathematical structures, generalizations, and abstract expressions; they can test the truth or falsity of a structure. In addition, they are curious about learning mathematical ideas; they are faster and more competent in comprehension and application than their peers (Erdogan & Erben, 2018; Miller, 1990; Sriraman, 2005; Wieczerkowski et al., 2000; Young & Worrell, 2018). Therefore, it is thought that this study comparing the mathematics self-efficacy of gifted and normally developing primary school students will significantly contribute to the literature.

It was observed that the studies in the literature addressed the effects of different practices according to other variables within groups or between groups. For example, among personal experiences, social persuasions, vicarious experiences, and psychological states that constitute the self-efficacy resources of gifted middle school students, only personal experiences had a significant effect on gifted students' mathematics anxiety (Yurt & Kurnaz, 2015). It was found that there was a positive relationship between mathematics anxiety and mathematics self-efficacy perceptions of 3rd and 4th-grade normally developing students (Altuntas, 2021). It was observed that there was a significant difference between the academic self-efficacy of gifted students and the academic self-efficacy of normally developing students studying in the 4th grade of primary school. It was determined that the academic self-efficacy perceptions of gifted students in Turkish, Mathematics, Science, and Social Studies courses were relatively high compared to normally developing students (Aksoy, 2014). The general emotional intelligence, managing emotions, and motivation levels of gifted students were higher than those of normally developing students (Yildiz, 2019). Therefore, this study will significantly contribute to the literature by comparing the mathematics self-efficacy perceptions of gifted and normally developing primary school students. At the end of the study, it is thought that the results obtained from the comparison of mathematics self-efficacy of gifted and normally developing primary school students will guide teachers of primary school and gifted students to consider individual differences when planning mathematics activities with their students and to differentiate and enrich mathematics activities.

Problem of Study

In this study, in which the mathematics self-efficacy perceptions of gifted and normally developing primary school students (grades 3-4) are compared, the following questions will be answered:

- Is there a statistically significant difference between the mathematics self-efficacy perceptions of gifted and normally developing primary school students according to the grade variable?
- Is there a statistically significant difference between the mathematics self-efficacy perceptions of gifted and normally developing primary school students according to the gender variable?
- Is there a statistically significant difference between the mathematics self-efficacy perceptions of gifted and normally developing primary school students according to their favorite course variable?
- Is there a statistically significant difference between the mathematics self-efficacy perceptions of gifted and normally developing primary school students according to the variable of being a gifted/normally developing student?

Method

Research Model

Relational survey design was used in the study. Relational survey design aims to reveal the current situation or the level of change between two or more variables (Fraenkel et al., 2012; Karasar, 2013). In the study, the effect of gender, grade, favorite course, and being a gifted/normally developing student variables on elementary school students' mathematics self-efficacy was examined.

Participants

The study, which was conducted to compare the mathematics self-efficacy of gifted and normally developing primary school (3-4th grade) students, was conducted by including 152 primary school students studying in Afyonkarahisar province in the study using convenience sampling. The convenience sampling method, one of the purposive sampling methods, is a sampling method preferred to speed up the research (Ekiz, 2009). The research was conducted by reaching gifted students at the Science and Art Center, where the researcher worked in the fall semester of 2022-2023. For the primary school normally developing students, the researcher collected the data by reaching the primary school students studying in their immediate vicinity. Information about gifted and normally developing primary school students is shown in Table 1.

Table 1. Demographic information of gifted and normally developing students

Status	Variable	Gifted		Normally Developing	
		f	%	f	%
Group	Gifted/Normal	63	41.45	89	58.55
Grade	3rd grade	30	19.74	44	28.95
	4th grade	33	21.71	45	29.60
Gender	Female	28	18.42	38	25
	Male	35	23.02	51	33.56
Popular lesson	Mathematics	28	18.42	29	19.08
	Other	35	23.02	60	39.48

When Table 1 is examined, 41.45% of the students participating in the study were in the gifted group, and 58.55% were in the normally developing group. 19.74% of the 3rd-grade students were in the gifted group, and 28.95% were in the normally developing group. While 21.71% of 4th-grade students were gifted, 29.60% were in the normally developing students group. 18.42% of the female students, were gifted, and 25% were normally developing. While 23.02% of the male students were gifted, 33.56% were in the normally developing students group. In addition, 18.42% of the students, who liked the math course at first place, were gifted, and 19.08% were normally developing students. 23.02% of the students, who liked other courses, were gifted, and 39.48% were in the normally developing students group.

Data Collection Tools

The "Mathematics Self-Efficacy Perception Scale" developed by Karalı and Cosanay (2022) for primary school students was used to compare the mathematics self-efficacy perceptions of gifted and normally developing primary school students (3-4th grade). The scale consists of 13 questions and includes three sub-dimensions (Attitude, Motivation, and Application). Cronbach's Alpha reliability coefficient was calculated as 0.84 in the reliability analysis of the scale prepared in a triple Likert style. The Cronbach Alpha reliability coefficient calculated for this study was 0.72. The "Personal Information Form" prepared by the researcher was used to collect personal information about the students' grades, gender, favorite course preferences, and the schools they attended.

Analysis of Data

The data subjected to analysis in the study were collected in the first week of the second semester of the 2022-2023 academic year. The researcher collected the scale from primary school students in 20 minutes with the support of classroom teachers. Before data collection, the researcher made the necessary explanations and told the students that this form contained no evaluation elements. Whether the mathematics self-efficacy perceptions of primary school

students differed statistically significantly according to the variables of grade, gender, favorite course, and being a gifted/normally developing student was examined with the help of the SPSS 26 program. Before starting the analysis, the normality of the data set was checked. The data related to the procedures performed to check the normality condition are shown in Table 2.

Table 2. Normality test results of the data

Status	Variable	n	Min	Max	*M*	sd	Kolmogorov-Smirnov		
							Statistic	df	Sig.
Gifted	3rd-grade	30	24	38	32.36	3.72	0.104	30	0.200*
	4th-grade	33	21	38	31.39	5.16	0.148	33	0.066*
Normally Developing	3rd-grade	44	22	37	32.5	3.61	0.129	44	0.065*
	4th-grade	45	22	38	30.75	4.27	0.119	45	0.121*
Gifted	Female	28	23	38	31.46	4.28	0.134	28	0.200*
	Male	35	21	38	32.17	4.75	0.135	35	0.104*
Normally Developing	Female	38	24	37	32.26	3.51	0.146	38	0.041
	Male	51	22	38	31.13	4.35	0.123	51	0.054*
Gifted	Mathematics	28	23	38	33.89	3.80	0.146	28	0.134*
	Other	35	21	38	30.22	4.44	0.116	35	0.200*
Normally Developing	Mathematics	29	28	38	34.51	2.78	0.220	29	0.001
	Other	60	22	37	30.21	3.80	0.144	60	0.003
Gifted/Normally Developing	Gifted	63	21	38	31.81	4.52	0.126	63	0.014
	Normally Developing	89	22	38	31.61	4.03	0.108	89	0.012

Table 2 shows the results of the Kolmogorov-Smirnov test for the variables of class, gender, favorite course, and being a gifted/normally developing student. According to the results of the Kolmogorov-Smirnov test, when the p (Sig.) value of the data obtained is larger than 0.05, it can be said that the data are normally distributed (Can, 2019). According to the grade, gender, and favorite subject (for gifted students) variables of primary school students, the data are above the desired values ($p>0.05$). In the variables of gender and favorite course (for normally developing students) and being a gifted/normally developing student, the data are below the desired values ($p<0.05$). In this case, since the data according to grade level, gender, and favorite course (for gifted students) showed normal distribution, the Independent Sample t-test, one of the parametric tests, was used. Since the data according to gender, favorite course, and being a gifted/normally developing student variable (for normally developing students) did not show normal distribution, the Man Whitney U test was used, one of the non-parametric tests.

Results

Findings According to Grade Variable

The results of the independent sample t-test conducted to determine whether the mathematics self-efficacy perceptions of gifted and normally developing students differed according to their grade level are shown in Table 3.

Table 3. Mathematics self-efficacy perceptions of gifted and normally developing students by grade level

Group	Dimension	Grade	n	*M*	sd	df	t	*p*
Gifted	Attitude	3rd-grade	30	10.23	2.86	61	-0.478	0.635
		4th-grade	33	10.54	2.31			
	Motivation	3rd-grade	30	11.20	1.27	61	1.777	0.081
		4th-grade	33	10.33	2.38			
	Application	3rd-grade	30	10.93	1.01	61	1.144	0.257
		4th-grade	33	10.51	1.75			
	Total	3rd-grade	30	32.36	3.72	61	0.849	0.399
		4th-grade	33	31.39	5.16			
Normally Developing	Attitude	3rd-grade	44	11.38	1.46	87	2.483	0.015*
		4th-grade	45	10.46	1.98			
	Motivation	3rd-grade	44	10.25	1.51	87	0.784	0.435
		4th-grade	45	9.97	1.75			
	Application	3rd-grade	44	10.86	1.39	87	1.621	0.109
		4th-grade	45	10.31	1.79			
	Total	3rd-grade	44	32.5	3.61	87	2.075	0.041*
		4th-grade	45	30.75	4.27			

According to Table 3, it is seen that gifted students' mathematics self-efficacy perceptions of the three sub-dimensions and the whole scale do not differ significantly according to the grade variable [t(61)=-0.478; t(61)=1.777, t(61)=1.144; t(61)=0.849, p>0.05]. The mathematics self-efficacy perceptions of normally developing students in the attitude sub-dimension and the whole scale differed significantly according to the grade variable [t(87)=2.483; t(87)=2.075, p<0.05]. There is no significant difference in motivation and application sub-dimensions according to the grade variable [t(87)=0.784; t(87)=1.621, p>0.05].

The results of the Man Whitney U test conducted to reveal whether the mathematics self-efficacy perceptions of gifted and normally developing students differed according to the grade variable are shown in Table 4.

Table 4. Mathematics self-efficacy perceptions of gifted and normally developing students by grade level

Grade	Dimension	Students	n	Rank Average	Rank Total	*U*	*p*
3rd grade	Attitude	Gifted	30	32.58	977.5	512.5	0.098
		Normally Developing	44	40.85	1797.5		
	Motivation	Gifted	30	46.23	1387	398	0.003*
		Normally Developing	44	31.55	1388		
	Application	Gifted	30	36.93	1108	643	0.843
		Normally Developing	44	37.89	1667		
	Total	Gifted	30	36.68	1100.5	635.5	0.786
		Normally Developing	44	38.06	1674.5		
4th grade	Attitude	Gifted	33	39.92	1317.5	728.5	0.886
		Normally Developing	45	39.19	1763.5		
	Motivation	Gifted	33	43.88	1448	598	0.127
		Normally Developing	45	36.29	1633		
	Application	Gifted	33	41.03	1354	692	0.595
		Normally Developing	45	38.38	1727		
	Total	Gifted	33	41.52	1370	676	0.500
		Normally Developing	45	38.02	1711		

According to Table 4, while the mathematics self-efficacy perceptions of gifted and normally developing students differed significantly only in the motivation sub-dimension at the 3rd-grade level (U=398, p<0.05), there was no significant difference in the other sub-dimensions and the whole scale (U=512.5; U=643; U=635.5, p>0.05). At the

4th-grade level, the mathematics self-efficacy perceptions of gifted and normally developing students did not differ significantly (U=728.5; U=598; U=692; U=676, p>0.05).

Findings According to Gender Variable

The results of the independent sample t-test conducted to reveal whether gifted students' mathematics self-efficacy perceptions differed according to their gender are shown in Table 5.

Table 5. Mathematics self-efficacy perceptions of gifted students by gender

Group	Dimension	Gender	n	*M*	sd	df	t	*p*
Gifted	Attitude	Female	28	10.21	2.55	61	0.500	0.619
		Male	35	10.54	2.61			
	Motivation	Female	28	10.75	1.64	61	-0.014	0.989
		Male	35	10.74	2.21			
	Application	Female	28	10.50	1.47	61	1.048	0.299
		Male	35	10.88	1.43			
	Total	Female	28	31.46	4.28	61	0.613	0.542
		Male	35	32.17	4.75			

According to Table 5, it is seen that gifted students' mathematics self-efficacy perceptions of the three sub-dimensions and the whole scale do not differ significantly according to gender variable [t(61)=0.500; t(61)=-0.014, t(61)=1.048, t(61)=0.613, p>0.05].

The results of the Man Whitney U test conducted to reveal whether the mathematics self-efficacy perceptions of normally developing students differed according to their gender are shown in Table 6.

Table 6. Mathematics self-efficacy perceptions of normally developing students by gender

Group	Dimension	Gender	n	Rank Average	Rank Total	*U*	*p*
Normally Developing	Attitude	Female	38	43.69	2228	902	0.572
		Male	51	46.76	1777		
	Motivation	Female	38	44.06	2247	921	0.684
		Male	51	46.26	1758		
	Application	Female	38	41.66	2124.5	798.5	0.139
		Male	51	49.49	1880.5		
	Total	Female	38	42.33	2159	833	0.257
		Male	51	48.58	1846		

According to Table 6, it is seen that the mathematics self-efficacy perceptions of normally developing students belonging to the three sub-dimensions and the whole scale do not differ significantly according to the gender variable (U=902; U=921; U=798.5; U=833, p>0.05).

The results of the Man Whitney U test conducted to reveal whether the mathematics self-efficacy perceptions of gifted and normally developing students differed according to the gender variable are shown in Table 7.

Table 7. Mathematics self-efficacy perceptions of gifted and normally developing students by gender

Gender	Dimension	Students	n	Rank Average	Rank Total	*U*	*p*
Female	Attitude	Gifted	28	29.34	821.5	415.5	0.126
		Normally Developing	38	36.57	1389.5		
	Motivation	Gifted	28	37.86	1060	410	0.098
		Normally Developing	38	30.29	1151		
	Application	Gifted	28	30.14	844	438	0.200
		Normally Developing	38	35.97	1367		
	Total	Gifted	28	31.20	873.5	467.5	0.401
		Normally Developing	38	35.20	1337.5		
Male	Attitude	Gifted	35	42.39	1483.5	853.5	0.728
		Normally Developing	51	44.26	2257.5		
	Motivation	Gifted	35	52.20	1827	588	0.005*
		Normally Developing	51	37.53	1914		
	Application	Gifted	35	47.96	1678.5	736.5	0.150
		Normally Developing	51	40.44	2062.5		
	Total	Gifted	35	47.39	1658.5	756.5	0.230
		Normally Developing	51	40.83	2082.5		

According to Table 7, the mathematics self-efficacy perceptions of gifted and normally developing female students did not differ significantly in all three sub-dimensions and the whole scale (U=415.5; U=410; U=438; U=467.5, p>0.05). While the mathematics self-efficacy perceptions of gifted male students differed significantly only in the motivation sub-dimension (U=588, p<0.05), there was no significant difference in the other sub-dimensions and in the whole scale (U=853.5; U=736.5; U=756.5, p>0.05).

Findings According to Favorite Course Variable

The results of the independent sample t-test conducted to reveal whether gifted students' mathematics self-efficacy perceptions differed according to the mathematics course chosen in the first place are shown in Table 8.

Table 8. Mathematics self-efficacy perceptions of gifted students according to their mathematics preferences

Group	Dimension	Course	n	*M*	sd	df	t	p
Gifted	Attitude	Mathematics	28	12.07	1.78	61	5.653	0.000*
		Other	35	9.05	2.32			
	Motivation	Mathematics	28	11	1.41	61	0.915	0.364
		Other	35	10.54	2.31			
	Application	Mathematics	28	10.82	1.56	61	0.520	0.605
		Other	35	10.62	1.37			
	Total	Mathematics	28	33.89	3.80	61	3.462	0.001*
		Other	35	30.22	4.44			

According to Table 8, gifted students' mathematics self-efficacy perceptions of the attitude sub-dimension and the whole scale differ significantly according to the mathematics course selected in the first place [t(61)=5.653; t(61)=3.462, p<0.05]. There is no significant difference in the sub-dimensions of motivation and application according to the mathematics course selected in the first order [t(61)=0.915; t(61)=0.520, p>0.05].

The results of the Man Whitney U test conducted to reveal whether the mathematics self-efficacy perceptions of normally developing students differed according to the mathematics course chosen in the first place are shown in Table 9.

Table 9. Mathematics self-efficacy perceptions of normally developing students according to their mathematics preferences

Group	Dimension	Course	n	Rank Average	Rank Total	*U*	*p*
Normally Developing	Attitude	Mathematics	29	67.86	1968	207	0.000*
		Other	60	33.95	2037		
	Motivation	Mathematics	29	57.02	1653.5	521.5	0.002*
		Other	60	39.19	2351.5		
	Application	Mathematics	29	54.05	1567.5	607.5	0.016*
		Other	60	40.63	2437.5		
	Total	Mathematics	29	64.17	1861	314	0.000*
		Other	60	35.73	2144		

According to Table 9, the mathematics self-efficacy perceptions of normally developing students regarding the three sub-dimensions of the scale and the whole differ significantly according to the mathematics course variable chosen at first place (U=207; U=521.5; U=607.5; U =314, p<0.05).

The results of the Man Whitney U test to reveal whether the mathematics self-efficacy perceptions of gifted and normally developing students differed according to the favorite course variable are shown in Table 10.

Table 10. Mathematics self-efficacy perceptions of gifted and normally developing students according to favorite course

Favorite Course	Dimension	Students	n	Rank Average	Rank Total	*U*	*p*
Mathematics	Attitude	Gifted	28	27.52	770.5	364.5	0.494
		Normally Developing	29	30.43	882.5		
	Motivation	Gifted	28	30.54	855	363	0.458
		Normally Developing	29	27.52	798		
	Application	Gifted	28	27.91	781.5	375.5	0.593
		Normally Developing	29	30.05	871.5		
	Total	Gifted	28	28.43	796	390	0.797
		Normally Developing	29	29.55	857		
Other Courses	Attitude	Gifted	35	38.87	1360.5	730.5	0.013*
		Normally Developing	60	53.33	3199.5		
	Motivation	Gifted	35	58.37	2043	687	0.004*
		Normally Developing	60	41.95	2517		
	Application	Gifted	35	49.81	1743.5	986.5	0.613
		Normally Developing	60	46.94	2816.5		
	Total	Gifted	35	47.70	1669.5	1039.5	0.935
		Normally Developing	60	48.18	2890.5		

Table 10 shows that the mathematics self-efficacy perceptions of gifted students who like mathematics and normally developing students do not differ significantly (U=364.5; U=363; U=375.5; U=390, p>0.05). While the mathematics self-efficacy perceptions of gifted students who liked other courses and normally developing students differed significantly in the attitude and motivation sub-dimension (U=730.5; U=687, p<0.05), there was no significant difference in the application sub-dimension and the whole scale (U=986.5; U=1039.5, p>0.05).

Findings According to the Variable of Being a Gifted/Normally Developing Student

The results of the Man Whitney U t-test conducted to determine whether the mathematics self-efficacy perceptions of gifted and normally developing students differed between the groups are shown in Table 11.

Table 11. Mathematics self-efficacy perceptions of gifted and normally developing students

Dimension	Students	n	Rank Average	Rank Total	*U*	*p*
Attitude	Gifted	63	71.48	4503.5	2487.5	0.232
	Normally Developing	89	80.05	7124.5		
Motivation	Gifted	63	89.42	5633.5	1989.5	0.001*
	Normally Developing	89	67.35	5994.5		
Application	Gifted	63	77.63	4891	2732	0.779
	Normally Developing	89	75.70	6737		
Total	Gifted	63	78.21	4927.5	2695.5	0.685
	Normally Developing	89	75.29	6700.5		

According to Table 11, the mathematics self-efficacy perceptions of gifted and normally developing students differed significantly in the motivation sub-dimension (U=1989.5, p<0.05). There is no significant difference between the groups in attitude and application sub-dimensions and the whole scale (U=2487.5; U=2732; U=2695.5, p>0.05).

Conclusion and Discussion

While there was no significant difference between the mathematics self-efficacy perceptions of gifted 3rd and 4th-grade students, the mathematics self-efficacy of 3rd-grade normally developing students differed significantly in favor of 3rd-grade students in the attitude sub-dimension and the whole scale compared to 4th-grade students. According to this result, while the grade variable was not effective on gifted students, it was effective on primary school normally developing students (in the attitude sub-dimension and the whole scale). The fact that the mathematics self-efficacy perception of secondary school students differed according to the grade level variable supports the results of our study (Ozturk & Kurtulus, 2017). According to this result, it can be evaluated that the grade variable is an effective variable on students' mathematics self-efficacy in primary school normally developing students. Medikoglu's (2020) findings that self-efficacy perception decreases as the grade level increases and that mathematics anxiety decreases and interest and motivation towards mathematics increase as mathematics self-efficacy perception increases to support the results of our study. However, Uzar (2010) found that mathematics self-efficacy perception did not differ according to grade level. The decrease in students' mathematics self-efficacy as the grade level increases in elementary school may be because students who face a high course load may get bored in the face of intensive lessons or be unable to conduct enjoyable lessons. The increase in grade level leads to a rise in the number of abstract subjects and thus causes students to experience learning difficulties. However, providing creative learning environments that will make abstract and complex mathematical concepts in students' minds concrete and engaging can prevent this problem (Tanriseven Uredi et al., 2008).

While the mathematics self-efficacy of 3rd-grade gifted students showed a significant difference compared to normally developing 3rd-grade students only in the motivation sub-dimension, it was determined that the mathematics self-efficacy of 4th-grade gifted and normally developing students did not differ. According to this result, it can be said that the mathematics self-efficacy of gifted 3rd-grade students in the motivation sub-dimension is higher than that of their peers. It can be seen as an expected result that the motivation of gifted students, who have high independent movement skills and are very eager to study, is high. Because these students are curious about learning mathematical ideas, they can exhibit high motivation to start and sustain a task (Erdogan & Erben, 2018; Miller, 1990). However, the fact that there was no significant difference between gifted students and normally developing students at the 4th-grade level can be considered an unexpected result. This is because gifted students receive differentiated education according to their interests and abilities outside of school. The fact that these educations provide concrete experiences, use materials, and require high attention suggests that they will positively affect the mathematics self-efficacy perceptions of these students.

It was determined that mathematics self-efficacy perception did not differ significantly between gifted male and female students and normally developing male and female students. In addition, while there was no significant difference between gifted female students and normally developing female students, it was determined that the

mathematics self-efficacy of gifted male students differed significantly in the motivation sub-dimension compared to normally developing male students. According to this result, it can be said that gifted male students are more motivated than their peers with normal development. Medikoglu (2020) determined that gender was an essential variable in determining mathematics self-efficacy in a study conducted with primary school students, which supports the result of the study. However, some studies show that gender is not an important variable in determining the mathematics self-efficacy of secondary school students (Haciomeroglu & Elmali-Erdem, 2021; Sevgi & Yakisikli, 2020).

According to the variable of favorite course, it was seen that the mathematics self-efficacy of gifted students who preferred the mathematics course in the first place differed significantly in the attitude sub-dimension and the whole scale compared to the gifted students who did not prefer the mathematics course in the first place. The mathematics self-efficacy of the normally developing students who preferred the mathematics course in the first place differed significantly in all three sub-dimensions and the whole scale compared to their peers who did not prefer the mathematics course in the first place. According to these results, the mathematics course chosen in the first place affects the mathematics self-efficacy of gifted students in the attitude sub-dimension and the whole scale. In contrast, it affects the mathematics self-efficacy of normally developing students in all three sub-dimensions and the whole scale. The fact that there is a significant relationship between students' attitudes towards mathematics and mathematics self-efficacy perception level supports the results of our study (Cavdar & Sahan, 2019). Related studies have shown that students with positive attitudes toward mathematics have a positive academic achievement (Bas et al., 2021; Razzouk, 2011). Therefore, it is considered that students who love mathematics will also have high mathematics self-efficacy perceptions based on the fact that students will be successful in affectionately loved courses. However, the mathematics self-efficacy of gifted students did not differ significantly, only in motivation and application sub-dimensions. This result may be because gifted students receive process-based and application-oriented education. Therefore, the fact that most gifted students receive this education may have caused them not to make a significant difference in the application sub-dimension. In addition, based on an item in the motivation sub-dimension of gifted students, the fact that most gifted students marked the statement "I can easily understand the mathematics lesson" as "always" may have led to this result. In addition, the fact that these students need less external force to start and continue their activities may be shown as the reason why their mathematics self-efficacy did not differ significantly in the motivation and application sub-dimensions.

It was determined that mathematics self-efficacy perception did not differ between gifted students who preferred mathematics in the first place and normally developing students who preferred mathematics in the first place. However, there is a significant difference in the attitude and motivation sub-dimensions of gifted students who prefer other courses in the first place compared to normally developing students who prefer other courses in the first place. According to these results, it can be said that even if gifted students prefer other courses first, their mathematics self-efficacy is higher in the attitude and motivation sub-dimensions compared to their peers because gifted students are more motivated and interested in mathematics lessons. After all, they are more capable of understanding and reasoning mathematical ideas than other students (Ataman, 2004; Caglar, 2004; Mingus & Grassl, 1999; Tuttle & Becker, 1980).

According to the results of comparing gifted and normally developing students between the groups, gifted primary school (Grade 3-4) students' mathematics self-efficacy perceptions differed significantly only in the motivation sub-dimension compared to their normally developing peers (Grade 3-4). There is no significant difference between the two groups in other sub-dimensions. According to this result, it can be said that gifted students are more motivated towards mathematics lessons than their peers. The result that self-efficacy perception showed a statistically significant difference according to school type supports this study result (Tasdemir, 2012). The fact that gifted students are highly motivated to carry out their tasks from the beginning to the end may have been effective in this result (Sternberg & Davidson, 2005). Although these students sometimes experience motivation and anxiety problems due to the high expectations and perfectionist structures of their parents and environment, they do not want to be successful because their close environment wants them to be successful but because they want to be successful. These students, who strive

to achieve their goals by concentrating their thoughts on an extensive range of areas, aim with the desire for superior learning without expecting to be encouraged and appreciated (Caglar, 2004).

Recommendations

The study was conducted with gifted and normally developing students at the 3rd and 4th-grade primary school levels. Future studies can be performed in which gifted and normally developing middle school or higher levels students are included in the study group. These studies can use different variables (parental education status, mathematics achievement, etc.). Experimental studies can be conducted to measure the development in mathematics self-efficacy perceptions of gifted and normally developing students. Studies can be planned to reveal which group these variables are more effective. In order to generalize the results obtained, research can be conducted with study groups with more students.

Limitations of Study

This research is limited to the quantitative research method and the survey design conducted with this method. It is limited to 63 students studying at the Science and Art Center in Afyonkarahisar province at the 3rd and 4th-grade level in the 2022-2023 academic year and 89 primary school students studying at a primary school in that province. The data obtained are limited to the interview form consisting of four variables and a scale of 13 items created for this study.

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Biodata of Author

Dr. **Ramazan Divrik** is an assistant professor in the Department of Primary Education at Trakya University. In 2007, he started to work as a primary school teacher in the Ministry of National Education and completed his master's degree at Selçuk University and his doctorate at Necmettin Erbakan University, Department of Primary School Education. During his tenure at the Ministry of National Education, he worked as a primary school teacher and school administrator. He worked as a primary school teacher in Science and Art Centre. He has studies on mathematics education in primary school and education of gifted students. **Affiliation:** Trakya University, Edirne, Turkiye. **E-mail:** ramazandivrik@trakya.edu.tr **ORCID:** 0000-0002-7126-7664

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Research Article

Investigation of the relationship between emotional intelligence and sportsmanship behavior levels of students participating in school sports

Hacı Şükrü Taştan [1]

Sports Management, Faculty of Sport Sciences, Niğde Ömer Halisdemir University, Niğde, Turkiye

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Abstract

The aim of this research is to examine the emotional intelligence and sportsmanship behavior levels of student athletes who take part in the girls and boys basketball teams competing in the star and junior category in the basketball semi-finals organized by the Turkish School Sports Federation within the scope of school sports. In the research, it is envisaged that suggestions will be made for planning emotional intelligence training to improve the sportsmanship behavior of national and international professional basketball player candidates, and that it will make positive contributions to the sports lives of the athletes and indirectly to their social lives. Quantitative research method was used in the research. The sample of the research is a simple random sample of the 10-17 age group middle school and high school athletes participating in the girls and boys semi-finals in the school sports basketball star and youth a categories, which are included in the school sports activity program of the 2022-2023 season academic year. It consists of 239 students selected by the method. Emotional Intelligence and Multidimensional Sportsmanship Orientation scales were applied to the participants. SPSS statistical package program was used in the analysis of the obtained data. Frequency analysis, percentage trend analysis, factor analysis, correlation analysis were performed descriptively in the analyses. The findings obtained as a result of the analysis were interpreted and reported. According to the research results; a significant and weak relationship was found between the emotional intelligence and sportsmanship behavior levels of the athlete students. The use of emotional intelligence by basketball athlete students can be associated with their sportsmanship behaviors in basketball competitions. Course or weekly course topics that will increase the emotional intelligence development of students studying at this level can be added to the curriculum. In this sense, the study can give ideas about students' emotional intelligence training needs, career development and improvement areas.

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Introduction

Physical education and sports lessons have an important place in the physical and mental education of human resources of societies. States want their people of all age groups and social statuses to be physically and mentally healthy. In this context, it attaches importance to and supports physical education and sports with the plans and projects they make at all levels, from the birth to the death of the individual. An important part of these is the Physical Education and Sports course, which is included in the national education plans in primary and secondary education. The aim of the Ministry of National Education (MoNE) Physical Education and Sports lesson curriculum is "*to bring students to the next level of*

[1] Corresponding Author: Dr., Sports Management, Faculty of Sport Sciences, Niğde Ömer Halisdemir University, Niğde, Turkiye. E-mail: h.sukrutastan@ohu.edu.tr. ORCID: 0000-0001-5082-4698

education by developing their self-management skills, social skills and thinking skills along with movement skills, active and healthy life skills, concepts and strategies that they will use throughout their lives. they are prepared." (MoNE, 2018). As stated in this definition, the main purpose of the course is to emphasize the importance of emotional intelligence development in order to socialize and socialize the individual, that is, to adapt to the environment. Along with this, the vision of "Being the most successful country in international school sports competitions with our student athletes who have adopted local and universal values" regarding the participation of students in sports, with the Department of School Sports established within the body of the Ministry of Youth and Sports (MYS), which is the other ministry, is the OSDB's "*service to develop, plan and organize its activities and activities in a way that embraces all students; to create an athlete infrastructure by spreading sports to the grassroots, to spread the sports culture and the spirit of olympism in schools; It has a mission to represent the country successfully and qualified in international school sports competitions*" (OSDB, 2023). It is seen that both MoNE and MYS have goals such as preparing and training athletes for competitions in order to raise future generations healthy and to represent the country in international competitions within the scope of school sports. In this context, state executive bodies are working diligently in the field of sports in order to raise the welfare level of societies to higher levels in the globalizing, changing, developing and increasing competitive environment.

In addition to the positive effects of sports on human character, the positive effects of participating in sports activities on the physical and mental health of people are known. When the national education system is examined, it is seen that the aim is to raise individuals physically and mentally healthy (Alper, 2020). In this sense, schools are at the forefront of units that regularly direct individuals between the ages of 10-18, through physical education and sports lessons and school sports, together with local governments (Öcal & Koçak, 2010). In this context, school sports competitions organized between schools are important.

With the protocol signed between the General Directorate of Youth and Sports and the Ministry of National Education, it was decided to use the youth sports facilities of the General Directorate of Sports and to organize official sports competitions and youth activities. With this protocol, it is aimed to disseminate and develop school sports, social and cultural activities, and sports culture and sports activities in schools (OSYT, 2022). Moreover Turkish School Sports Federation was established with the aim of "In order to ensure the development of sports in schools and its spread throughout the country; to make short, medium and long-term plans and programs; to take, implement and enforce the necessary decisions and measures in these matters" (R.G., 2007). The Federation was closed in 2023 with the Presidential decree numbered 148, and its duties are carried out by the School Sports Department under the General Directorate of MYS Sports Services (R.G., 2023).

There are local, group, semi-final and Türkiye championship competitions in school sports. School teams that will participate in the competitions in the 2022-2023 Academic Year School Sports Activities Basketball Sports Branch Application Principles are in the Junior, Star and Youth category; It has been stated that it will consist of a maximum of 12 (twelve) student athletes (OSYT, 2022). Competition categories, education and training level, birth dates and age ranges are given in Table 1. Schools can only participate in one of the Junior (A) and (B) categories. In addition, the legal expenses of the convoy are covered by the Provincial Directorates of Youth and Sports, which organizes the organization.

Table 1.OSYT competition categories, education and training level, birth dates and age ranges

Category	Education and Training Stage	Competition Stage	Dates of Birth	Age Range (as of 2022)
Little ones	Primary school	Local	01.09.2012-2013-2014-2015-2016	6-9 Age
Minors	Middle school	Local/National	2011-2012	10-11 Age
Stars	Middle school	Local/National	01.09.2008- 2009-2010	12-13 Age
Juniors (B)	High school	Local	2007-2008	14-15 Age
Juniors (A)	High school	Local/National	01.09.2004- 2005-2006-2007-2008	14- 17 Age

Considering the positive benefits of school sports and physical education lessons for the physical and mental development of children, it is seen as an important tool for young people who are in their growing age. While the lung and cardiovascular capacities of the students increase with the exercises done in sports, their immune systems also develop. In addition, the flexibility and endurance of the students' muscular system increases (Lee, 1991). It is stated that students who participate in school sports have higher levels of socialization, extroversion, responsibility, general behavioral development and academic success than students who do not (Öcal & Koçak, 2010). In addition, it is stated that sports and exercise reduce the effects of depression and have positive effects on memory, classroom behavior and intellectual performance (Oğuz & Oğuz, 2017; Trudeau & Shephard, 2008).

Sport, which is an important tool for creating a healthy society and integrating with the world, is also an important criterion that shows the welfare level of societies (Yazıcı, 2014). Many countries carry out many practices that will improve sports with goals such as training athletes at professional level or increasing participation in many sports branches (Alper, 2020). With these policies, countries use sports as a tool to improve the general health of the society, support social life, increase social welfare, raise healthy generations and fight loneliness (Hoye, Nicholson, & Haulihan, 2015; cited in: Balcı, Gök & Akoğlu, 2018).

One of the subjects that have been researched in recent years is the concept of emotional intelligence. The problem of the research is the decrease in the time spent by children aged 10-18, who are in the age of development of academic success expectation in parents, and the decrease in the interest in Physical Education and Sports lessons, which are planned to be given as a compulsory course in schools. In recent years, the concept of emotional intelligence has emerged as a subject that has been intensively covered as a master's and doctoral thesis. When the concept of "emotional intelligence" was scanned on the Higher Education Council Theses platform between 2000-2023, there were a total of 641 records (HEC Theses, 2023). These studies conducted in the last two decades emphasize that not only IQ is sufficient for the development of human intelligence, but also the need to develop EQ.

In the emotional intelligence researches, it can be said that the individual's being oriented towards human relations, taking the person into consideration, interacting with them by establishing empathy (sympathy), providing motivation to the group members and establishing a relationship based on trust reveal the necessity of the individual's emotional intelligence abilities in the social environment (Somuncuoğlu, 2005; Serrat, 2017; Koppad et al., 2023). It is emphasized that emotional intelligence skills should not develop in order for a person to fulfill his roles in the group he is in in order to achieve his goals in social life and to be successful (Chaplin, 2015).

As Maslow stated in the hierarchy of needs pyramid, the emotional and social needs of the person should be met as well as the physical needs of the person (Maslow, 1943). For this, it is necessary to develop the emotional, intellectual and social characteristics of individuals, in short, their emotional intelligence. It is considered that the use of emotional intelligence abilities in the socialization and socialization processes of individuals will contribute positively to their motivation(Guy-Evans, 2023). For this reason, it can be thought that individuals should have high emotional intelligence skills in order to meet these needs (Turan et al., 2019)

Emotional intelligence; It can be expressed as abstract skills that enable the individual to understand his own and others' feelings, motivate the people around him, understand what the other person is feeling by creating empathy with

them, and be successful in human relations (Martin, 2018). The first academic use of the concept of emotional intelligence began in the USA in 1985 with the doctoral thesis of W.L. Payne (Dökmen, 2008). In the 1990s, it is seen in many studies that the individual's success in social life is important not only with IQ ability, but also with EQ. Emotional intelligence was evaluated as a part of social intelligence in the studies of Salovey and Mayer. They emphasized the concept of social intelligence as a person's ability to use his/her own internal states, harmony with the environment and social abilities well and to act in the light of these abilities (Dağlı et al., 2010). It can be stated that emotional intelligence is a skill that directly affects the relations of the individual with others in their social environment. Emotional intelligence can be acquired from birth or can be learned later. It can be said that the individual's maturation by developing himself and developing his relations with his environment are the effects of emotional intelligence (Eymen, 2007). It is stated in the literature that there are two models as a talent-based emotional intelligence model and a mixed emotional intelligence model (Mayer & Salovey, 1990; Goleman,1995; Bar-On, 1997; Cooper & Sawaf, 1997). The mixed emotional intelligence model belonging to Goleman is examined in its sub-dimensions as self-consciousness, self-activation or motivation, managing emotions, understanding the emotions of others and managing relationships with others or social skills (Doğan, 2005).

In sports competitions, the concept of sportsmanship, fair play, olympicism or ethical values in sports comes to the fore (Güllü et al., 2021). Violent events, racism, separatist discourses or the situations of individuals with limited opportunities are handled in universal values and it is argued that these behaviors are wrong in every platform, and societies with universal unity are tried to be created (FIFA, UEFA, 2023). "*Fair Play; Although honest play is expressed as honest behavior, its real meaning is above ethical behavior. Ethical behavior means applying the rules with honesty and respect in all matters. Fair Play, on the other hand, is to reveal the superior human spirit in life by suppressing personal interests and ambitions*." (TMOKFK, 2023). When the concept of fair play is evaluated in the sports approach, it is seen that "sports" evokes action, while "fair play" evokes the moral side of sports action (Yıldıran, 2011). Studies are carried out on ethical approaches in sports practices, sports management and organizations, looking at fair play behavior from the perspective of athletes, coaches, referees and managers (Arıpınar & Donuk, 2011).

The concept of fair play is also used together with the concept of sportsmanship. Sportsmanship refers to the good behavior expected from male or female athletes in sports competitions. In other words, sportsmanship is defined not to win the competition unfairly with illegal behavior, but to show good behavior to the opponent whether he wins or loses (Güllü, 2018). Sportsmanship behavior; It includes the features that can maximize sports ethics such as courage, patience, sincerity, self-confidence, self-control, respect for the opponent and teammate, kindness, goodness, nobility, honor and generosity, which are desired by the athletes (Güllü & Şahin, 2018; Turan, 2020). The International Sportsmanship Association established the principles of sportsmanship in 1926; He stated eight different principles as "*Obey the rules, stick to your teammates, keep yourself fit, control your anger, avoid violent behavior in the game, do not brag about your victory, do not collapse in a loss, be strong-spirited and open-minded to have a healthy body*" (Keating, 2007; Koç, 2013).

Another purpose of competition in school sports is to compare the abilities of students. Sportsmanship does not consider what behavior the athletes should exhibit in these competitions, but how they should behave (Turan, 2020). For example; It is shown as sportsmanship that an athlete removes his opponent from the ground, which he has dropped intentionally or unintentionally, that the wrong decision is corrected by the players when the referees make a wrong decision, and that the athletes fully comply with the rules. Sportsman individual; It is stated as an individual with good morals, noble, respectful, beneficial to the society, improving himself physically and mentally (Gürpınar, 2009).

With the Physical Education and Sports Lesson in the curriculum of the Ministry of National Education, sports awareness and moral principles in sports are given to students in schools. While explaining the importance of moral principles in sports in these lessons, sports ethics and values such as developing sports awareness, socialization, always being honest and respectful towards their opponents and teammates, behaving "fair play" and making them a way of behavior by participating in school sports. related gains are expected to be achieved (MEB, 2023). In these courses, students can go beyond sports morals with their ambition to succeed. On the contrary, physical education lessons are an

important environment in which students should learn moral values and develop awareness of rules, depending on their achievements. As a matter of fact, it can be said that relatively speaking, students exhibit sportsmanlike behavior in accordance with sports morals and values in physical education and sports classes (Altun & Güvendi, 2019).

In this sense, the moral and humanitarian general aims of school sports are; It is considered very important to create awareness of physical, mental and social health in students and to gain them these values. In line with these general objectives, the adaptation of the individual to social life is realized by creating the awareness of rules, as well as gaining values such as solidarity, cooperation, justice, tolerance and benevolence in students (Pehlivan, 2004).

The Genevan philosopher and writer Jean-Jacques Rousseau wrote in his book "Emile or On Education", that his first education in children's education is completed by physically directing him to walk and talk. By gradually dominating his movements, he discovers his body, develops mastery of the body and creates a measure for power (Jean-Jacques Rousseau 2009; Köktürk, 2019). It is seen that the development of physical and cognitive abilities of each individual takes place in a natural process. It is known that sport, which has an important place in the development of these abilities, contributes positively to the mental and physical development of people in many researches, as well as making important contributions to the socialization and socialization of individuals sociologically.

Problem of Study

In this study, it was aimed to examine the relationship between emotional intelligence and sportsmanship behavior levels of students participating in school sports. It is evaluated that the research will contribute to the development of healthy and happy individuals and to social welfare and production by evaluating the relationship between the emotional intelligence levels and sportsmanship behaviors of the students participating in school sports, which will play an important role in the future, in the field of basketball sports, and by developing suggestions for the planning of future emotional intelligence training.

In this context, the building blocks of the future are young people doing sports at the age of development, participating in Physical Education and Sports classes at school, IQ (intelligence quotient) for their academic success as well as their physical development, and EQ (for them to take an active role in socialization, socialization and social life adapting to social life). Emotional intelligence) development is also seen as important. In this sense, the research is considered to make original and important contributions to the field.

For this purpose, answers to the following questions will be sought: Is there a relationship between the emotional intelligence development of athlete students and their emotional intelligence levels?

Method

Research Model

Quantitative research method was used in the research. In the research, descriptive scanning was conducted to determine the attitudes, opinions, expectations and behaviors of the people (Gürbüz & Şahin, 2018). In the first part of the research, analyzes are formed in the light of the information obtained from the literature related to the research topic. In the second part of the study, the analysis and interpretation of the data obtained from the emotional intelligence levels and sportsmanship behavior scales are included.

Participants

The population of the research is 10-17 age group athlete students who participated in the girls and boys semi-finals in the Star and Youth A categories, which were organized between 23-26 May 2023 in the 2022-2023 academic year School Sports Activity Program. GSB School Sports, 2023). As the sample of the research, 239 people who were determined by simple random method participated in the research. In the simple random sampling method, each individual in the population is equally and independently likely to be selected (Büyüköztürk, 2010).

In determining the sample size, ready-made tables that were calculated and prepared before were used (Karagöz, 2016a, Karagöz, 2016b; Gürbüz & Şahin, 2018). According to the minimum sampling table accepted for different populations, the 99% confidence interval was calculated as 217 in the population with 500 (Gürbüz & Şahin, 2018). This sample size was considered sufficient as 239 people participated in the study. Questionnaires were applied to the participants face-

to-face and electronically and simultaneously with the Google Forms application by the researcher.

Data Collection Tools

The population of the research is 10-17 age group athlete students who participated in the girls and boys semi-finals in the Star and Youth A categories, which were organized between 23-26 May 2023 in the 2022-2023 academic year School Sports Activity Program. GSB School Sports, 2023). Emotional Intelligence and Multidimensional Sportsmanship Orientation scales were applied to the participants. In order to save time and money in their research, researchers can benefit from scales that are generally developed or scales whose validity and reliability have been proven in previously completed studies (Gürbüz & Şahin, 2018). In this study, data collection tools that were previously applied or developed with this method were used.

Emotional Intelligence Scale

In this study, "Wong and Law Emotional Intelligence Scale" (WLEIS - Wong and Law Emotional Intelligence Scale) developed by Wong and Law (2002), based on the emotional intelligence thoughts of Salovey and Mayer (1990), was used to measure the emotional intelligence level of students. The scale used by Melike Kıvanç Sudak (2013) in Turkey consists of a total of 16 expressions and 4 dimensions: self-evaluation of emotions (KDD), evaluation of others' emotions (BDD), use of emotion (DK) and emotion regulation (DZ).

Multidimensional Scale of Sportsmanship Orientation

The Multidimensional Sportsmanship Orientation Scale (MSOS-25), originally developed by Vallerand et al. (1997), is a 5-point Likert-type scale consisting of 25 items and 5 sub-dimensions. The Multidimensional Sportsmanship Orientation Scale, which was adapted to Turkish by testing the factor structure, validity and reliability of the scale by Sezen Balçıkanlı (2009), has 4 sub-factors and 20 items: Compliance with Social Norms, Respect for Rules and Management, Commitment to Responsibilities in Sports, Respect for Competitors (Sezen- Balçıkanlı, 2009).

In the questionnaire used in the research, 42 questions were asked to the participants in 3 separate sections. Within the scope of the research, demographic information (6 questions), Emotional Intelligence scale (16 questions) and Multidimensional Sportsmanship Orientation Scale (20 questions) were applied.

Analysis of Data

In the research, the data collection tools were applied to the sample group with a simple random method from the universe and the collected data were transferred to the electronic environment through the microsoft office program. The data transferred to the electronic media were analyzed in the IBM SPSS (Statistical Package for the Social Sciences) 18 statistical program and the findings were reached. The findings obtained from the analysis were interpreted and reported.

In the research, frequency analysis, percentage trend analysis and correlation analysis were performed descriptively. In addition, correlation analysis was conducted to determine the existence and severity of a mutual relationship between two variables or multiple variables (Gürbüz & Şahin, 2018). Since kurtosis and skewness values are between +1.5 and -1.5, it can be said that the data are normally distributed (Tabachnick & Fidell, 2013).

Results

In this part of the research, the results of the analysis regarding the relationship between the emotional intelligence levels of the students participating in school sports in basketball sports and their sportsmanship behaviors are included. The demographic findings of the participants are given in Table 2.

Table 2. Descriptive statistical distribution of demographic information

Demographic Variables	Groups	Frequency (n)	Percent (%)
Gender	Female	141	59
	Male	98	41
Age	Middle school between the ages of 10-15	111	46.4
	High school between the ages of 15-18	128	53.6
School level	Public	114	47.7
	Special	125	52.3
Academic achievements	Very good	95	39.7
	Good	91	38.1
	Middle	47	19.7
	Bad	6	2.5
	Too bad	0	0
Reason for participating in competitions	Being a professional basketball player	164	68.6
	Participating in sporting activities	63	26.4
	Being healthy	12	5.0
	Total	**239**	**100.0**

Table 2 contains descriptive statistical information about the demographic information of the athletes participating in the research. A total of 239 people participated in the research. According to the findings, 141 (59%) of the participants were female and 98 (41%) were male. Considering the age and educational status distribution of the participants, there are 111 (46.4%) middle school athletes between the ages of 10 and 15 at the U 12 level, and 128 (53.6%) of the U18 level high school athletes between the ages of 15-18.

While 114 (47.7%) of the participants attend public schools, 125 (52.3) attend private schools. While there were 95 people (39.7%) with very good academic achievement, 91 people (38.1%) with good, 47 people (19.7%) with average, 6 people (2.5%) with bad academic achievement. There are no participants. The reasons for participating in the competitions were 164 (68.6%) professional basketball players, 63 (26.4%) participating in sports activities, and 12 (5.0%) being healthy.

Table 3. Results of correlation analysis between research variables

Variables	$\bar{x}$	SS	1	2
Emotional intelligence	3.59	0.59	-	
Sportsmanship behavior	4.17	0.48	0.30**	-

**p< 0.01, n=239

Table 3 shows the correlation relations and significance levels between the factors of the research dimensions. According to the results in the table; there is a significant and positive weak ($0 < r \leq 0.3$) correlation between participants' emotional intelligence and sportsmanship behavior (r=.30) (p<.01). It can be shown as an important proof of the existence of a relationship between the emotional intelligence levels of the students participating in the school sports basketball competitions and their sportsmanship behaviors against their rivals in the competitions.

Table 4. Results of correlation analysis between sub-dimensions of research variables

Variables		x̄	SS	KDD	BDD	DK	DD	SNU	KYS	SSB
Emotional intelligence	KDD- Evaluating of wn Emotions	3.7144	.86195	-						
	BDD-The value of other people's feelings.	3.5649	.85779	.166*	-					
	DK-Emotion use	3.8389	.76538	.468**	.036	-				
	DZ-Emotion regulation	3,2207	.96045	.453**	.186**	.417**	-			
Sportsmanship behavior	SNU-Compliance with Social Norms	4.3607	.57362	.011	.287**	.046	.171**	-		
	KYS-Respect for Rules and Management	4.0611	.57346	.173**	.255**	.212**	.256**	.560**	-	
	SSB-Commitment to Responsibilities in Sports	4.2117	.56199	.115	.136*	.221**	.236**	.489**	.615**	-
	RS-Respect the Opponent	4.0351	.61911	.056	.186*	.074	.217**	.595**	.593**	.557**

*p<0.05, **, p< 0.01, n=239

Table 4 shows the correlation relations and significance levels between the sub-dimensions of the research variables. According to the results in the table, there is a significant positive weak correlation (p<0.05) between the emotional intelligence sub-dimension of the participants, KDD-Evaluating one's own emotions, and the sportsmanship behavior KYS-Rules and Respect for Management sub-dimension (r=.173).

There is a weak and significant correlation between all of the sportsmanship behavior sub-dimensions of the BDD-Evaluation of the emotions of others sub-dimension of emotional intelligence and respectively (r=.287, r=.255, r=.136, r=.186) (p <0.01, p<0.05).

There is a weak and significant correlation between the sportsmanship behavior sub-dimensions of the DK-Emotion use sub-dimension of emotional intelligence, KYS-Respect for the rules and management, and SSB-Commitment to responsibilities in sports, respectively (r=,212, r=,221) (p< 0.01).

Sportsmanship behavior sub-dimensions of the EE-Emotion regulation sub-dimension of emotional intelligence, SNU-Compliance with social norms, KYS-Respect for rules and management, SSB-Commitment to responsibilities in sports, RS-Respect to the opponent sub-dimensions, respectively (r=,171, r=,256, r=.236, r=.217), there is a weak positive correlation (p<0.01).

According to these results, it can be concluded that the students try to take their own emotions into account in a way that takes into account the emotions of their opponent rather than evaluating their own emotions in the competitions, despite the tension of the match. Because, as a result of the analysis of the data obtained from the questionnaires of the student athletes, a significant and positive relationship was found between the sub-dimensions of emotional intelligence, taking into account the feelings of others and the regulation of their own emotions, sportsmanship behavior, compliance with social norms, respect for rules and management, commitment to responsibilities in sports and respect for the opponent.

Conclusion and Discussion

This research was carried out on the students who participated in the Turkish final, semi-final and qualifying competitions in the basketball branch within the scope of school sports. In the study, the relationship between the emotional intelligence levels of student athletes and their sportsmanship behaviors was examined. Within the scope of the research, as a result of the statistical analysis of the data obtained from the participants, it was determined that there

was a weak and positive relationship between emotional intelligence levels and sportsmanship behaviors. In other words, it can be said that the emotional intelligence levels of student athletes have an effect on their sportsmanship behaviors.

In relation to sportsmanship behaviors of the emotional intelligence scale's EQ-evaluation of own emotions sub-dimension, only a significant, positive and weak relationship was found with the KYS-Rules and respect for the management sub-dimension of the sportsmanship behavior scale, while no relationship was found with the other sub-dimensions of sportsmanship behavior. While the DK-Emotion use sub-dimension of emotional intelligence has a significant, positive and weak relationship with the sub-dimensions of sportsmanship behavior, KYS-Respect for the rules and management, and SSB-Commitment to responsibilities in sports, there is no relationship between SNU-Compliance with social norms and RS-Respect for the opponent sub-dimensions. However, a significant, positive and weak relationship was found between the BDD-Evaluation of the emotions of others and DZ-Emotion regulation sub-dimensions of emotional intelligence with all sub-dimensions of sportsmanship behavior.

In addition to this research to determine the relationship between emotional intelligence and sportsmanship behavior, it is seen that many studies have been carried out to reveal the importance of emotional intelligence in different fields and universes, and studies to develop emotional intelligence provide data that are consistent and supportive with the findings of this research. In one of these studies, Turan (2020) found that the attitudes and self-efficacy levels of secondary school students participating in school sports predicted sportsmanship behaviors in physical education class positively, at a low level and statistically significantly. It is seen that the students exhibit sportsmanlike behaviors at a high rate in the physical education lesson (Turan, 2020). In addition, Alper (2020) determined that there are significant differences between the emotional levels of the students' time to do sports on a yearly basis.

While the participation of students in school sports in the category of stars and youth has an effect on skill development, team membership and gaining spirit, having fun, friendship and success, the behaviors of the students involved in school sports, their motivation to participate in sports, physical education teachers and students in school sports. It has been stated that the use of physical activities by their coaches to determine and develop them will contribute to the positive development of sportsmanship behaviors of students (Bozkurt, 2014).

It has been determined that secondary school students who participate in school sports have a high tendency to show sportsmanship behavior, and their aggression-anger levels are low in sports, and it is stated that as the level of sportsmanship increases, their aggressive behavior decreases (Zor, 2021). In a different study, it is stated that the students participating in school sports find an area to apply the knowledge and skills they have gained thanks to school sports, respecting differences and being fair and increasing their social and emotional learning skills (Tan, 2021). It is stated that the level of emotional intelligence plays a role in the prevention of violent behavior (Yılmaz Bingöl & Yılar Erkek, 2020).

In another study, it was determined that students' sportsmanship behaviors were at a better level than their negative behaviors. While displaying sportsmanship behaviors does not differ according to gender, it is observed that students' ability to avoid negative behaviors decreases as their grade levels increase (Temel et al., 2023).

Federation, the organization of the Federation as the School Sports Department affiliated to the General Directorate of Sports Services in 2023, and the presence of sports halls in newly built schools. In addition, it should be known that reference groups, family and peers, cultural themes, and external factors are also influential in students' participation in school sports (Tüfekçi, 2020). Considering that these students will also take part in the business environment in the future, and when it is evaluated that there is a positive relationship between the emotional intelligence levels of leaders in the business environment and the job performance of their subordinates, measures can be taken for the EQ training needs, career development and improvement areas of the human resources of the business world in their secondary and high school education (Bar-On, 1997).

According to Goleman (2012), emotional intelligence can be learned, but this process is not easy. Studies show that emotional intelligence can be taught. Emotional intelligence can be used to improve social and emotional functioning in social life. This can have beneficial results in terms of socialization. Emotional intelligence training to be given to students during their education can help them become more effective, emotionally healthy and productive individuals in their lives (Arslan & Güven, 2015).

Emotional intelligence is expressed as one of the striking factors in the display of personal skills of athletes. Emotional intelligence research in sports has an important place in examining the psychology of young athletes. He states that there is a significant difference between the age and emotional intelligence of these athletes (Soylu, 2016).

In conclusion; In the education process, which has an important place in the adaptation processes of people to social life, which is the main reason for life, it is necessary to pay attention to the development of emotional intelligence while being educated with social teachings and teaching basic sciences in schools. In today's social life and business world, employees are required to be intelligent and equipped, as well as to be able to work in a team and team spirit. One means of achieving this can be seen as school sports. In this process, it is evaluated that school sports will contribute significantly to the development of the use of emotional intelligence in the attitude of student athletes towards their teammates, their behavior towards and against their rival player friends, and their sportsmanlike behavior towards referees, coaches and game rules. It is thought that when the student takes part in social life in the future, he will be able to establish more successful relationships with the experience he has gained here. In this sense, the study can give ideas about students' emotional intelligence training needs, career development and improvement areas.

Limitations of Study

The limitations of the research are listed below;

- The research is limited to girls and men students attendıng the school sports basketball competıtıons ın the fınals and semı-fınals in the 2022-2023 academic year.
- The data in the research is limited to the data collection tool applied within the scope of the research.
- The research is limited to the answers given to the research tool of 10-18 age group secondary and hıgh school students attendıng school sports.

Acknowledgment

I declare that I have not taken any of the actions listed under the heading " Actions Contrary to Scientific Research". This research was approved by the Niğde Ömer Halisdemir University Ethics Committee with the decision dated 07/06/2023 and numbered: E-86837521-050.99-369562. No project or funding support was received in the research.

Biodata of Author

Dr. Hacı Şükrü TAŞTAN is a graduate of İstanbul University School of Physical Education and Sports (current name Faculty of Sports Sciences) Coaching Education Department in 2010 and Anadolu University Faculty of Economics/Political Science And Public Administration/Public Administration programs in 2004. He completed his MA in İstanbul University Institute of Health Sciences/Sports Management program between 2011-2014 and his PhD in İstanbul Universıty Institute of Health Sciences/Sports Management program between 2015-2019. He has articles in the fields of Physical Education and sports and Sports management. He is currently working as an Assistant Professor at Niğde Ömer Halisdemir University, Faculty of Sports Sciences, Department of Sports Management. Affiliate: Niğde Ömer Halisdemir University, Faculty of Sports Sciences, Niğde, Türkiye E-mail: h.sukrutastan@hotmail.com ORCID: https://orcid.org/0000-0001-5082-4698

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Research Article

Analysis of the science and environment achievements in preschool curriculum for students with special needs

Abdulkadir Özkaya[1]

Department of Science Education, Education Faculty, Hatay Mustafa Kemal University, Hatay, Turkiye

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Abstract

This study was conducted to determine the distribution of science and environmental achievements in the "Cognitive Development Area" of the 2018 Turkish Preschool Special Education Curriculum according to the Revised Bloom's Taxonomy. The document analysis method, with a qualitative viewpoint, was used in the study. The achievements in "The Cognitive Development" sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" were analyzed according to the Revised Bloom's Taxonomy. For this purpose, 22 learning achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" were analyzed. According to the data obtained, a total of 22 learning achievements were classified as factual knowledge-remembering 8, factual knowledge-understanding 2, factual knowledge-applying 3, conceptual knowledge-remembering 2, conceptual knowledge-understanding 4, metacognitive knowledge-understanding 1 and metacognitive knowledge-applying 2. There were no achievements in the sub-dimensions of procedural knowledge, analyzing, evaluating and creating. While a total of 158 achievements are included in the cognitive development field, only 13.92% of them belong to the cognitive development sub-field of "Science-Scientific Skills and Methods" and "Science-Natural, Physical Environment and Life". From this point of view, it may be useful to increase the number of achievements given to science and environment topics. In addition, it was observed that the achievements analyzed did not show a homogeneous distribution according to age levels. In addition, it was concluded that the achievements related to high-level knowledge and cognitive process dimensions that make students more active were not sufficiently included.

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Introduction

Preschool period is a critical period in which the basis of a child's cognitive, emotional, social and physical development is established (Shonkoff et al., 2000; Genç & Tolan, 2021; Luby et al., 2022; Sevim et al., 2023). Providing a correct and effective educational curriculum is of great importance for the healthy growth and development of children between 37-78 months. Especially for children with special needs, if developmental problems or special needs are identified and intervened in the preschool period, these problems can be prevented from turning into bigger issues in the future. Hence, it can be seen as an important priority to implement appropriate educational curricula for children with special needs at an early age. Since children begin to acquire basic skills in the preschool period, supporting basic skills such as language

[1] Corresponding Author: Dr., Department of Science Education, Faculty of Education, Hatay Mustafa Kemal University, Hatay, Türkiye, email: kayakadir78@gmail.com ORCID: 0000-0002-6962-4597

development, motor skills, social interaction and self-care in this period enables children to become more independent and capable individuals in their future lives (Adama, 2023; Beckley, 2013; Braslauskienė, & Turauskienė, 2021). Curricula designed for children with special needs in the preschool period help to meet their needs in developing social interaction skills and expressing themselves emotionally. Curricula designed for children with special needs in the preschool period aim to support the healthy development of children and enable them to maximize their potential. A functional and viable preschool special education curriculum will positively impact children's future lives and strengthen their social inclusion. Special education curricula enable children to be supported at home in collaboration with families. In addition, special education curricula prepared for preschool children support their social adaptation and participation (Mirzajonova & Parpiyeva, 2022). Children with special educational needs also have the right to education, and curricula specially designed for these children will provide them with equal opportunities. With the equal opportunity provided by the curriculum, the holistic development of cognitive, emotional, social and motor skills of preschool children with special needs will not be neglected.

Considering that the preschool period is a period in which children develop basic cognitive, emotional, social and motor skills, environmental and science education can be seen to have a special importance in this period. This is because it stimulates children's sense of curiosity and enables them to develop an understanding of their environment and discover basic science concepts. Environmental and science education should start from the preschool period and continue throughout the school years (Türkoğlu, 2019). Including environmental and science education achievements in the curriculum at an early age supports children to grow up as individuals who are sensitive to their environment, in harmony with nature and have a scientific mindset (Ardoin & Bowers, 2020). At the same time, a curriculum that includes environmental and science achievements increases children's interest in learning by encouraging their curiosity and willingness to explore. Children's natural tendencies to be curious and to notice differences between people can be utilized in their socialization and learning (Erwin et al., 2023). Environmental and science education, which can stimulate curiosity and the willingness to explore, can have an impact on increasing the environmental awareness of future generations by raising children's awareness of environmental protection, sustainability and nature at an early age. In preschool special education curricula that can enable children to become environmentally and scientifically sensitive, learning achievements based on realistic needs should be determined first. A curriculum can achieve the desired results only with targeted learning achievements based on realistic needs (Karacaoğlu, 2020a).

Examining environmental and science education achievements in preschool special education curricula will provide a structure that includes different thinking skills to assess learning achievements. Such a study also plays an important role in environmental and science education in preschool special education. This study can help students gain a clearer understanding of the environmental and science education learning achievements. This, in turn, allows students to receive a better education. This will allow students to receive a better education. Individualized education approach is important in special education (Smith, 1990; Florian, 2019; Fowler et al., 2019). Examining the targeted outcomes can help to create individualized education plans using the levels of Bloom's Taxonomy to better assess students' learning levels and skills. If environmental and science education is seen as an important component of preschool special education curricula, the achievements examined within the framework of the Revised Bloom's Taxonomy (RBT) can help to make the curricula more holistic and targeted. The evaluation of environmental and science education achievements in preschool special education curricula according to the RBT may contribute to evaluating more effective learning in the field of special education, developing curricula and providing better education to students.

It has been tried to be explained that environmental and science education of preschool special education students has a lifelong importance starting from early ages. It is clear that the environmental and science education to be provided through the preschool special education curriculum will also form the basis for further education. Different taxonomies can be used to determine the appropriateness of the targeted achievements in a curriculum of such importance to the achievements of the curriculum (Birgin, 2016). Bloom's taxonomy is one of them. Anderson and Krathwohl (2010) revised Bloom's Taxonomy into two dimensions: cognitive process and knowledge. This taxonomy enables the organization of learning-teaching processes and the examination of learning achievements the curriculum (Tutkun et

al., 2010). The fact that the learning achievements in the curricula used in Turkey consist of noun and verb roots has brought the RBT to the forefront in their evaluation. While the cognitive process dimension of the RBT is remembering - understanding - applying - analyzing - evaluating - creating, the knowledge dimension is organized as factual- conceptual- procedural- metacognitive knowledge (Tutkun et al., 2015; Zorluoğlu et al., 2016). Anderson and Krathwohl reviewed and updated the information on learning achievements, which is an important criterion for teaching, learning and assessment. In the re-adapted taxonomy, the view that Bloom's taxonomy should be changed according to the fields of study and usage in order to be used by educators continues. The main changes that differ from the taxonomy developed by Bloom are the renaming of the lowest level of the taxonomy, known as knowledge, as remembering, and the reversal of synthesis (level 5) and evaluation (level 6), which constitute the highest cognitive levels of the taxonomy, as evaluating (level 5) and creating (synthesis, level 6). Another important change in the taxonomy is related to its use. Although Bloom's original taxonomy was designed to assist educators in planning assessment tools, it has been found to be used more for educators to learn how to ask questions in the classroom and to plan teaching processes. The RBT emphasizes the importance of "planning the curriculum, the instructional process, the assessment, and the sequencing of these three." With this change in understanding, the RBT has become more usable for educators and curriculum development experts, and has also reduced misunderstandings arising from readers' interpretations. The taxonomy is written in the spoken language of the field in a user-friendly way and includes many examples of how the taxonomy should be used for effective planning (Karacaoğlu, 2020a).

In the preschool period, when children with special needs develop basic skills and make great progress in cognitive, emotional, social and motor fields, assessing environmental and science education achievements according to the RBT can provide information to encourage in-depth learning at different skill levels by providing a multidimensional learning experience. It can provide feedback that will contribute to children's in-depth understanding of learning by evaluating environmental and science education achievements at different taxonomic levels. This study will also contribute to integrating more appropriate and effective strategies into the learning processes of children in need of special education, thereby contributing to a better learning experience for these students and supporting their cognitive development at the highest level. The researchers were also motivated by the lack of a study on environmental and science education achievements related to preschool special education curricula. It is thought that the results of the research will shed light on curriculum development, environmental and science education practices in preschool special education. For these reasons, it has been a matter of curiosity how the evaluation of environmental and science education achievements in preschool special education curriculum according to the RBT can contribute to the development of cognitive and metacognitive skills of children in need of special education. It is necessary to conduct a research on the problem of how the number and level of achievements in the preschool special education curriculum are. As a result of this necessity, a qualitative and quantitative evaluation of the environmental and science learning achievements in the preschool special education curriculum in Turkey was conducted in accordance with the RBT .

Problem of Study

The aim of this study is to analyze the achievements of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the cognitive development field of the 2018 preschool special education curriculum according to the RBT. The 22 achievements will be examined within the framework of the following sub-problems.

- How do the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the Cognitive Development Field of the 2018 Preschool Special Education Curriculum show a distribution in the knowledge dimension according to the RBT?
- How do the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the Cognitive Development Field of the 2018 Preschool Special Education Curriculum show a distribution in the cognitive process dimension according to the RBT?
- What is the ratio of the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the Cognitive Development Field of the 2018 Preschool Special Education Curriculum to the achievements in the total cognitive development field?

Method

Research Model

Document analysis method, with a qualitative point of viewpoint, was used in the study. In the document analysis, the number and levels of the achievements in the preschool special education curriculum were determined. In qualitative content analysis, the levels in the RBT were accepted as criteria.

Participants

This research was conducted as a document analysis within the framework of qualitative method. With document analysis, which is based on the examination of written materials, information about the situation targeted to be investigated is obtained. Document analysis was utilized in data collection (Yıldırım & Şimşek, 2005). The advantage of document analysis is that many results can be obtained by examining documents without the need for observation and interviews about the field and subject of research (Bowen, 2009). In this study, 22 achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the Cognitive Development Area of the 2018 Preschool Special Education Curriculum were analyzed according to the RBT. For the analysis of the achievements, one science education expert and two academicians and one researchers with competence in the field of curriculum development worked independently of each other on the topics in the study. The experts put forward their opinions on which level the achievements should be placed in terms of knowledge dimension and cognitive process dimension in the RBT and then a comparison was made. Items with consensus and disagreement were identified. The formula determined by Miles and Huberman (1994) was used to determine the reliability of the analysis by using the data obtained from the two-dimensional comparisons made by the experts. As a result of the comparison of these codings, 19 of the 22 learning achievements were coded in the same way and the other 3 were coded differently. Thus, the percentage of agreement between the coders of the study was 86.36%. This result shows that the research is quite reliable.

Reliability formula determined by Miles and Huberman;

The formula for percent agreement is $p=\frac{Cx100}{C+A}$. In the formula, p: Reliability coefficient, C: Number of achievements on which consensus was reached, A: Number of achievements on which consensus was not reached (Miles & Huberman, 1994). Full consensus was achieved by working together again on the 3 achievements on which there was no consensus. The achievements in the curriculum are in the form of sentences and consist of two parts: verb and noun expressions. In order to find the place of the learning achievements in the taxonomy matrix, the sentence of the learning achievement is first analyzed. According to RBT, the verb expression of the achievement constitutes the cognitive process dimension and the noun expression constitutes the knowledge dimension. However, there are problems because some achievements contain more than one verb and noun expression (Anderson & Krathwohl, 2001; Yıldırım & Şimşek, 2005). In cases where the achievement includes more than one verb expression or noun expression, the higher dimension expression should be selected; if the achievement includes both applying and understanding, the higher dimension applying should be selected. If both factual knowledge and metacognitive knowledge are included, the metacognitive knowledge sub-dimension, which is the higher sub-dimension, is selected and coded in the cell where the dimensions of the achievement intersect (Anderson & Krathwohl, 2010; Yıldırım & Şimşek, 2005; Bekdemir & Selim, 2008). The learning achievements in the curriculum are coded by placing them in the cell where the column containing the cognitive process dimension and the row containing the knowledge dimension intersect (Amer, 2006; Krathwohl, 2002). For instance, the verb expression "names" in the achievements item "Says the ten small parts of his/her body" is in the remembering level of the cognitive process dimension. Based on the data obtained, the code of this achievement is decided by finding cell A1, which is the cell where the row with factual information and the column with the remembering level intersect in the taxonomy matrix of the achievement.

The achievements were coded according to the knowledge and cognitive process dimensions in accordance with the RBT Matrix (RBTM) in Table 1.

Table 1. Revised Bloom Taxonomy matrix (Krathwohl, 2002; Anderson, 2005)

Knowledge Dimension		Cognitive Process Dimensions					
		1	2	3	4	5	6
		Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
A	Factual K.	A 1	A 2	A 3	A 4	A 5	A 6
B	Conceptual K.	B 1	B 2	B 3	B 4	B 5	B 6
C	Procedural K.	C 1	C 2	C 3	C 4	C 5	C 6
D	Metacognitive K.	D 1	D 2	D 3	D 4	D 5	D 6

K: Knowledge

Data Analysis

The knowledge dimension and cognitive process dimensions were coded according to the RBT matrix by taking Table 1 into consideration.

In order to determine the cell in the taxonomy matrix for the achievement "Defines objects and events in the environment by observing them", it was divided into the noun expression "objects and events in the environment" and the verb expression "defines them by observing them". While the noun phrase is in the factual knowledge dimension since it constitutes the knowledge of the components and the basic part of the subject, the verb phrase "defines by observing" is in the remembering and applying level. When two cognitive process dimensions are in one achievement, a higher level is taken. Since the cell where factual knowledge and application level intersect is A3, this code is included in this cell.

Research Ethics

The subject of this study is educational curriculum evaluation. Within the scope of the research, human or animal subjects, data collection methods such as experiments, observations, questionnaires or interviews were not used. For this reason, it was not necessary to obtain an ethics committee report.

Results

In this study, 22 achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the Cognitive Development Area of the 2018 Preschool Special Education Curriculum were examined according to the RBT and the place of the achievements in the RBT matrix was determined. The distribution of the data obtained according to the dimensions and sub-dimensions in the RBT is given in tables 2, 3 and 4. In order to better understand the distribution of the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life", the data were presented as graphs.

Table 2. Analysis of learning achievements for 37-48 months children with special educational needs

Sub-fields	Achievements	RBTM
SSSM	Ask questions about objects and events in the environment.	A2
	Describes objects and events by observing them.	A3
	Tells the similarities and differences of objects according to their physical characteristics.	B1
SNPEL	Says ten small parts of the body.	A1
	Identifies natural objects in the sky such as the moon, sun, clouds and stars.	A1
	Describes the physical characteristics of living things.	A1
Total		**6**

SSSM: Science-Scientific Skills and Method **SNPEL**: Science-Natural, Physical Environment and Life **RBTM**: Revised Bloom's Taxonomy Matrix

Table 3. Analysis of learning achievements for 49-60 months children with special educational needs

Sub-fields	Achievements	RBTM
SSSM	Makes detailed descriptions by observing the beings and events around them.	A3
	Uses tools or senses to collect and analyze information, observe processes and relationships.	D3
SNPEL	Tells the states of matter.	A1
	Describes the properties of the substances around them by comparing them in terms of color, size and shape.	B2
	Explains the changes by observing natural entities in the sky such as moon, sun, clouds, stars.	A3
	Explains the effects of seasonal changes on living things.	B2
	Group living things according to their characteristics and tell their common features.	A2
	Explains the similar and different characteristics of the habitats of living things.	B2
Total		**8**

SSSM: Science-Scientific Skills and Method **SNPEL**: Science-Natural, Physical Environment and Life **RBTM**: Revised Bloom's Taxonomy Matrix

Table 4. Analysis of learning achievements for 61-78 months children with special educational needs

Sub-fields	Achievements	RBTM
SSSM	Explains the information he/she gathers about beings using his/her senses.	D3
	Explains why or how an observed event happened.	D2
SNPEL	Tells what material objects are made of.	A1
	Explains the transformation between the forms of matter in a simple way.	B2
	Explains the similarities and differences in the physical characteristics or behaviors of living things.	B1
	Say the characteristics of landforms such as mountains, rivers, oceans, deserts and seas.	A1
	Says the names of different time periods of the day.	A1
	Says the days of the week in order.	A1
Total		**8**

SSSM: Science-Scientific Skills and Method **SNPEL**: Science-Natural, Physical Environment and Life **RBTM**: Revised Bloom's Taxonomy Matrix

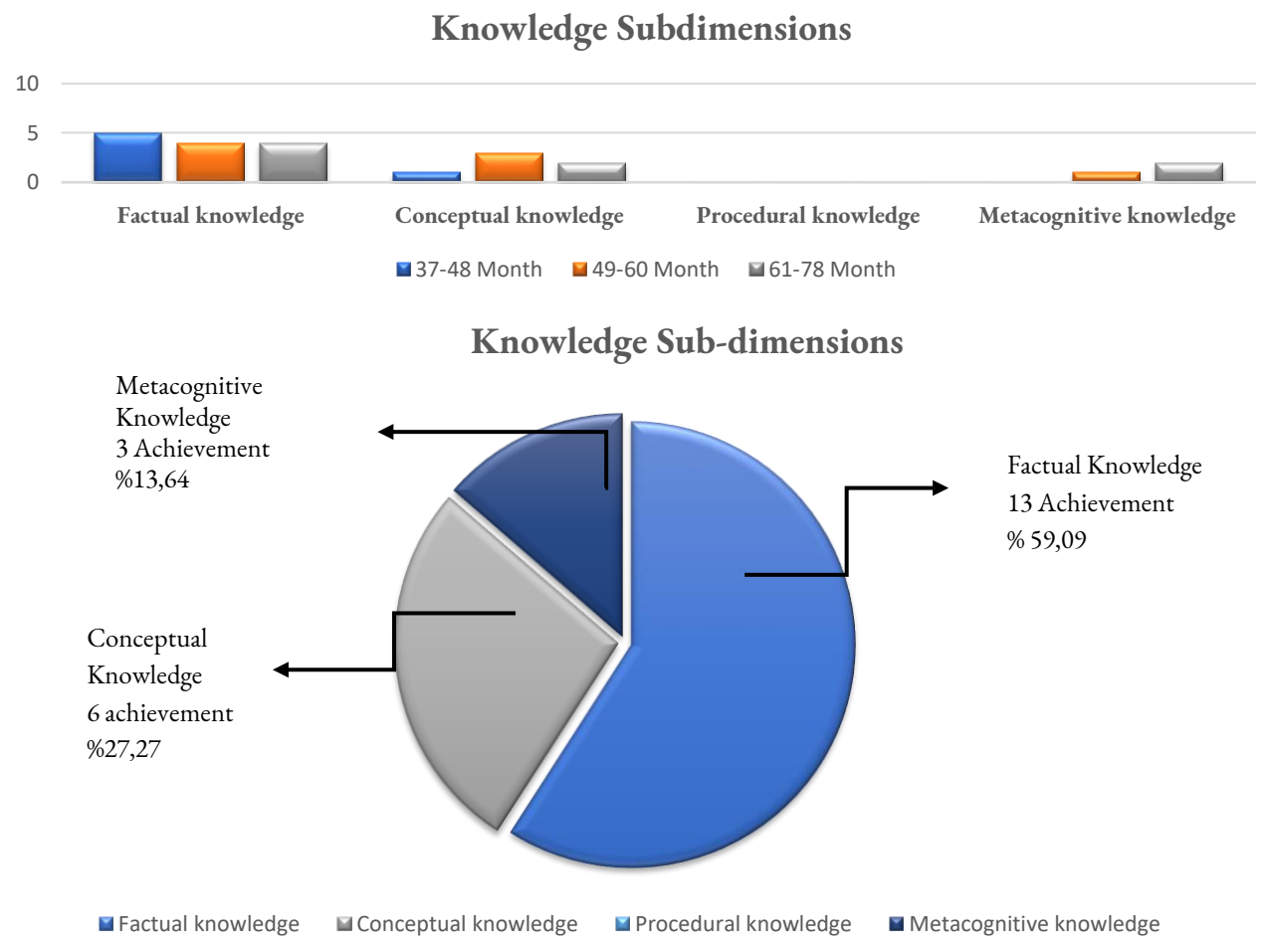

Figure 1. Distributions of learning achievements for children with special educational needs at preschool level

In Figure 1, the achievements belonging to the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" are analyzed according to the knowledge dimension sub-levels according to the RBT. The achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" did not include any achievements related to the procedural knowledge dimension. It is seen that the most common knowledge dimension is the factual knowledge dimension. In Figure 2, it is possible to see the distribution of knowledge dimensions proportionally.

According to Figure 1, 59.09% of the learning achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" were factual knowledge (13 learning achievement), 27.27% were conceptual knowledge (6 learning achievement), 13.64% were metacognitive knowledge (3 learning achievement), and no learning achievement was included at the procedural knowledge sub-dimension.

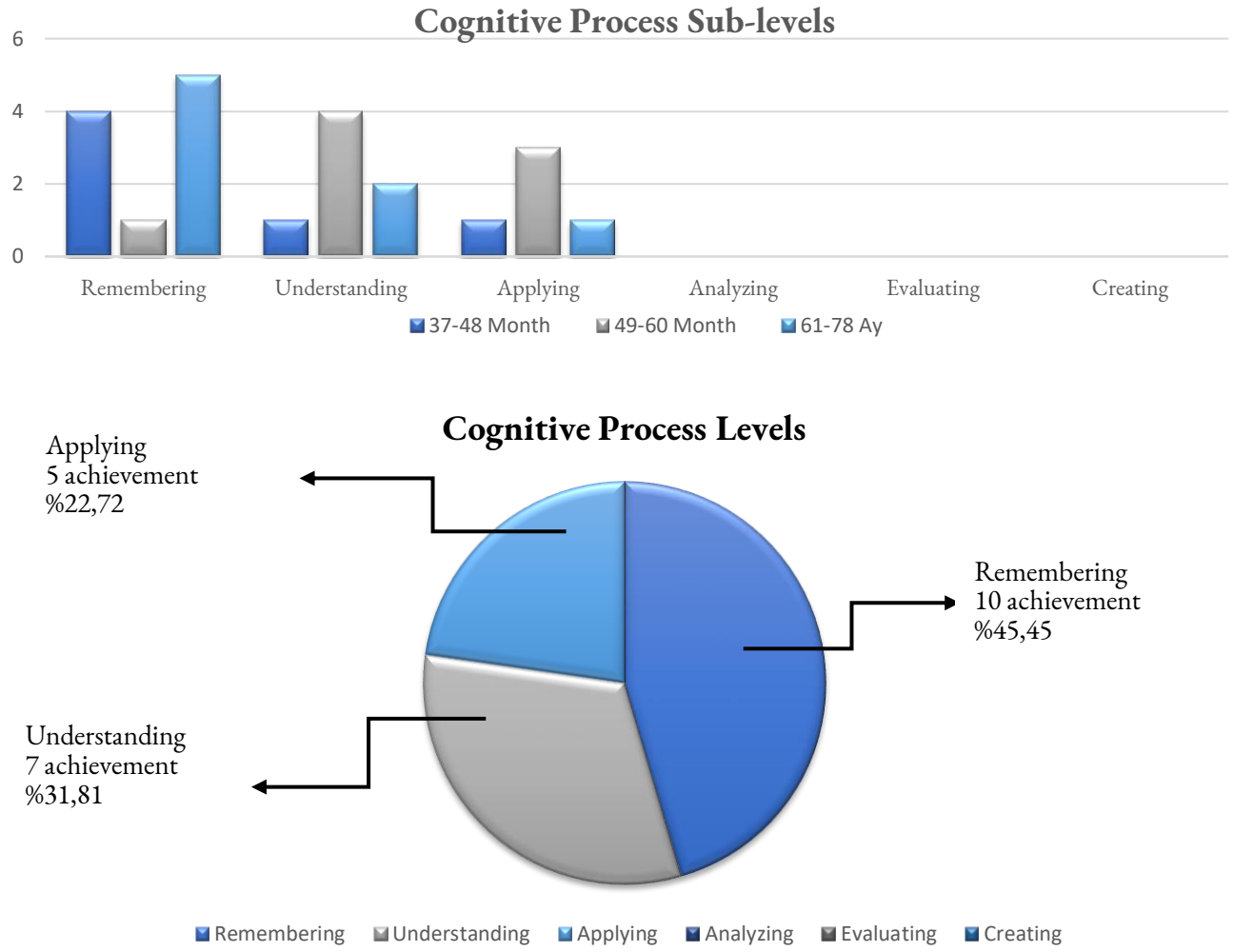

Figure 2. Distributions of learning achievements according to RBTM for children with special educational needs at preschool level

The evaluation of the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" according to the cognitive process dimension sub-levels of the RBT is given in the graph in Figure 3. When this graph is analyzed, it is seen that the highest number of achievements is at the remembering level with 10 achievements. This is followed by understanding with 7 achievements and applying with 5 achievements. No achievements were found in the sub-levels of analyzing, evaluating and creating.

According to Figure 2, 45.45% of the learning achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" were remembering (10 learning achievements), 31.81% were understanding (7 learning achievements) and 22.72% were applying (5 learning achievements). There were no achievements in the levels of analyzing, evaluating and creating.

Table 5. Distributions of learning achievements according to RBTM for children with special educational needs at preschool level

Knowledge Dimension	Cognitive Process Dimension						
	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating	Total
Factual K.	8	2	3	0	0	0	13
Conceptual K.	2	4	0	0	0	0	6
Procedural K.	0	0	0	0	0	0	0
Metacognitive K.	0	1	2	0	0	0	3
Total	10	7	5	0	0	0	22

K: Knowledge

Table 5 shows the analysis of a total of 22 outcomes in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" in the Cognitive Development Field of the Preschool Special Education Curriculum according to the RBT. Table 5 shows the general trend of the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life". Table 5 and the graphs are instructive for teachers and provide information about the knowledge dimension of the subject to be taught and which dimension should be taught at least according to the sub-levels of the cognitive process dimension. When Table 5 is examined, it is seen that the learning achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" are not homogeneously distributed according to the RBT.

While a total of 158 achievements are included in the cognitive development field, only 13.92% of them belong to the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life".

Conclusion and Discussion

In line with the main purpose of the study, environmental and science education learning achievements in the preschool special education curriculum implemented in Turkey were determined and these learning achievements were evaluated qualitatively and quantitatively in accordance with the RBT. Within the scope of this evaluation, the learning achievements belonging to the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" were analyzed according to the sub-levels of the knowledge dimension according to the RBT. It was determined that the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" did not include any achievements related to the procedural knowledge dimension. It is seen that the most common knowledge dimension is the factual knowledge dimension. When Gülay and Ekici (2010) examined the preschool curriculum in general, it was found that there were no achievements and achievements for environmental education in the preschool curriculum in the developmental, psychomotor and language fields, but the environmental goals in the social-emotional, cognitive and self-care skills fields had a 25.9% share in the learning achievements in the entire curriculum. It was also determined that the learning achievements for environmental education constituted 15.5% of all learning achievements. In addition, it is understood that 29.0% of the concepts in the curriculum and 26.3% of the specific days and weeks in the curriculum are related to environmental education.

When the literature was reviewed, no research on environmental and science education related to learning achievements in the preschool special education curriculum in Turkey was found, so similar studies at the next higher level (primary school) were examined. Akınoğlu and Sarı (2013) emphasized that the third grade life science curriculum has more environmental learning achievements than the first two grades. Karacaoğlu (2020b), who examined according to taxonomy and levels, stated that two-thirds of the 2nd grade achievements of the life science curriculum are related to the cognitive domain and approximately one-third are related to the affective domain. Only 1 of the 50 achievements in the 2nd grade of the life science curriculum is related to the psychomotor domain. Similarly, Bahar et al. (2013) emphasized that in the life sciences curriculum, achievements at the cognitive level are included more than achievements in other domains (affective and psychomotor). In the 2005 life science curriculum, it was emphasized that the targeted

achievements covered the dimensions of environmental literacy more than the 1998 curriculum. Akınoğlu & Sarı (2013) found that the first grade life science achievements were mostly about natural disasters and the least about environmental cleaning and conscious consumption of resources. He found that the number of learning achievements related to conscious consumption of resources was higher in the environmental learning achievements of the second grade life science curriculum. According to Anderson and Krathwhol (2001), as the age level increases, it is expected that the achievements in the factual knowledge dimension will decrease and the achievements in the procedural knowledge dimension will increase. When different studies are analyzed, it is seen that these expectations are partially met.

Of the 22 learning achievements in the cognitive development sub-fields of "Science-Scientific Skills and Methods" and "Science-Natural, Physical Environment and Life", 10 were at the remembering, 7 at the understanding and 5 at the applying level. No learning achievements were found at the analyzing, evaluating and creating levels. The distribution of learning achievements in the cognitive development sub-field is not homogeneous according to the RBT. This result about the distribution of achievements according to their levels is supported by the research conducted by Akınoğlu & Sarı (2013). In the study, it is seen that the fourth grade social studies course has the lowest percentage (4.35%) in terms of achievements related to the environment, while the science and technology course has the highest percentage (17.73%). In the fourth grade social studies curriculum, there are no achievements on environmental cleanliness, environmental sensitivity or environmental awareness. Only one achievement is related to natural disasters and one to weather events. As can be seen, the distribution of environmental and science education achievements in the preschool special education curriculum and primary school courses is similar. This result about the distribution of learning achievements according to their levels is supported by the study conducted by Akınoğlu & Sarı (2013). In the study, it is seen that the fourth grade social studies course has the lowest percentage (4.35%) in terms of achievements related to the environment, while the science and technology course has the highest percentage (17.73%). In the fourth grade social studies curriculum, there are no learning achievements related to environmental cleanliness, environmental sensitivity or environmental awareness. Only one achievement is related to natural disasters and one to weather events. As can be seen, the heterogeneous distribution of environmental and science education achievements in the preschool special education curriculum and primary school courses is similar.

When the achievements in the cognitive development sub-fields of "Science-Scientific Skills and Method" and "Science-Natural, Physical Environment and Life" were analyzed according to the sub-levels of the cognitive process dimension of the RBT, it was determined that they were mostly concentrated in the remembering step with 10 achievements. The other achievements are followed by 7 understanding and 5 applying levels. In the sub-levels of analyzing, evaluating and creating, there are no achievements in the sub-levels of the cognitive process dimension of the curriculum. Of the 22 learning achievements in the cognitive development sub-dimension, 13 of them are at the level of factual knowledge, 6 of them are at the level of conceptual knowledge, and 3 of them are at the level of metacognitive knowledge with a rate of 13.64%. No learning achievement was found at the procedural knowledge level and it was determined that there was not an equal distribution quantitatively related to the levels. In the study conducted by Balkan and Atabek-Yiğit (2023), it was determined that learning achievements related to the environment were included more in the Brazilian science curriculum than in Turkey and the number of learning achievements aimed at preventing future problems was more in the Brazilian science curriculum than in Turkey. Similarly, in the study conducted by Arsal (2014), few learning achievements were found at the application level of the science and technology curriculum learning achievements, very few learning achievements were found at the analyzing level, and no learning achievement was found for higher level cognitive learning. Kılıç et al. (2010), on the other hand, determined that the number of learning achievements for knowledge and skills learning fields was higher, while the number of learning achievements for science-technology-society-environment subjects was lower. In the study, it was emphasized that high-level science process skills were not sufficient in the curriculum and that students should design more experiments and gain skills through more extensive research. Brownne et al. (2011) emphasized the importance of developmental experiences in terms of environmental sustainability.

In the study, while a total of 158 achievements were included in the cognitive development area, only 13.92% of them belonged to the "science" cognitive development sub-area. From this point of view, it may be useful to increase the number of achievements given to science and environment subjects. Various studies show that studies on environmental and science education learning achievements in the preschool special education curriculum and the achievements, outcomes and concepts that will facilitate the examination of this subject are insufficient. In the study conducted by Güneş, (2018), activities related to science education and practices and environmental education were found to be among the intensively examined topics. In the scans conducted on the research on preschool science and nature education in Turkey, it was determined that children, teachers and prospective teachers were evenly distributed as the sample group, while the number of studies conducted with parents was limited. As with the research conducted with parents, evaluation studies on preschool special education curriculum and achievements should be increased, and quantitative and qualitative studies should be conducted as seen in the international literature.

Although Brenneman (2011) highlights the increased interest and funding investment in early science education in the United States and the expectation that high quality educational supports will lead to increased school readiness and achievement in science and related areas, research and program evaluation efforts lack appropriate assessments of learning and related areas. This article reports on a set of promising tools and approaches for assessing children's learning progress in science and the quality of instructional supports for this learning. Biedinger (2011), using data from a project on pre-school education and educational careers among disadvantaged migrant children in Germany, emphasized the importance of the home environment and parental education for children's futures. Both home environment and parental education play an important role in explaining the development of cognitive abilities of migrant children. He emphasized that it is very important to develop children's abilities at an early age and that parents need to be active with their children so that they can compensate for the disadvantage associated with their low educational background. Åström et al. (2022) noted that the Swedish preschool curriculum emphasizes child-centeredness, play and contact with nature. In the Norwegian preschool setting, high levels of play have been shown to have a strong relationship with engagement and well-being (Storli, & Hansen Sandseter, 2019). Kernan (2007) emphasizes that in the implementation of preschool education curricula in the Netherlands, the natural environment should be supported and organized in areas for children. As can be seen, natural environment, active participation of students, activities and student-centered practices are considered important in the implementation of preschool education curricula in many countries.

Recommendations

If we need to address environmental and science education for sustainable development from the most basic curriculum, we need to turn our eyes to the preschool period. Another issue that we do not miss in the pre-school period is children in need of special education. Every activity related to environmental and science education should aim to develop awareness, competence, knowledge, skills and attitudes in the field of environmental protection to support meeting the needs of future generations. In the face of environmental and social challenges, as well as the disadvantage of preschoolers, work should continue to identify key competencies that require significant changes in curricula that support a sustainable and innovative economy (Zwolińska et al., 2022). In addition to emphasizing that environmental awareness and sustainability can be achieved through environmental education and curricula, environmental education, science education and curricula should be seen as a tool for solving global environmental problems (Orlovic Lovren et al., 2020).

School-based citizen science can be a powerful tool to engage disadvantaged preschool children in environmental education, but it is necessary to develop substantial curricula around citizen science activities (Bopardikar et al., 2023). In this study, the preschool special education curriculum in Turkey was analyzed in order to evaluate the curriculum in practice for the development of a reliable environmental education curriculum. By developing comparative studies with the curricula of other countries, the field of study can be improved and a common pool of achievements can be created and new curricula for environmental and science education in preschool and special education can be developed with

the necessary recommendations in terms of sustainability, universal environmental education and raising more sensitive world citizens.

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Biodata of Author

Born in 1978 in Karaman, Abdulkadir ÖZKAYA graduated from Selçuk University, Faculty of Education, Science Teaching Program in 2001. Between 2001-2005, he worked as a research assistant in Selçuk University, Department of Science Teaching. In 2004, he completed his master's degree in Selçuk University Institute of Science and Technology, Department of Elementary Education, Science Teaching Program. In 2013, he completed his PhD at Gazi University, Institute of Educational Sciences, Elementary Science Teaching Program. In 2017, he started to work as a lecturer at Hatay Mustafa Kemal University, Faculty of Education, Department of Science Education. The author is still working in the same department.

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Research Article

Computational thinking scale: the predictive role of metacognition in the context of higher order thinking skills

Özlem Üzümcü [1]

Digital Game Design Department Department, Faculty of Communication, Hasan Kalyoncu University, Gaziantep, Turkiye

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Abstract

This study aims to determine the predictive role of cognition in computational thinking. In this context, the research has two problem situations. The first one is the development of a computational thinking scale for prospective teachers. The second is to determine the predictive role of metacognition in computational thinking with this scale. In Study-1, the computational thinking scale was developed with (N= 365) participants. In Study-2 (N=306), the role of metacognition in computational thinking was explained with structural equation modeling. These findings show that, the computational thinking scale consisting of 28 items in Study-1 explained 48% of the total variance with a single factor structure and the internal consistency coefficient was found to be .985. In Study-2, the role of metacognition in computational thinking was tested with structural equation modeling. Accordingly, the planning, debugging and procedural knowledge sub-dimensions of metacognition explained 47% of the variance of computational thinking.

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Introduction

Thinking skills are among the essential 21st century competencies for success today (Saad & Zainudin, 2022). We can classify those thinking skills, characterized by cognitive functioning, as high order and low order thinking skills. While low order thinking skills refer to routine mental activities, high-order thinking skills emphasize the multidimensional and elaborate operation of the mind (Newmann, 1988; Bloom et al., 1956). Students are expected to acquire these skills in their social or academic life. The thinking skills of teachers, who have the leading role in conveying these skills, are of critical importance (Zohar, 1999; Zain et al., 2022). Metacognition and computational thinking (CT), which are high-order thinking skills, are similar concepts (Yadav et al., 2022), and their interactions arouse curiosity. The purpose of this research to develop a CT scale for practicing and preservice teachers and to explore the role of metacognition, which is effective in teaching high-order skills (Hamzah et al., 2022) in CT is one of the 21st century competencies that improve teachers' teaching skills (Kim et al., 2019; Uzumcu & Bay, 2021).

High-order thinking skills

Thinking is a complex mental process (Umay & Arıol, 2011), and high-order thinking involves elaborate and ambiguous mental functions (Nguyễn & Nguyễn, 2017). Several approaches in the literature define high order thinking skills. For example, Bloom et al. (1956) proposed a classification of knowledge from basic to complex, just like the classification of plants and animals. In their taxonomy, knowledge, comprehension, and application are low level steps, while analysis,

[1] Corresponding Author: Dr., Digital Game Design Department Department, Faculty of Communication, Hasan Kalyoncu University, Gaziantep, Turkiye. E-mail: ozlem.uzumcu@hku.edu.tr. ORCID: 0000-0002-0589-5312

synthesis, and evaluation are high level steps (Pegg, 2010). Newmann (1988) explains the distinction between high level and low level thinking: low level thinking covers routine tasks that do not require intellectual endeavor, and high order thinking is used for tasks that challenge the mind, such as analyzing, interpreting, and problem solving. According to another definition, high-order thinking is characterized by ambiguity and complex thinking and reflection, offering different solutions or criteria (Resnick, 1987).

The recent changes in information, technology, and interactions emphasize the significance of high order thinking skills (Rabadi & Selam, 2018; Meng et al., 2020). Using high order thinking skills in teaching offers effective learning environments for learners (Atkinson, 2000). In this regard, teacher training is a central issue. Practicing and prospective teachers' advanced higher-order thinking skills have direct and indirect effects on both their and students' professional development (Bravo et al., 2016; Husamah et al., 2018).

High order thinking skills are also featured in certain skills. Among such skills are creative, critical, reflective, problem-solving, and metacognitive (Ananadou & Claro, 2009; Brookhart, 2010; Canas et al., 2017; Husamah et al., 2018). Also being a skill on its own, creativity can also be combined with other competencies, for example creative thinking, creative problem solving (Casakin et al., 2010), and creative reading (Yurdakal, 2019). Creative thinking, defined as unique thinking for new and better outcomes (Lee, 2005), is one of the high order thinking skills can be observed through performance-based outputs and innovative processes (Mumford et al., 2013). Another high order thinking skill, critical thinking, is considered an integral part of education (Miri et al., 2007; Stanger-Hall, 2012). Reflective thinking, a systematic and disciplined thinking endeavor (Göğüş et al., 2020), allows learners to analyze and evaluate their learning (Ghanizadeh, 2017). It refers to making a judgment after a throughout analysis of a problem (Eby & Kujawa, 1994; Rodgers, 2002; Lee, 2005).

High level cognitive abilities, which involve complex steps to arrive at a resolution, are often associated with problem solving. (Simamora & Saragih, 2019; Güner & Erbay, 2021). Although problem-solving is a practical skill when used separately, it can be applied to social, cognitive, or emotional problem situations. CT, frequently preferred in recent years, is a complex problem-solving skill as well (Wing, 2006), with a few different features from problem-solving (Pedaste et al., 2019). Those differences are related to the scope, dimension, and usage of CT.

Computational Thinking

Although CT is considered computer programming (Zhang & Nouri, 2019), it is chiefly characterized by problem-solving processes (Aho, 2012). Thus, it is described systematic problem solving skill that involves a number of strategies (Hooshyar et al., 2021). Considering extensive utilization of problem solving skills, this thinking skill can be effective in the solution of problems in branch courses such as science, mathematics, and social sciences (Bussaban & Waraporn, 2015; Knochel & Patton, 2015; Lu et al., 2022). Those technical and practical uses of CT have made it a popular competence integrated into the education system in various fields and methods (Tang et al., 2020). So, it is essential to address the scope and framework of CT correctly. CT is mainly applied in decomposition, abstraction, data, generalization, modeling, evaluation, algorithm, and debugging (Barr & Stephenson, 2011; Yadav et al., 2014; Kalelioglu et al., 2016; Rijo-García et al., 2022). As understood, CT is not a simple competence but requires high order thinking skills. It has been suggested that CT can be effective in students' acquisition and application of high order thinking skills (Tang et al., 2020). It also proves efficacious in nurturing creative and critical thinking abilities, both of which are considered advanced cognitive skills (Lee et al., 2022).

Metacognition

While cognition refers to understanding, remembering, and perceiving, metacognition is considered thoughts and awareness of these issues (Garner & Alexander, 1989). According to Flavell (1976), one of the leading figures in the field, metacognition includes cognitive processes and knowledge and regulation of these processes. Briefly described as cognitive awareness, metacognition is a high-order thinking skill (Ohtani & Hisasaka, 2018) as it requires individuals to plan, control, and evaluate the learning processes (Drmrod, 1990; Schraw & Dennison, 1994).

While cognitive functioning mostly has a single goal, metacognitive checks whether an appropriate cognitive pathway is chosen to achieve goals (Doğan et al., 2009). From this perspective, it can be inferred that individuals with

metacognitive skills are competent in monitoring their cognitive processes with different methods (Meijer et al., 2006). According to Schraw & Dennison (1994), people with superior metacognitive skills are good at information planning and management, monitoring, debugging, and evaluating.

According to Flawell, metacognition significantly contributes to reading comprehension, concentration, memory, and problem solving (Flavell, 1979). According to Mayer (1998), metacognition significantly affects a person's learning also problem solving skill. At the same time making the thinking and learning processes effective, metacognition also interacts with other high order thinking skills, for instance critical thinking and problem solving (Hartman, 1998). In this sense, as high order thinking skills, metacognition and problem-solving are interrelated. Since that CT is considered a 21st century complex problem-solving skill, it is inevitably related to metacognition. Since CT is almost a new field, research on metacognition is minimal. In a study on the overlaps in CT metacognition, Yadav et al. (2022) revealed that CT could help develop students' metacognitive strategies. They discussed the content of metacognition under eight dimensions and two main headings: knowledge and regulation of cognition (Schraw & Dennison, 1994). The knowledge of cognition involves knowledge types. The processes of planning, monitoring, evaluation, debugging, and management are addressed in the regulation of cognition. Evaluation and debugging are both involved in CT. In this framework, the goal of this paper is to explore the predictive role of metacognition in CT. This research has two problems and was conducted as study1 and study2: *i. What are the validity and reliability studies of the computational thinking scale for prospective teachers? ii. According to the structural equation model, what is the predictive role of declarative knowledge, procedural knowledge, conditional knowledge, planning, monitoring, evaluation, debugging, and information management- components of metacognitive thinking in computational thinking?*

Method

Study 1

In Study 1, a scale for CT was developed using the survey method and its validity and reliability analyses were conducted.

Participants

The participants consisted of 365 pre-service teachers from 6 departments (Table 1) (classroom teaching, psychological counseling and guidance, special education teaching, preschool teaching, English teaching, Turkish teaching).

Table 1. Distribution of the participants

	Classroom Teaching	Psychological counseling and guidance	Special Education Teaching	Preschool Teaching	English Language Teaching	Turkish Teaching	Total
CT EFA	60	75	55	81	37		308
CT and Critical Thinking	34					23	57
Total							365

Why was a new scale needed?

There are several reasons for developing a new bid scale for pre-service teachers. The age groups of the CT scales developed in Turkey are at the middle school or high school level (Gülbahar et al., 2018; Yağcı, 2019; Kukul & Karataş, 2019; Karalar & Alpaslan, 2021). In the scales developed for teachers (Korkmaz et al., 2017; Dolmacı & Akhan, 2020), the current bid scale was needed because the subject content such as creativity, critical thinking, and collaborative work within the scope of the subject is not encountered in the international literature. In another scale developed for teachers (Ertugrul-Akyol, 2019), bid was directly included in the scale items as a concept, and robotics, coding and software were also included as subject content. In order for this scale to be used, teachers' readiness to use it requires them to know and internalize bid. Therefore, it would not be appropriate to apply it to teachers who are not conceptually familiar with the subject. For these reasons, a new bid scale was developed.

According to Devellis (2003), the development stages of the CT scale consist of eight stages. These are, respectively, identifying the construct to be measured, preparing the item pool, deciding on the scale form, ensuring language control,

checking the items by an expert, ensuring item validity, applying the scale, evaluating the items and finalizing the scale. Accordingly, firstly, the structure of CT was examined with current studies and the most frequently used contents were determined (Wing, 2008; Brennan & Resnick, 2012; CSTA, 2017; Kukul and Karatas, 2019; Yağcı, 2019; Uzumcu & Bay, 2021; Tsai et al. 2022); these are decomposition, abstraction, model extraction or recognition, algorithm and evaluation, debugging.

While creating the item pool, current scale development studies and field research in this field were utilized. In this context, we generated a pool of 29 items using Likert type scale (with five point), including the topics of decomposition, abstraction, model extraction, evaluation, and debugging of CT (Table 2). These items were sent to two field experts, a measurement and evaluation expert, and a language expert for their opinions, and the relevant corrections were made.

Table 2 The item pool created for the CT Scale and the resources utilized

CT Topics	Order	Scale Items	Sources Utilized
Decomposition	2	I can break down a problem into its small parts.	Rıjke et al. (2018)
	3	I can understand the sub-headings of a problem.	Barr & Stephenson, (2011)
	4	I can see that a big problem consists of small problems.	Shute et al. (2017)
	17	I can break a problem into its parts in order to reach a solution.	Kukul & Karatas (2019)
	5	I can solve a problem more easily when I divide it into parts.	Selby & Woollard, (2013)
Abstraction	7	I can understand the important points of a problem.	Qian & Choi, (2022)
	8	I can understand the main topic of a problem without getting caught up in the details.	Cetin & Dubinsky, (2017)
	9	I do not get stuck in details when trying to understand a problem.	Wing, (2006)
	11	I can understand what the main problem is in a problem I encounter.	Gülbahar et al. (2018)
	13	I can understand the focus of a problem.	Tsai et al. (2022)
	14	I can distinguish the difference between a problem I have encountered and problems I have experienced before.	Wing, (2006) Wing, (2008)
Pattern extraction/	16	I can learn from a problem I have experienced.	Palts & Pedaste, (2020)
	18	When I encounter a problem, I can recognize whether it is similar to a problem I have experienced before.	Rich et al. (2021)
	28	I can use a solution that has worked for me before in different problems.	Calderon et al. (2015, July)
	19	I can find similar aspects of different problems I encounter.	Van Borkulo et al. (2021, October)
	20	I can benefit from my previous experiences when solving a problem.	Barrón-Estrada et al. (2022)
Algorithm	21	I try to find different ways to find a solution to a problem I encounter.	Choi et al. (2017)
	22	I know that the decisions I make will affect the decisions I will make.	Yağcı, (2019)
	6	I consider alternative solutions in the process of solving a problem.	Özmutlu et al. (2021)
	1	I consider both positive and negative consequences when making a decision in solving a problem.	Yağcı, (2019)
	23	I plan the tasks I will do in a problem step by step.	Gresse Von Wangenheım et al. (2019)
	24	I consider all kinds of possibilities in problems that I need to decide.	Tsai et al. (2022)
	10	When planning the solution of a problem, I calculate all the steps involved.	Shute et al. (2017)
Evaluation and debugging	25	When I look for a solution to a problem I encounter, I try to find the most effective solution.	Vourletsis et al. (2021)
	26	I can find the mistakes I made during the solution process of a problem I have experienced.	Fitzgerald et al. (2008)
	27	I check whether the solution I have developed for a problem I have encountered is correct or not.	Fitzgerald et al. (2008)
	15	I review the steps I take to reach the best solution in my problem solving processes.	Kim et al. (2018)
	12	When I search for a solution to a problem, if the solution I find does not work, I investigate why.	Yağcı, (2019)
	29	I check my planned steps in my problem solving process.	Tsai et al. (2022)

Validity and Reliability Studies of the Scale

The construct validity of the CT scale was firstly evaluated by two different field experts. Afterwards, EFA was conducted for the statistical validity study.

To determine the criterion based validity of the CTS, the "Marmara Critical Thinking Scale" (MTCS) developed by Özgenel and Çetin (2018) was applied to 57 students simultaneously with the CTS. Developed with 410 teachers, this scale has a 28-item, 5-point Likert-type, 6-factor structure. The Cronbach Alpha internal consistency coefficient value was calculated as .91 during the development/adaptation process of the MTCS. In this research, the Cronbach's Alpha value of MTCS was calculated as .96. Pearson product-moment correlation coefficient was calculated by performing correlation analysis to determine the relationship between the scores obtained with CTS and MTCS.

We computed item-total correlation coefficients using item analysis methods as part of the reliability assessment process. Item total correlation coefficients are expected to be higher than .30. In addition, lower-upper group item analysis was also conducted within the context of the investigation into reliability. In this analysis, the result of the comparison of the differences between the item mean scores of the lower 27% and upper 27% groups to the total scores of the test with the unrelated t-test is accepted as an indicator of the internal consistency of the scale. In addition, Cronbach Alpha coefficient, which is the consistency coefficient of the scale, was calculated.

Study 2

In Study 2, to determine the role of metacognition in CT, structural equation modeling was used in the correlational research type.

Participants

The participants consisted of 306 pre-service teachers studying in five different departments at a foundation university (Table 3).

Table 3 Distribution of participants of Study 2 according to departments

	Classroom Teaching	Psychological counseling and guidance	Special Education Teaching	Preschool Teaching	English Language Teaching	Total
CT CFA and MC	73	55	52	68	58	306

Data Collection Tools

For the purpose of Study 2, bid and metacognition scales will be used. For the Bid scale, a 28-item Likert-type, single-factor scale with a reliability coefficient of .985, developed with 365 pre-service teachers in Study 1, was used. For metacognition, the iteration of the metacognitive awareness inventory formulated by (Schraw & Dennison, 1994) and adapted into Turkish (Akın et al., 2007) was used in this study. The correlation between the original and the adapted version of the measurement tool, which was adapted with 607 students, was found to be .93. Accordingly, the inventory consists of 8 factors; declarative knowledge, procedural knowledge, conditional knowledge, planning, monitoring, evaluation, debugging, debugging, information management.

Data Analysis

The data obtained from 306 participants were tested with structural equation modeling to determine the role of metacognition in CT.

Results

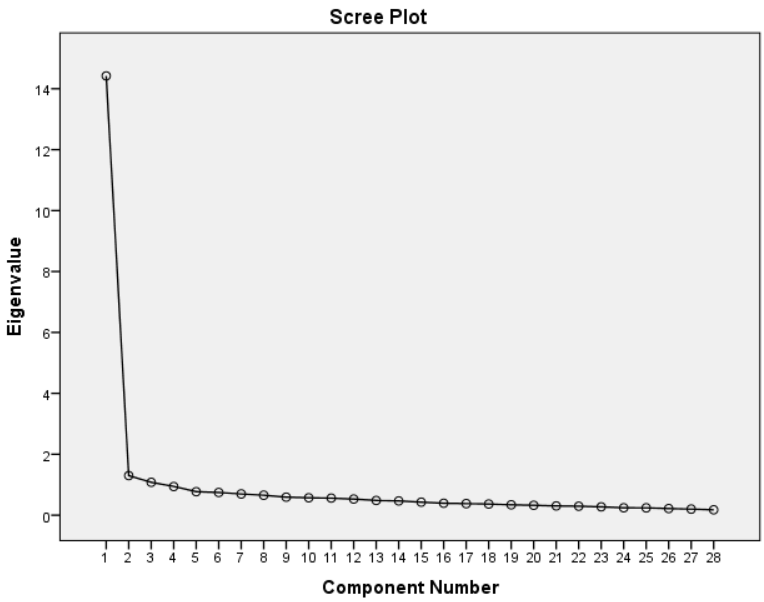
Study-1

Development of Computational Thinking Scale: *Exploratory factor analysis*

An EFA (Exploratory Factor Analysis) was conducted to review the properties of the CTS draft. Since the sample size in a factor analysis should be ten times the number of items (Ho, 2006, Can, 2014; Büyüköztürk, 2011), the draft scale including 29 items was applied to 308 university students. The EFA results (KMO=.958, χ^2=5325.84 (df=406; p<0.001) showed that the sample size was adequate and there was a sufficient correlation between the variables to perform EFA (Tabachnick & Fidell, 2001; Can, 2014). Additionally, we determined that the scale had a 3-factor structure with an eigenvalue greater than 1, which explained approximately 56% of the variance. The first three factors are respectively

explained approximately 46.7%, 5.9%, and 3.7% of the variance, respectively. Figure 1 shows the eigenvalues in more detail.

Figure 1 The Factors in CTS



As seen in Figure 1, the graph became more stable after the 1st factor, and the tool had a single-factor structure (the eigenvalue of the 1st factor was 13.5 while it was 1.7 for the 2nd factor) that explained approximately 46.71% of the variance. The factor load of the 9th item on the scale was .334, which was acceptable. It is knowns that if factor load values are above .45, item discrimination is considered high (Ho, 2006; Buyukozturk, 2011; Bayram, 2016). Since the discrimination power of other scale items was high, item 9 was removed from the scale, and EFA was performed again. In the second EFA [KMO=.960, χ^2=5211.46 (df=378; p<0.001)], it explained 48% of the variance. The factor loads obtained for each item are shown in Table 4 below.

Table 4 Factor loads for CTS items

Item No	Factor Load value	Item No	Factor Load value
m1	,551	m16	,558
m2	,684	m17	,781
m3	,626	m18	,678
m4	,562	m19	,717
m5	,629	m20	,720
m6	,715	m21	,732
m7	,718	m22	,674
m8	,554	m23	,732
m10	,675	m24	,754
m11	,751	m25	,733
m12	,581	m26	,730
m13	,739	m27	,772
m14	,701	m28	,737
m15	,742	m29	,758

As seen in Table 4, the highest factor loading value was .772, and the lowest value was .551 in EFA. It can be concluded that the items on the scale had a high level of discrimination. The Cronbach Alpha internal consistency coefficient was calculated as .98 in this study.

We computed item-total correlation coefficients as a measure of item reliability. If the item-total correlation

coefficients are higher than .30, the discrimination power of the items is considered high (Ho, 2006; Büyüköztürk, 2011). Additionally, the scale scores were ordered from smallest to largest and extreme scores in each item were compared. Accordingly, the CTS scores obtained from two groups of 83 participants (27%) with lower and higher scores were measure the differences between the independent group t-test. The item analysis results are shown in Table 5 below.

Table 5 CTS item analysis results

Item No	Item-Total Correlation	The t-test for the Scores of the Extreme Groups
m1	,52	-8,06*
m2	,66	-13,47*
m3	,60	-12,36*
m4	,53	-10,69*
m5	,60	-9,06*
m6	,69	-12,45*
m7	,69	-14,08*
m8	,52	-10,33*
m10	,64	-17,30*
m11	,73	-17,54*
m12	,55	-10,34*
m13	,71	-16,19*
m14	,67	-14,67*
m15	,72	-14,81*
m16	,52	-10,66*
m17	,76	-14,69*
m18	,65	-12,50*
m19	,69	-13,45*
m20	,69	-13,23*
m21	,70	-15,10*
m22	,64	-12,02*
m23	,70	-13,56*
m24	,73	-16,56*
m25	,70	-13,88*
m26	,70	-14,97*
m27	,75	-15,85*
m28	,71	-12,24*
m29	,73	-13,70*

*p<.01

The highest correlation coefficient was .75, the lowest was .52, which proved that all items were similar and served the purpose of the scale (Table 5). The item analysis on extreme values revealed the CTS scores from the lower and upper groups as statistically significant (p< .01). Therefore, it was concluded that each item could distinguish the lower as well upper groups.

Criterion Validity

The relationship between CT and critical thinking was examined to determine the criterion based validity of the developed CTS. Studies have reported that CT and critical thinking are interrelated (Buckley, 2012; Doleck et al., 2017; He et al., 2021). The Pearson product-moment correlation coefficient was measured to define the correlation between the scores from the CTS and MCTDS. The analysis results suggested a positive, statistically significant correlation between CT and critical thinking. (r= .87; p<.01), which also proves the reliability of the CTS.

Study 2 Findings

What is the predictive role of metacognition, one of the high-order thinking skills, in computational thinking?

The mean scores, standard deviation, skewness, and kurtosis coefficients regarding participants' metacognitive awareness and CT were calculated and shown in Table 6 below.

Table 6 Descriptive statistics of variables

	N	Avg	Sd	Skewness	Kurtosis
Declarative knowledge,	306	3,90	0,63	-0,40	0,18
Procedural knowledge	306	3,81	0,66	-0,32	-0,02
Conditional knowledge	306	3,91	0,66	-0,53	0,39
Planning	306	3,78	0,65	-0,38	0,37
Monitoring	306	3,77	0,63	-0,35	0,12
Evaluation	306	3,83	0,65	-0,44	0,31
Debugging	306	3,88	0,64	-0,49	0,16
information management	306	3,79	0,61	-0,30	0,25
Metacognitive Awareness	306	3,83	0,56	-0,34	0,32
Computational Thinking	306	3,99	0,71	-0,96	0,98

As seen in Table 6, participants' metacognitive awareness level was 3.83 out of 5 (sd=0.56), and the CT level was 3.99 (sd=0.71). The kurtosis and skewness coefficients ranged between -1 and +1, which suggests that the variables did not deviate significantly from normality. Pearson correlation coefficients were calculated to determine the level of relationship between the scores and the variables. The results are shown in Table 7 below.

Table 7 Correlation analysis results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Declarative knowledge (1)	-									
Procedural knowledge (2)	,773**	-								
Conditional knowledge (3)	,820**	,703**	-							
Planning (4)	,810**	,731**	,756**	-						
Monitoring (5)	,807**	,772**	,797**	,826**	-					
Evaluation (6)	,761**	,755**	,746**	,784**	,816**	-				
Debugging (7)	,628**	,619**	,671**	,651**	,669**	,665**	-			
Information management (8)	,734**	,702**	,763**	,755**	,812**	,783**	,691**	-		
Metacognitive Awareness (9)	,903**	,846**	,884**	,902**	,929**	,895**	,780**	,897**	-	
Computational Thinking(10)	,600**	,600**	,566**	,592**	,627**	,585**	,541**	,604**	,669**	-

N=306; p<.01

Table 7 shows a positive, moderate, and statistically significant correlation between metacognitive awareness and CT (r=.604, p<.01). In parallel, there was a positive, moderate, and statistically significant correlation relationship between CT and the sub-dimensions of metacognitive awareness.

The structural equation modeling was used to examine the effects of metacognitive thinking sub-dimensions on CT. The structural equation model shown in Figure 2 was tested on the AMOS.

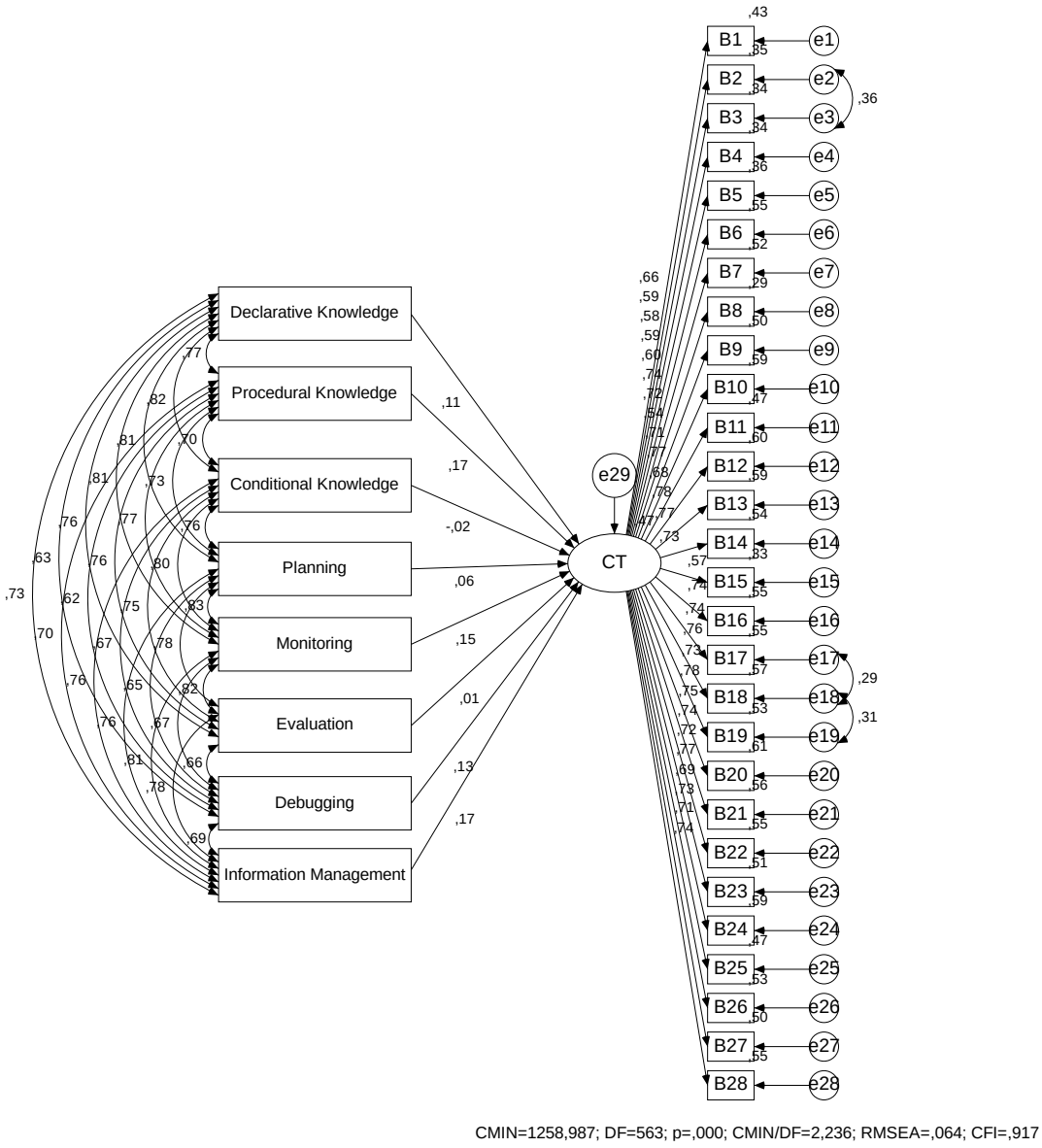


Figure 2. The structural equation model on the effect of metacognitive awareness on computational thinking

As seen in Figure 2, according to the CFA results, the fit value of the model (χ2/df) was 2.236, which indicates a perfect fit as it is less than 3. The fit indices were also acceptable (RMSEA =.064, CFI =.917; and SRMR=.0426) (Jackson et al., 2009; Browne & Cudeck, 1993). The structural equation model explained 47% of CT. The findings are shown in Table 8 below.

Table 8 Analysis results regarding the structural equation model

Measurement Model			β_0	β_1	S.E.	C.R.	P
CT Scale	<---	Declarative knowledge	0,11	0,12	0,11	1,16	.246
CT Scale	<---	Procedural knowledge	0,18	0,19	0,08	2,25	.025
CT Scale	<---	Conditional knowledge	-0,02	-0,02	0,09	-0,26	.799
CT Scale	<---	Planning	0,06	0,07	0,10	0,69	.488
CT Scale	<---	Monitoring	0,15	0,16	0,11	1,45	.146
CT Scale	<---	Evaluation	0,01	0,01	0,09	0,12	.902
CT Scale	<---	Debugging	0,13	0,14	0,07	1,99	.047
CT Scale	<---	Information management	0,17	0,20	0,10	1,99	.046

β_0: Standardized path coefficients; β_1: non-standardized path coefficients; S.E.: Standard error C.R.: Critical ratio

At the Table 8, procedural knowledge was a positive and significant predictor of CT (β_0=.11, p<.05). Similarly, debugging (β_0=.13, p<.05) and information management (β_0=.17, p<.05) sub-dimensions were also positive and significant predictors of CT. It was found that declarative knowledge, conditional knowledge, monitoring, planning,

and evaluation sub-dimensions did not significantly predict CT.

Discussion

Study-1

A CT scale was developed in the first part of this study. CT is interrelated to critical thinking, one of the high-order thinking skills, so the correlation between both skills was examined for the criterion validity of the scale. Accordingly, there was a high correlation between them. The internal consistency coefficient of the 28-item scale was .98, explaining 48% of the variance. The results confirmed the accuracy and consistency of the CTS

The fact that the scale was found to be unidimensional may have caused it to be expected to be five-dimensional since it includes the five most common topics of the bid, which I mentioned in the method section. However, actually the item correlation coefficients ranged between .52 and .75 in the statistical analyses I conducted reflects the strength of the items in the scale, and indeed the scale explained 48% of the variance also reveals the strong structure of the scale. The strong evidence for the content validity of the scale items can be explained as the references from which each item was inspired.

In addition, the correlation of the scale with the Marmara Critical Thinking Scale developed by Özgenel and Çetin (2018) for criterion-based validity was found to be positive and high ($r= .87$; $p<.01$). Studies have also shown that there is a correlation between CT and critical thinking (Buckley, 2012; Doleck et al., 2017; He et al., 2021). Therefore, it can be said that the scale meets the standards of validity and reliability.

Study-2

According to the structural equation model based on the metacognition sub-dimensions and the CTS, procedural knowledge, debugging, and information management sub-dimensions significantly predicted 47% of CT, which suggests a close interrelation between metacognition and CT. Procedural knowledge is primarily used in solving routine problems and is similar to algorithms (Anderson, 2005; Braithwaite & Sprague, 2021). Procedural knowledge, described as task-oriented (Anderson, 1995) and showing how to do a task (Schraw & Dennison, 1994), resembles algorithms because algorithms provide the knowledge of how to do a task step by step. Procedural knowledge also shows how to use suitable methods or strategies for problem-solving (Kumar, 1998) and allows for managing this information (Cross & Paris, 1988). As for the role of procedural knowledge in metacognition, Schneider and Lockl (2002) suggest that most developmental researches on metacognition deal with the procedural dimension.

The information management sub-dimension of metacognition was also a significant predictor of CT. According to Schraw & Dennison (1994), information management is characterized by a set of “skills and strategies for efficient information use," such as an elaborative introduction, analysis, organization, or summary of a particular subject. However, abstraction in CT refers to a distinctive focus. As abstraction entails focusing on a given issue in challenging problems (Shute et al., 2017), information management may also be related to abstraction.

Debugging similarly operates in both metacognition and CT. It is defined as removing comprehension and performance errors (Schraw & Dennison, 1994) and also refers to eliminating errors in the specific problem-solving steps in CT (e.g., decomposition, abstraction, pattern recognition) (Bers et al., 2014). Although the content of debugging changes, its function remains the same, which overlaps with the obtained findings. Although the evaluation dimension is present in both metacognition and CT, it is not a significant predictor. At this point, conducting more research on this issue would be beneficial.

Conclusion

The purpose of this paper to develop a CT scale for practicing and prospective teachers and to determine the role of metacognition, one of the high-order thinking skills, in CT. A CTS was developed with 365 participants. The one-factor scale has 28 items and includes: decomposition, abstraction, pattern recognition, algorithm, evaluation and debugging. The Cronbach Alpha, internal consistency coefficient, was .98, which explained 48% of the total variance.

A SEM was developed (N=306) to determine the role of metacognition on CT (see Figure 2). Accordingly,

procedural knowledge, debugging, and information management, which were the sub-dimensions of metacognition, substantially explained CT (47%). The procedural information sub-dimension may be related to algorithms in terms of content; the information management sub-dimension is partially similar to abstraction; the debugging also exists in CT, with the same purpose of use but in different usage areas.

Those findings significantly point to the interactions between metacognition (Rhodes, 2019), which contributes to comprehension and decision-making in any aspect of life, and CT skill, a new and popular problem-solving competency characterized by programming. In this sense, it will be useful to conduct studies that address metacognition and CT together to investigate their effects on learning and teaching.

Recommendations

Applied research on CT and metacognition will be supportive in explaining the relationship between these two thinking skills.

Limitations of Study

The research is limited to pre-service teachers.

Acknowledgment

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Biodata of Author

Dr. **Özlem Üzümcü**

The author completed her doctoral dissertation on computational thinking in 2019. She has studies on educational programs, educational technologies, teacher training, learning and thinking skills. She is currently working at Hasan Kalyoncu University.

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Research Article

Giftedness and mathematics education: a bibliometric analysis

Ayşe Arzu Arı [1], Barış Demir [2] and Ebru Çakır [3],

Mathematics and Science Education Department, Education Faculty, Kocaeli University, Kocaeli, Turkiye

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Abstract

The aim of this study is to conduct a bibliometric analysis of the articles written in the field of mathematics related to gifted students. Bibliometric analysis is the numerical examination of publications produced in a specific field and in a limited period and the relationships between these publications. The analysis included 104 research articles published in Turkish journals between 2010 and 2023 and accessed by searching Google Scholar, Dergipark and ULAKBIM databases. It is seen that the majority of the articles were written in 2020 (f: 18) and in Turkish (74%). A total of 52 articles by authors from 52 different institutions were found, and most of these articles belonged to MoNE teachers (f: 59, 27%). It was also found that the articles in this field were published in 69 different journals and the journals that published the most articles were "Turkish Journal of Gifted Intelligence" (5%) and "Journal of Gifted Education and Creavity" (5%). A total of 165 authors' publications on giftedness and mathematics were found and the authors who published the most were Avni Yıldız (f: 5) and Serdal Baltacı (f: 5). A total of 1244 words were used in the titles of the published articles and the words "gifted" (f: 57), "gifted" (f: 52), "students" (f: 41), "mathematics" (f: 37), "problem" (f: 31) were prominent. In the articles, 240 different keywords were used; "gifted students" (f: 18), "gifted students" (f: 16), "gifted students" (f: 12) and "problem solving" (f: 10) were the most preferred keywords. In 67% of the studies, fewer than 100 people were studied and the sample of students (f: 81, 78%) was preferred more. When the articles in the field of giftedness and mathematics were analyzed in terms of their purposes, "problem solving" (f: 24) and "STEM" (f: 13) came to the fore. In addition, 51 different scales were used in the analyzed articles and the most preferred scales were "Problem Solving Inventory (Heppner & Petersen, 1982)" (f: 4, 8%) and "Learning Styles Inventory (Kolb, 1984)" (f: 3, 6%). A total of 3364 different sources were cited in 104 articles; the most cited source in the field of giftedness was "Education of the Gifted and Talented (Davis G. A. & Rimm S.B., 1998)" (f: 16).

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Introduction

Despite all these and other definitions, mathematics, which is defined as a system consisting of structures and relations reached as a result of successive abstractions and generalizations that help us understand and perceive the world by developing logical thinking (Baykul, 2014), is not just a pile of formulas and rules, as it includes counting, calculating, measuring and drawing operations used to solve problems in daily life. Therefore, learning mathematics does not only involve memorizing formulas and rules (Olkun & Toluk Uçar, 2006). Mathematics is a tool that individuals need to

[1] Corresponding Author: Dr., Mathematics and Science Education Department, Education Faculty, Kocaeli University, Kocaeli, Türkiye. E-mail: abural@kocaeli.edu.tr. ORCID: 0000-0002-0907-2663
[2] Dr., Mathematics and Science Education Department, Education Faculty, Kocaeli University, Kocaeli, Türkiye. E-mail: baris.demir@kocaeli.edu.tr. ORCID: 0000-0001-6997-6413
[3] MEB, İstanbul, Turkiye. E-mail: eramis0401@gmail.com. ORCID: 0000-0002-2335-8393

discover their abilities and direct them correctly, to follow a logical path in their thought system and in many activities (Bulut, 1988).

The concept of talent is defined as a person's ability to understand or do certain things, ability, innate quality, capacity (TDK, 2020). Giftedness, on the other hand, is defined as an individual who differs from his/her peers, constantly asks questions and inquires. Although there is no common definition of giftedness, there have been various definitions of this concept (Erdoğan, 2014). Gifted individuals have skills such as thinking, questioning, and inferring, as well as the ability to conduct scientific research (by gaining skills such as hypothesizing, determining variables, changing variables, designing experiments, and creating models) (Tortop, 2016). According to the Three Rings Theory developed by Renzulli (1986), giftedness is defined as the intersection of above-average general or special ability, motivation and creativity. In studies on giftedness, the concept of genius was first emphasized and the concepts of intelligence and genius were discussed on the basis of social sciences. Later, the concept of general intelligence as an individual's intelligence capacity (potential) came to the fore. When the studies on the concept of giftedness are examined in the historical process of a century, it is seen that especially in the recent period, the concept of domain-specific talent has been focused on (Şengil Akar, 2017). Tannenbaum (2003) defined the concept of giftedness as a state of performance and productivity that emerges depending on the abilities that individuals possess

According to the American National Association for Gifted Children (2006), gifted and talented individuals are defined as individuals who have special intellectual and general talents in the academic sense, have the potential to perform at a high level in areas such as leadership, creativity and visual art applications, and exhibit this potential to contribute positively to their countries. MoNE (2016) defines giftedness as an individual who performs at a higher level than their peers in intelligence, creativity, art, sports, leadership capacity or special academic fields. In the Science and Art Center regulation, giftedness is defined as a higher level of performance in intelligence, leadership, art, creativity capacity or special academic areas compared to peers (MoNE, 2016). Renzulli (1977), on the other hand, defines a gifted student as an individual who is willing to take responsibility, has high-level thinking skills, performs better than his/her peers in characteristics that require instant thinking, and has high productive power.

Mathematics is perhaps one of the most popular subjects among gifted students. The concept of giftedness in mathematics, like the concept of giftedness, is explained in different ways. This is due to the fact that students can exhibit behaviors indicative of mathematical giftedness in different ways (Gavin et al., 2013; Tsui, 2017). Sriraman (2005) defined individuals who have the cognitive ability to work expertly in mathematics as mathematically gifted individuals. Although experts have made different definitions about what giftedness in mathematics is, there are two main approaches in the literature. In the first approach, the performance of individuals in mathematics tests is accepted as an indicator of giftedness, while in the second approach, attention is drawn to the different cognitive performances of gifted individuals and cognitive processes that indicate mathematical creativity such as understanding mathematical structures, bringing different solutions to mathematical problems, and establishing relationships between mathematical structures are emphasized (Şengil Akar, 2017). According to Miller (1990), giftedness in mathematics is defined as unusual curiosity about mathematical and numerical knowledge, unusual quickness in learning, comprehending and applying mathematical ideas, abstract thinking, ability to see mathematical relationships, ability to make analogies, ability to think and solve mathematical problems in a flexible and creative way different from learned prototypes, and ability to transfer mathematical knowledge to a new and unlearned situation. Wagner and Zimmermann (1986) defined mathematical giftedness as a measurable set of abilities such as organizing materials, being aware of rules or patterns, changing the representation of the problem and seeing mathematical relationships in the new form, comprehending very complex structures and working within these structures, reversing the process, and finding (constructing) related problems. If an individual has high achievement in almost all of these abilities, he/she is likely to produce successful creative work in mathematics or other mathematics-related fields. Uzun (2004) stated that children who are gifted in mathematics have mental agility, original interpretation ability, superior generalization ability, comprehension ability above their peers, unusual mathematical processing ability, can solve difficult problems that their peers cannot solve, can associate mathematics with other categories, can solve problems in a very short time, focus on different solution methods and

application, analysis, synthesis and evaluation steps in solutions, and ask unusual problems that are difficult to solve and require effort.

The findings obtained as a result of bibliometric studies also provide the opportunity to determine how the related discipline has developed, to reveal problems or deficiencies, and to discuss the corrections or suggestions to be made in this context (Üstdiken & Pasadeos, 1993; Şakar & Cerit, 2013; Ulu & Akdağ, 2015). When the mathematics literature is examined, it is seen that bibliometric analysis studies both in Turkey and abroad have increased in recent years. Özkaya, mathematics education (2018) and STEM education (2019); Hwang and Tu (2021), artificial intelligence in mathematics education; Aydın (2021), mathematics and creativity; Aydemir (2021), geometry learning domain; Muhammad, Darmayanti, and Arif (2023), learning through discovery in mathematics learning; Phan et al. (2022) and Bayrak (2022), realistic mathematics education; Dede and Özdemir (2022), noticing skills in mathematics education; Kurtuluş and Yılmaz (2022), STEM education; Poçan (2023), digital game-based learning in mathematics education. Çelik, Kaymakçı, and Can (2023) conducted a different study by analyzing the studies on the career development of gifted students through bibliometric analysis. Bıçakçı and Baloğlu (2021), who conducted a bibliometric analysis on another topic related to gifted students, examined research on personality traits.

There are thematic analyses on gifted students in various fields. For example, Kadıoğlu Ateş and Mazı (2017) examined graduate theses on gifted students between 2010 and 2016 without making disciplinary restrictions. Kırnık and Susam (2018), Kara and Nuhoğlu (2022), Ayvacı and Bebek (2019), Özenç and Gül Özenç (2013) also analyzed theses on the same topic, but they differed in the time periods investigated. Bulgurcu (2021) contributed to the literature by analyzing international doctoral dissertations written in English in the field of giftedness. Dönmez and İdin (2017) analyzed the studies on gifted students specifically in the field of science education from various aspects. In the mathematics literature on gifted students, there have also been authors who have applied thematic analysis. Among them, Nacar (2017) examined theses and articles on this subject in Turkey and abroad; Kaya (2021) analyzed the thematic and methodological trends of graduate theses; İnan and Mert Uyangör (2022) analyzed master's and doctoral studies in the database of the National Thesis Center of the Council of Higher Education; Demirci and Işık Tertemiz (2022) analyzed publications in national and international journals publishing in the field of giftedness between 2000 and 2022.

In the aforementioned studies, the analysis of the mathematics literature on gifted students was routinely limited to the topics, year of publication, type of publication, etc. In this study, on the other hand, the keywords used, words used in titles, authors, journals, institutions and most importantly, bibliographies were examined in detail as required by bibliometric analysis.

Research problem

- What is the distribution of the studies in the mathematics literature on gifted/talented students according to the years and the language in which the studies were written?
- What is the distribution of the keywords used in the mathematics literature on gifted students?
- Which words are mostly used in the titles of the researches in the mathematics literature on gifted students?
- What is the distribution of the samples selected in the mathematics literature on gifted students?
- What are the aims of the studies conducted in the mathematics literature on gifted students and the characteristics examined for this purpose?
- What are the most commonly used scales in the mathematics literature on gifted students?
- Who are the researchers who have contributed the most to the mathematics literature on gifted students?
- Which institutions have contributed the most to the mathematics literature on gifted students?
- What are the journals that contribute the most to the mathematics literature on gifted students?
- What are the most common sources of research in the mathematics literature on gifted/talented students?

Method

Descriptive research model was used in this study. Descriptive research can be defined as explaining a particular event, phenomenon or situation with its existing characteristics (Büyüköztürk et al., 2017). In the study, bibliometric analysis technique was used because it was desired to examine the articles published in the field of mathematics education related to gifted students in terms of bibliometric parameters and to reveal the current situation. Bibliometric studies enable the evaluation of scientific studies in terms of both quantity and quality by determining the contributions of scientists working in that field to the relevant discipline, determining the quality of academic journals or determining their relationship with other disciplines (Al et al. 2010; Al & Soydal, 2012; Zupic & Čater 2015; Huang et al. 2006; Üstdiken & Pasadeos, 1992; Yozgat & Kartaltepe, 2009).

Data Collection

For the purpose of the study, the publications in Google Scholar, Dergipark and ULAKBIM databases were scanned starting from 2010 in order to access research on gifted students. The reason for not using SCOPUS and WoS databases, which are frequently used for bibliometric analysis, is that this study aims to analyze publications originating from Turkey. In addition, the review of the relevant literature was conducted in June 2023; therefore, publications after this date were excluded from the analysis. It was ensured that the studies to be analyzed were research articles in mathematics, geometry or STEM fields with "gifted/special talent", "gifted/special intelligence" in the keywords, abstract or title, and graduate theses, papers or review articles on the subject were excluded from the study.

Data Analysis

We reached 104 research articles that were decided to be included in the study. These articles were started to be examined by creating an evaluation table according to the criteria determined by using MS EXCEL (year and language of publication, keywords used, words in the titles of the studies, samples selected in the studies, purposes of the studies and the characteristics examined in line with this purpose, scales used in the studies, researchers, institutions and journals contributing to the literature, sources that the studies were fed). This evaluation form was filled in separately by the researchers. In order to ensure that the study yielded valid and reliable results, the researchers first created the evaluation table independently of each other and then compared the tables to measure consistency. Miles and Huberman (1994) found that the reliability formula was used in the study, a reliability of 95% was calculated. When the agreement between the researchers is 70% and above, it shows that the research data is reliable and can be used (Miles & Huberman, 1994). The most important point to be considered while examining the studies is to take the studies exactly as they are written without changing any words since the studies are examined word-based in bibliometric analysis. In addition, Turkish or English words were taken in the language in which they were written without translation and included in the analysis.

Findings

Distribution of research by years and languages

Between 2010 and 2023, research articles in the mathematics literature on gifted students were analyzed in terms of year and language distribution. The findings are shown in Figure 1 and Figure 2.

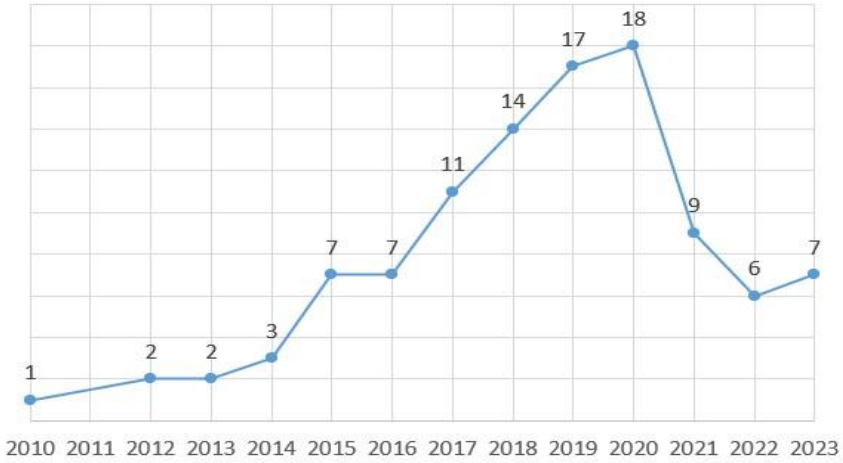

Figure 1. Distribution of the research on gifted students in the mathematics literature according to years

According to Figure 1, a total of 104 studies were conducted between 2010 and 2023. These studies are distributed as 1 study in 2010, 2 studies in 2012 and 2013, 3 studies in 2014, 7 studies in 2015 and 2016, 11 studies in 2017, 14 studies in 2018, 17 studies in 2019, 18 studies in 2020, 9 studies in 2021, 6 studies in 2022 and 7 studies in 2023. In 2011, no study was found.

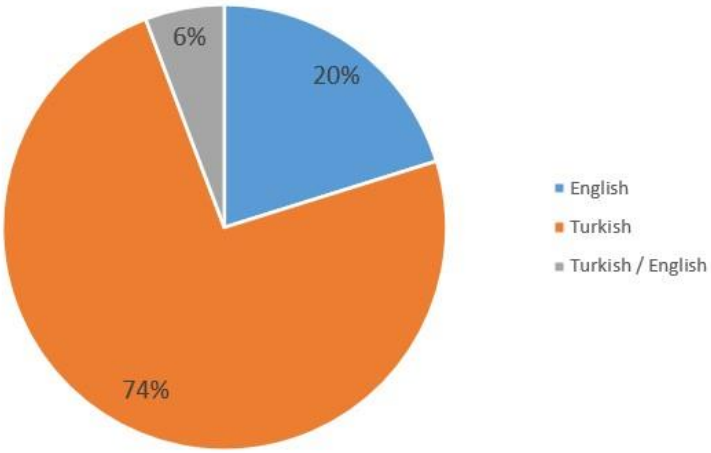

Figure 2. Distribution of research on gifted students in the mathematics literature according to languages

Figure 2 shows that 74% of the studies in this field were written in Turkish, 20% in English and 6% in both Turkish and English.

Distribution of keywords used in the studies

A total of 240 different keywords were found in 104 research articles analyzed in the mathematics literature on gifted students. The distribution of these keywords is shown in Figure 3.

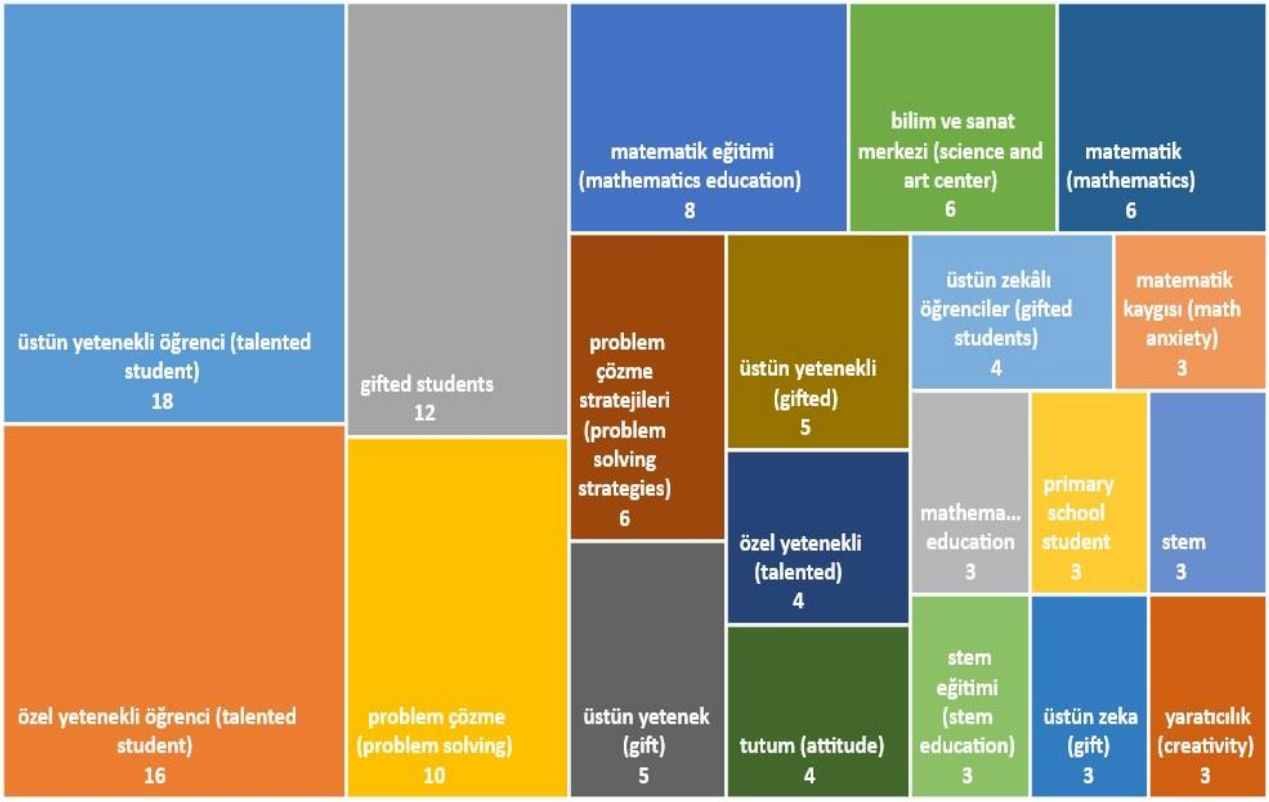

Figure 3. Distribution of the keywords of the studies in the mathematics literature on gifted students

As shown in Figure 3, the most frequently used keywords were "gifted student" in 18 studies and "gifted student" in 16 studies. Following these; "gifted students" used 12 times, "problem solving" used 10 times, "mathematics education" used 8 times, "science and art center", "mathematics", "problem solving strategies" used 6 times each, "gifted" and "gifted" used 5 times each, The keywords "gifted students", "gifted", "attitude", "mathematics anxiety", "stem", "primary school student", "mathematics education", "stem education", "giftedness", "creativity" were used 4 times each, and 3 times each. The usage of other keywords varies between 1 and 2.

The most common words in the titles of the studies

There are a total of 1243 words in the titles of 104 research articles examined in the mathematics literature on gifted students. The visualization of the frequency of use of these words is shown in Figure 4 and their ranking is shown in Table 1.

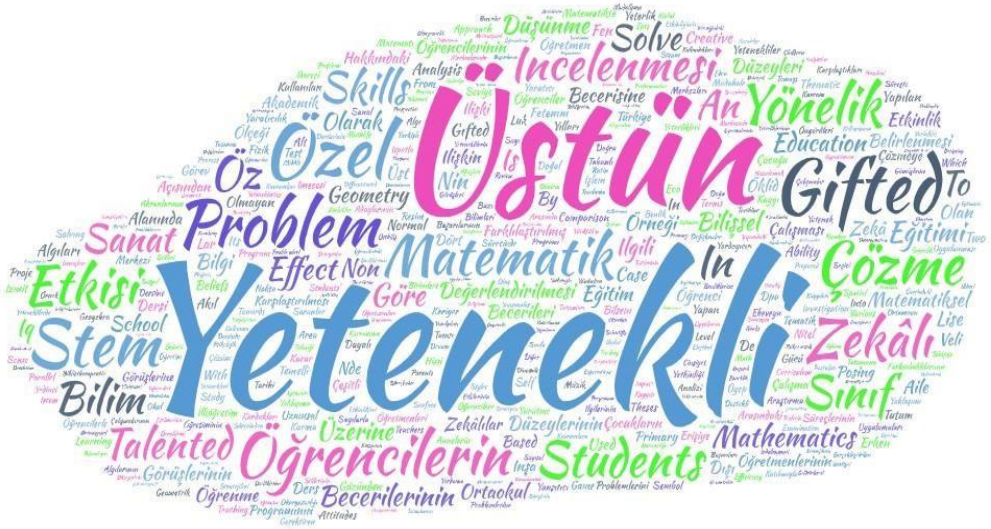

Figure 4. Weighted representation of the words in the titles of the studies in the mathematics literature on gifted students

Table 1. Frequency table of the words in the titles of the studies in the mathematics literature on gifted students

Words	f
Talented	57
Superior	52
Student	41
Mathematics	37
Problem	31
Review	25
Gifted	24
Special	23
Students	20
Directional	20
Solving	18
STEM	16
Intelligent	12
Mathematics	9
Talented	8

According to Table 1, the words "gifted" used 57 times and "superior" used 52 times were the most preferred words in the titles of the analyzed studies. The following words were used: "students" 41 times, "mathematics" 37 times, "problem" 31 times, "examine" 25 times, "gifted" 24 times, "special" 23 times, "students" and "directed" 20 times, "solving" 18 times, "stem" 16 times, "intelligent" 12 times, "mathematics" 9 times and "talented" 8 times.

Preferred samples in research

When the 104 research articles examined in the mathematics literature on gifted students were classified in terms of their samples, Table 2 was formed.

Table 2. Graph of the samples of the studies conducted in the mathematics literature on gifted students

Sample Group	%	Sample	f
Teacher	9%	SAC math teacher	3
		SAC teacher	2
		SAC teacher and psychological counselor	1
		Math teacher	1
		Math and primary school teacher	1
		Pre-school and primary school teacher	1
Student	77%	Talented and normal primary school students	2
		Talented and normal middle school students	8
		Talented primary and middle school students	3
		Talented and normal primary school and middle school students	2
		Talented primary school students	4
		Talented high school students	7
		Talented pre-school students	2
		Talented middle school students	53
Parents	2%	Parents of gifted and normal students	1
		Parents	1
Publications	5%	Thesis	2
		Articles	2
		Thesis and articles	1
Prospective teachers	3%	Pre-Service Teachers of Math	2
		Pre-Service Teachers of Gifted Students	1

Mixed groups	4%	SAC math teacher and Talented middle school students	1
		SAC math teacher and manager and parents and gifted students	1
		Talented middle school students and parents	1
		Talented middle school students and math teachers	1

As can be seen in Table 2, the most preferred sample is student groups (77%). Other samples were teachers (9%), publications (5%), prospective teachers (3%), mixed groups (teacher and student, student and parent) (4%) and parents (2%). Among the student groups, the most preferred group was gifted middle school students with 65%. In the studies conducted with teachers, BİLSEM teachers (56%) and specifically BİLSEM mathematics teachers (22%) were mostly involved. Likewise, in the studies conducted with pre-service teachers, pre-service mathematics teachers (67%) constitute the most preferred group. In the studies examining publications on gifted students, articles and theses were examined equally (40%). In addition, 67% of the 104 articles analyzed in this study had a sample size of less than 100 people.

Characteristics and research objectives

The classification of the most examined characteristics in 104 research articles analyzed in the mathematics literature on gifted students is shown in Table 3.

Table 3. Characteristics examined in the mathematics literature on gifted students

Area Under Review	**f**
Problem solving	24
Stem	13
Tendency	10
Skill	7
Perception (Opinion)	6
Differentiated program	6
Material development	7

When Table 3 is examined, it is seen that most of the studies were conducted under the title of "problem solving" with 24 out of 104 studies. The aims of the studies under this heading are shown in Table 4.

Table 4. Objectives of the studies in the mathematics literature on gifted students under the title of "Problem Solving"

Category	**Purpose of the research**	No
Impact of a method	Investigation of the effect of bibliotherapy method on problem solving skills of gifted students	A21
	Investigation of the effect of early intervention program on problem solving skills of gifted preschool students	A85
Comparison	Determination of problem-solving strategies of gifted and non-gifted students	A89
	Investigating the success of gifted and non-gifted students in solving non-routine problems	A103
	Comparison of selective problem-solving technique satisfaction levels of students with and without a diagnosis of giftedness	A102
	Comparison of the strategies used by gifted and other students in solving mathematical problems	A98
	Comparison of non-routine problem-solving strategies of gifted primary school 4th grade students and successful primary school 4th grade students not diagnosed as gifted	A1
Process review	Investigating the mathematical literacy problem solving processes of gifted students	A55
	Investigating gifted students' perceptions of mathematics problem solving attitudes and processes	A93
	Determination of gifted students' performance in solving mathematical problems and the strategies they use while solving problems	A56
	Determination of metacognitive skills of gifted students during problem solving	A2
	Determination of metacognition levels of gifted students towards problem solving skills	A78
	Analyzing creative problem-solving styles of gifted students	A12
	Determination of problem-solving strategies of gifted students	A84
	Examining reflective thinking skills for problem solving	A96
	Determination of creative problem-solving skills of gifted students	A9
	Determination of gifted students' self-concept in problem solving skills	A19
Relationship with variables	Determination of problem-solving skills of gifted students according to their gender and grade level	A35
	The relationship between problem solving strategies and Van Hiele geometric thinking levels of gifted students	A3
	Determining the relationship between problem solving competencies and career development of gifted students	A77
	Investigating the relationship between problem solving perceptions and cognitive flexibility levels of gifted education candidates	A82
	Investigation of reflective problem-solving skill levels of gifted students according to age, gender, parental education level, playing computer games and playing sports	A101
	Examining the relationship between parental competence levels and problem-solving skills of mothers of gifted students according to gender, number of children, marital union status, education level of their husbands and themselves, and perceived economic income	A79
	Determination of the relationship between intelligence and problem-solving skills of gifted students	A27

According to Table 4, the subcategories of the studies in which the problem solving skills of gifted students were examined were: investigating the effect of a method (f: 2), comparing the problem solving skills of gifted and nongifted students (f: 5), examining the problem solving process (f: 10) and investigating the relationship between problem solving skills and various variables (f: 7). Bibliotherapy method and early intervention program were the methods investigated for their effectiveness on problem solving skills of gifted students. In the studies examining the relationship between

problem solving skills and various variables, these variables include gender, grade level, parental education level, intelligence levels, etc.

Table 5 below shows the aims of 13 studies on "STEM" conducted with gifted students.

Table 5. Aims of the studies on "STEM" in the mathematics literature on gifted students

Category.	**Purpose of the research**	**No**
Evaluation (Opinion taking)	Taking the opinions of BİLSEM teachers on STEM education approach	A16
	Gifted students' strategies and experiences in the process of designing STEM-oriented environmentally friendly projects	A30
	Determining the perspectives of teachers, administrators, parents and gifted students on FETEMM approach	A44
	Determination of student views on GeoGebra within the framework of STEM education	A61
	Investigation of gifted students' interest in STEM professions according to gender, program of study and parental education status	A58
	Determination of STEM attitude levels of gifted students and their interest in STEM career occupations	A59
	Determination of STEM attitude, epistemological beliefs and STEM attitude epistemological beliefs of gifted students	A13
	Determining the STEM practices of gifted students and participants' views on Algodoo as a STEM material	A86
Impact review	Examining the effect of STEAM education process on teachers' critical thinking	A48
	Effectiveness of STEM education nature and science camp	A20
	Evaluation of the gains achieved by students with STEM education	A87
	The effect of STEM activities for gifted students	A50
	Examining the effect of STEM on problem-posing skills of gifted students	A62

According to Table 5, the subcategories of STEM studies conducted with gifted students were identified as STEM-related evaluation (opinion taking) (f: 8) and studies examining the effects of STEM programs on students' learning (f:5). It is noteworthy that the studies in which the opinions on STEM were evaluated had teacher (f: 1), student (f: 6) and mixed (students, parents, teachers and administrators) samples (f: 1). The following Table 6 shows the aims of the 10 studies on "disposition" conducted with gifted students.

Table 6. Aims of the studies under the title of "disposition" in the mathematics literature on gifted students

Category.	**Purpose of the research**	**No**
Self-efficacy and attitude	Examining the attitudes and self-efficacy of prospective elementary mathematics teachers towards gifted education according to gender, grade level, type of high school they graduated from, whether they have participated in a course or activity related to gifted education before, whether they are willing to work in the Science and Art Center after graduation, and whether they have a gifted individual in their environment	A23
	Investigation of gifted students' attitudes towards mathematics course, academic self-efficacy and self-perception levels according to gender, grade level and learning styles	A54
	Investigation of gifted students' mathematics literacy achievement and mathematics literacy self-efficacy perceptions in terms of school type, grade level, parental education level and occupation	A53
	Investigating the predictive power of gifted students' mathematics self-efficacy on their mathematics achievement by gender	A92
Math anxiety	Comparison of mathematics anxiety levels of students with and without a diagnosis of giftedness	A88
	Investigating the effects of gifted students' mathematics selfefficacy resources on their mathematics anxiety	A51
	The power of gifted students' perfectionism levels to predict math anxiety	A91
Other	Determination of gifted students' motivational insights about math problems	A94
	Determination of gifted students' cognitive predictions about mathematical problems	A90
	Determining the relationship between self-regulated learning and motivational beliefs of gifted students in mathematics	A69

According to Table 6, the subcategories of the dispositional studies conducted with gifted students are selfefficacy and attitude (f: 4), mathematics anxiety (f: 3) and other (f: 3). In the studies named as "other" category, motivational and cognitive predictions about mathematics problems were examined, and the relationships between self-regulated learning in mathematics and motivational beliefs were also examined.

Table 7 shows the aims of 7 studies on "skills" conducted with gifted students.

Table 7. Objectives of the studies under the title of "skills" in the mathematics literature on gifted students

Purpose of the research	No
Determination of gifted students' reasoning skills in geometry learning domain	A73
Investigating the effect of mathematics and art activities on the spatial abilities of gifted students	A31
Investigating the abstraction process of gifted students	A100
Determination of repeated pattern skills of gifted students	A60
Comparison of mathematical thinking process skills of gifted and non-gifted students	A97
Gifted education program model (GEP) and its effect on gifted students' mathematical creativity	A99
Metacognitive knowledge and skills of gifted students about complex numbers	A52

According to Table 7, studies examining the skills of gifted students were grouped under a single category. Among the skills examined were gifted students' reasoning skills, spatial abilities, pattern skills, mathematical thinking process skills, etc.

Table 8 shows the aims of 6 studies on "perception (opinion)" conducted with gifted students.

Table 8. Aims of the studies under the title of "perception (opinion)" in the mathematics literature on gifted students

Category.	Purpose of the research	No
Mathematics	Investigation of gifted students' mental images of mathematics concept	A74
	Determining the effect of history of mathematics activities on gifted students' perceptions of history of mathematics	A36
	Investigating the perceptions of gifted elementary school students about mathematics courses in their schools	A41
Gifted student	Investigation of mathematics teachers' judgments about the characteristics of gifted students in mathematics	A47
	Determination of mathematics teachers' views on giftedness	A38
Math teacher	Determination of gifted students' perceptions of mathematics teachers	A42

According to Table 8, the subcategories in the studies conducted with gifted students to determine perceptions (opinions) were perceptions towards mathematics (f: 3), perceptions towards gifted students (f: 2) and perceptions towards mathematics teachers (f: 1). While the studies conducted to determine the perceptions towards gifted students were conducted with the sample of mathematics teachers, the other studies were conducted with the sample of gifted students.

Table 9 shows the objectives of 6 "differentiated curriculum studies" for gifted students.

Table 9. Aims of the studies on "differentiated curriculum" in the mathematics literature on gifted students

Category.	Purpose of the research	No
Geometry	Determining the effects of differentiated geometry instruction (Polygons and Geometric Objects) on the spatial ability of gifted students	A63
	Investigating the effect of a differentiated geometry program (Geometry, Measurement and Numbers units) on creativity, spatial ability and achievement levels of gifted students	A25
	The effect of a differentiated mathematics program (Geometric Bodies subject) on retention and easy learning	A46
Mathematics	Determining the effect of a differentiated mathematics curriculum (Fractions subject) on the academic self-concept of gifted students	A26
	Determining the effect of differentiated problem solving instruction on gifted and talented students' success in solving mathematical problems and creative thinking	A28
STEM	Investigating the effect of differentiated STEM applications on creativity and attitude	A83

According to Table 9, differentiated curricula were developed for gifted students mostly in geometry (f: 3), while differentiated curricula were also developed in mathematics (f: 2) and STEM (f: 1). In these studies, a differentiated curriculum was developed in a selected subject (geometric objects, fractions, problem solving) and the effects of this curriculum on various variables (academic self-concept, creative thinking, retention and easy learning, spatial ability) were examined.

Table 10 shows the aims of 7 studies on "material development" conducted with gifted students.

Table 10. Objectives of the studies on "material development" in the mathematics literature on gifted students

Category.	Purpose of the research	No
Scale	Development of "STEM Self-Efficacy Scale" for gifted education	A45
	Development of "Mathematical Modeling Competencies" scale for gifted students	A40
	Adaptation of the TOMAGS scale into Turkish	A8
	Developing a scale to measure gifted students' perceptions of problem solving skills	A68
Event / Program	To develop and implement a mathematics program suitable for distance education for gifted students and to test the effectiveness of the program	A34
	Developing a FETEMM activity that can be implemented with the participation of families of gifted students in Science and Art Centers	A17
	Evaluation of the program developed for teaching problem solving skills of gifted students	A95

According to Table 10, while scale studies (f: 4) were prominent in material development studies conducted for gifted students, activity/program development studies (f: 3) were also conducted. Within the scope of scale studies, scale development was conducted in 3 studies (A45, A40, A68) and the existing scale was adapted into Turkish in the other study (A8).

Scales used in research

In 104 research articles analyzed in the mathematics literature on gifted students, 51 different scales were used. The most commonly used scales are shown in Table 11.

Table 11. Table of scales used in the mathematics literature on gifted students

Scale name	Scale imprint	f	%	Research no.
Problem Solving Inventory	Heppner and Petersen (1982)	4	8%	A76, A79, A77, A82
Learning Style Inventory	Kolb (1984)	3	6%	A54, A37, A76
Problem Solving Inventory for Children	Serin, Bulut, Serin and Saygılı (2010)	2	4%	A35, A19
Mathematics Anxiety Scale	Bindak (2005)	2	4%	A51, A91
Reflective Thinking Skill Scale for Problem Solving	Kızılkaya and Aşkar (2009)	2	4%	A96, A101
STEM Attitude Scale	Friday Institute for Innovative Practices in Education (2012)	2	4%	A59, A13

According to Table 11, Heppner and Peterson's (1982) "Problem Solving Inventory" (f: 4, 8%) was used the most in mathematics studies on gifted students. Kolb's (1984) "Learning Style Inventory" (f: 3, 6%) came second, followed by Serin, Bulut, Serin, and Saygılı's (2010) "Problem Solving Inventory for Children", Bindak's (2005) "Mathematics

Anxiety Scale", Kızılkaya and Aşkar's (2009) "Reflective Thinking Skills Scale for Problem Solving" and Friday Institute for Innovative Practices in Education's (2012) "STEM Attitude Scale" (f: 2, 4%). The scales used in other studies are different from each other.

The researchers who have done the most work in this field

A total of 165 authors took part in 104 research articles analyzed in the mathematics literature on gifted students. The number of publications of these authors in the field and the 14 authors with the highest contribution rates to publications are shown in Table 12. The contribution rates given here are obtained by dividing the articles by the number of authors; therefore, the contribution rates of articles written with co-authors decrease.

Table 12. Table of the authors with the most publications in the mathematics literature on gifted students

Author	Number of publications	Total contribution rate
Avni YILDIZ	5	1,66
Serdal BALTACI	5	1,66
Fatma ERDOĞAN	4	2,00
Adem DOĞAN	4	1,83
Abdullah KAPLAN	4	1,33
Mesut ÖZTÜRK	4	1,33
Duygu ÖZDEMİR	3	2,50
Erhan ŞAHİN	3	2,50
Ramazan GÜRBÜZ	3	1,50
Ümit DAVASLIGIL	3	1,50
Ziya ARGÜN	3	1,50
Aygen KOÇ KOCA	3	1,50
Yasar AKKAN	3	1,00
Cahit AYTEKİN	3	0,92

According to Table 12, Avni YILDIZ and Serdal BALTACI (f: 5, contribution rate: 1,66) contributed the most to mathematics studies on gifted students. Other researchers who contributed to the field were Fatma ERDOĞAN (f: 4, contribution rate: 2), Adem DOĞAN (f: 4, contribution rate: 1,83), Abdullah KAPLAN (f: 4, contribution rate: 1,33), Mesut ÖZTÜRK (f: 4, contribution rate: 1,33).

Institutions with the most publications

It was found that 165 authors of the 104 research articles examined in the mathematics literature on gifted students belonged to 52 different institutions. The 9 most frequently mentioned institutions are shown in Figure 5.

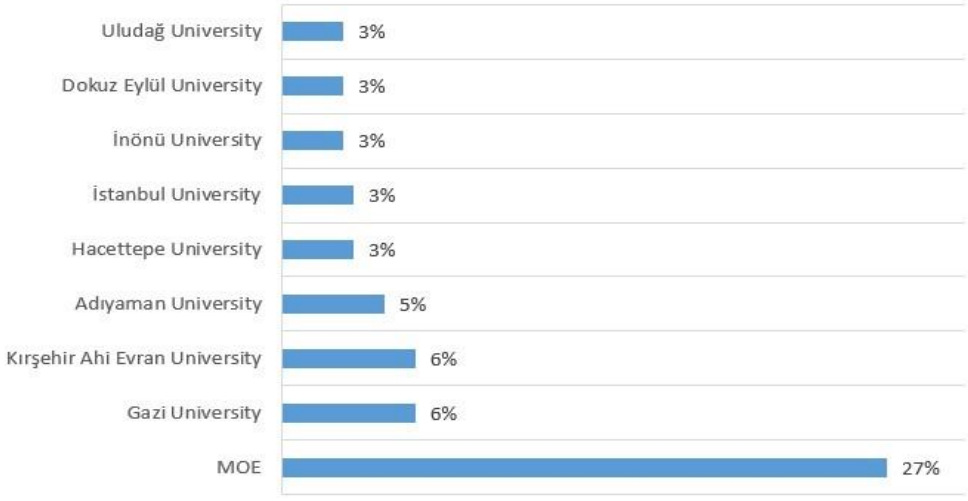

Figure 5. Graph of the institutions with the highest number of publications in the mathematics literature on gifted students

As can be seen in Figure 5, authors affiliated to the Ministry of National Education published the most publications (27%). Gazi University and Kırşehir Ahi Evran University (6%) ranked second, followed by Adıyaman University (5%). Hacettepe University, Istanbul University, İnönü University, Dokuz Eylül University and Uludağ University are also on the list of institutions with the highest number of publications in the mathematics literature in the field of gifted students with a rate of 3%. The number of publications of other institutions varies between 1 and 2.

Top published journals

It was found that 104 research articles analyzed in the mathematics literature on gifted students were published in 69 different journals. The 7 journals with the highest number of publications in this field are shown in Figure 6.

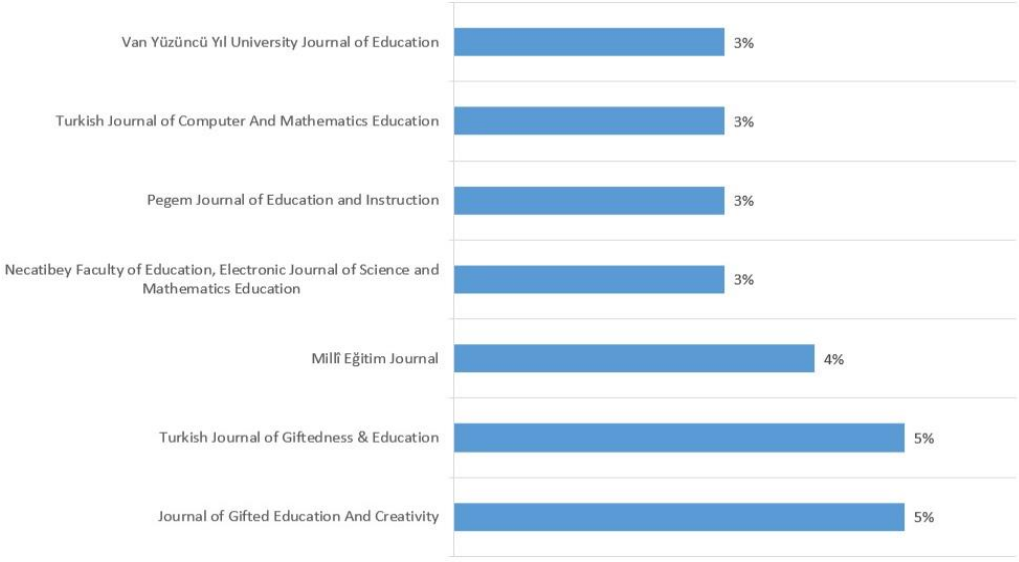

Figure 6. Graph of the journals with the highest number of publications in the mathematics literature on gifted students

According to Figure 6, the journals with the highest number of publications in the mathematics literature on gifted students are Turkish Journal of Gifted Education and Training and Journal of Gifted Education and Creativity (5%). The Journal of National Education (4%) and Necatibey Education Faculty Electronic Journal of Science and Mathematics Education, Pegem Education and Training Journal, Turkish Journal of Computer And Mathematics Education and Van Yüzüncü Yıl University Faculty of Education Journal (3%) are also among the journals that have made a name for themselves in the field. The number of publications in other journals varies between 1 and 2.

The most popular sources for publications

t is seen that a total of 3364 different publications/books/articles were included in the bibliography of 104 research articles examined in the mathematics literature on gifted students. Table 13 shows the table of the 15 most utilized sources.

Table 13. Table of the most frequently used sources in the mathematics literature on gifted students

Author	Publication name	Number of citations
MEB	Mathematics Curriculum (Grades 1, 2, 3, 4, 5, 6, 7 and 8)	33
MEB	Science and Art Center Directive	28
Yıldırım A. and Şimşek H.	Qualitative Research Methods in Social Sciences	28
Orton A. and Wain G.	Problems, Investigations and An Investigative Approach. In, A. Orton & G. Wain (Eds.). Issues In Teaching Mathematics	24
Davis G. A. and Rimm S.B.	Education of the Gifted and Talented	16
Karasar, N.	Scientific Research Method	16
Büyüköztürk Ş., Çakmak E. K., Akgün Ö. E., Karadeniz Ş. and Demirel F.	Scientific Research Methods	15
Krutetski V. A.	The Psychology of Mathematical Abilities In School Children	14
Miles B. M. and Huberman A. M.	Qualitative Data Analysis	14
Miller R. C.	Discovering Mathematical Talent. (Eric Digest No. E482)	14
NTCM	Principles and Standards of School Mathematics	14
Sak U.	Gifted Children: Characteristics, Identification and Education	14
Altun M.	Mathematics Teaching in Primary Secondary Education	13
Clark B.	Growing Up Gifted. Developing Children's Potential at Home and School	13
Renzulli J. S.	What Makes Giftedness? Reexamining A Definition	12

According to Table 13, MEB resources (f: 33 and f: 28) were mostly used in the articles examined in the mathematics literature on gifted students. The most frequently cited authors in the gifted literature were Davis G. A. and Rimm S. B. (f: 16), Miller R. C. (f: 14), Sak U. (f: 14), Clark B. (f: 13) and Renzullı J. S. (f: 12). The authors who received the most citations in research methods explanations were Yıldırım A. and Şimşek H. (f: 28), Karasar, N. (f: 16), Büyüköztürk Ş., Çakmak E. K., Akgün Ö. E., Karadeniz Ş. and Demirel F. (f: 15) and Miles B. M. and Huberman A. M. (f: 14).

Conclusion, Discussion and Recommendations

In this study, 104 research articles in the field of mathematics related to gifted students published in journals in Turkey between 2010 and 2023 were analyzed by bibliometric analysis method. The importance of bibliometric analysis can be expressed in terms of visually presenting the research in the giftedness and mathematics literature in our country, as well as revealing the gaps in the literature and guiding researchers (Çelik, Kaymakçı, & Can, 2023). The criteria for analyzing the studies were determined as the year and language of publication, the keywords used, the words used in the titles of the studies, the samples selected in the studies, the purposes of the studies and the characteristics examined in line with this purpose, the scales used in the studies, the researchers, institutions and journals that contributed to the literature, and the sources from which the studies were fed.

It was determined that mathematics research on gifted students in journals published in our country has been increasing since 2010 and reached the highest point in 2020. As in every field, with the transformation of gifted education into an international competition, there has been an increase in the studies published in this field (Bolat & Tekin, 2017; Demirci & Işık Tertemiz, 2022; Sak, 2020). However, it is also noticeable that the number of studies published in this field has declined after 2020; this is thought to be due to the difficulty in reaching students due to the COVID-19 pandemic (Kara & Nuhoğlu, 2022). In this direction, it is recommended that the necessary importance should be given to the studies in the field and even the interest in the studies conducted with gifted students should be increased since students can be reached as easily as before.

When analyzed in terms of the language in which the studies were published, it was found that the language used was mostly Turkish as a natural consequence of the fact that the studies included in this study were limited to journals published in Turkey. Although Ayvacı and Bebek (2019) commented that "research in the field of giftedness in our country is not at a level to contribute to international knowledge" for the scarcity of doctoral dissertations, the same comment can be made about the scarcity of studies in English. In today's world where the scientific language is English, it may be suggested that publications should be published both in our mother tongue and in English, which is how 6% of the studies analyzed in this study were published.

When the keywords used in the studies included in the study were analyzed, a total of 240 different keywords were found. Considering that most of the studies were published in Turkish, it can be assumed that the keywords used were mostly Turkish. Among these keywords, "gifted student" and "gifted student" stand out. The fact that "gifted students" and "gifted intelligence" were used in fewer studies draws attention to the use of the words "intelligence and talent". Dönmez and İdin (2017), who thematically analyzed science education studies conducted with gifted students, drew attention to the different definitions of the same concept. According to Sezgin (2020), Gardner prioritized talent rather than intelligence in his theory, but for social acceptance, he published his book under the title "Frames of Mind: The Theory of Multiple Intelligences" rather than "Seven Talents". As it is understood, even the author of the theory is in a state of indecision about which word to choose when writing his book and presenting his theory. Sak (2020), another researcher who emphasized this situation, stated that there is no universal consensus on the definition of giftedness in terms of the words used and the meaning intended. However, the fact that the word "ability" is used more frequently in the keywords of the studies analyzed in this study is thought to be an important evidence for this conflict.

When we look at the keyword analysis in the mathematics literature, it is seen that the results vary according to the subject of bibliometric analysis. Bayrak (2022), who conducted a bibliometric analysis on realistic mathematics education, found that the keywords "realistic mathematics education", "students", "mathematics" were used more frequently. Similarly, Özkaya (2018), who conducted a bibliometric analysis of mathematics education studies, showed that "mathematics", "education", "student" were frequently used as keywords. Köse (2021), who analyzed publications on pedagogical content knowledge, found that the preferred keywords were "teaching", "pedagogical content knowledge", "student" and "education". As can be seen in these examples, the results are English words. The reason for this is that WoS or SCOPUS, which contain mostly English articles, was chosen as the database. In this study, the fact that Turkish keywords are in the majority and do not match with these results is due to the use of ULAKBIM and Dergipark as databases where Turkish publications are in the majority.

The most frequently used words in the titles of the studies analyzed in this study also have findings that are in parallel with the keywords mentioned above. The words "talented" and "gifted" were the most preferred words in the titles of the studies, while "intelligent" was used less frequently. The fact that the word "problem", which is one of the following words, was used in the titles of 31 different studies sheds light on the fact that most of the studies analyzed in this field were conducted on problem solving.

The most preferred sample in research is student groups. This seems quite logical considering that the research topic is "gifted students". The fact that there are more gifted middle school students among the student groups is similar to the results of other thematic studies on gifted students (Kaya, 2021; Nacar, 2017; Kara & Nuhoğlu, 2022; Ayvacı & Bebek, 2019). The handicap of this result is that the necessary importance is not given to studies conducted with teachers (Kadıoğlu Ateş & Mazı, 2017), who are primarily responsible for identifying and educating gifted students and even integrating them into society.

When the studies with gifted high school students as the sample were examined, two of them (A3, A68) were conducted with science high school students, while in the others, high school students attending BİLSEM were preferred. Regarding science high school students as gifted, Türk (2018) stated that "Science high schools are the most successful institutions in our education system in terms of the program implemented, student quality and academic achievement. However, it cannot be said that all students of these schools, where students with the highest academic

potential study, are gifted." The mere success of these students in high school entrance exams does not mean that they are gifted.

Another point that draws attention on the basis of the samples of the studies is that 67% of the sample size is less than 100. Although it is thought that this is due to the difficulty in reaching gifted students and even because working with these students requires extra attention, it may pose a problem in terms of reflecting the generality of the research and creating a holistic perspective (İnan & Mert Uyangör, 2022; Özenç & Özenç, 2013). At this point, it may be recommended to conduct studies with a larger number of students and to increase the number of researchers involved in the studies in the same direction.

It was determined that 104 mathematics studies conducted with gifted students in this study were mostly under the title of "problem solving". While the importance given to problem solving skills is also observed in other thematic studies (Demirci & Işık Tertemiz, 2022; İnan & Mert Uyangör, 2022), this can be explained by the fact that problem solving skills and giftedness are thought to be directly proportional (Sak & Maker, 2004). On the other hand, in the thematic analysis conducted by Kaya (2021), it was revealed that more research was conducted on algebra with gifted students. According to Nacar's (2017) findings, it was seen that the focus was generally on mathematics education.

STEM ranks second in terms of the topics related to the studies. On the other hand, Dönmez and İdin (2017), who examined masters and doctoral theses in the field of science, stated that they did not come across a study on STEM related to gifted students. At this point, it is seen that STEM studies in the field are limited to research articles, and it is recommended that STEM studies on gifted students should be encouraged in masters and doctoral theses, which are thought to contribute more to the literature.

The results support Kaya's (2021) finding that theses conducted with gifted students mostly examine the cognitive aspects of students. However, in this study, it was found that there are also studies that examine the affective tendencies of students. In these studies, gifted students' self-efficacy in mathematics, attitudes, anxiety, motivational and cognitive predictions about mathematical problems were examined, and the relationships between self-regulated learning and motivational beliefs in mathematics were also examined.

The title of "differentiated curriculum", which is another area of interest in the reviewed studies, is very important for gifted students. Kaya et al. (2022), who examined differentiated programs in the education of gifted students, emphasized that different applications are needed for these students whose cognitive levels are ahead of their peers. In addition, the findings of the researchers who emphasized that differentiated programs were developed mostly in mathematics, geometry and science courses support this study. In the studies analyzed, it was found that differentiated programs were developed in geometric objects, fractions, problem solving subjects and STEM applications. More curriculum differentiation studies can be conducted to fill the gaps of these students in other mathematics subjects, such as inequality and equation, exponential and radical expressions, etc.

When we look at the findings regarding the distribution of the scales used, which is another research problem of the study, it is seen that 51 different scales were used in 104 research articles analyzed. It is also stated in other thematic analyses that surveys, tests, observation and interview forms are also used as data collection tools in the studies, but scales are mostly preferred (Ayvacı & Bebek, 2019; Dönmez & İdin, 2017; Kara & Nuhoğlu, 2022). When the frequency of the scales used was examined, it was found that problem solving inventories (Heppner & Petersen; Serin, Bulut, Serin, & Saygılı; Kızılkaya & Aşkar) were mostly applied in direct proportion to the fields of interest of the studies.

In this study, it was found that 104 mathematics studies on gifted students, which were bibliometrically analyzed, were published in 69 different journals by 165 authors affiliated to 52 different institutions. Among the institutions to which the authors are affiliated, MoNE is the leading institution, while Gazi University and Kırşehir Ahi Evran University are among the institutions with the highest number of publications. Kırnık and Susam (2018), who examined the postgraduate theses on gifted students in all fields, also found that most theses were conducted at Gazi University. Dönmez and İdin (2017), who specifically investigated the theses on gifted students in science education, stated that Istanbul University and Gazi University came to the forefront. In the light of these findings, it is seen that the mentioned institutions are always the same and there are very few publications on this subject from other institutions. It is very

important that all institutions pay maximum attention to the studies on gifted students, who are thought to play an important role in the future of our country.

When the researchers who published the most on the subject were analyzed, the names Avni YILDIZ and Serdal BALTACI were encountered. Fatma ERDOĞAN, Adem DOĞAN, Abdullah KAPLAN and Mesut ÖZTÜRK are also among the authors whose contribution to the field is quite high. The contribution rates of the authors were calculated according to the number of authors in an article.

Turkish Journal of Gifted Education and Training and Journal of Gifted Education and Creativity stand out among the 69 journals publishing in the mathematics literature on gifted students. It was also noteworthy that the publications of these journals were only on gifted students. The Journal of National Education, Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, Pegem Journal of Education and Training, Turkish Journal of Computer and Mathematics Education and Van Yüzüncü Yıl University Faculty of Education

Journal are among the journals that have made a name for themselves in the field. According to the findings of Demirci and Işık Tertemiz, who examined mathematics research in national and international gifted journals, TÜZED (TJGE) and JEGYS stand out in the national arena with the articles they publish.

Another important research problem of this study is the sources from which the analyzed studies are mostly fed. It should be kept in mind that citation analyses will change according to the topics that bibliometric analyses focus on and different results will be obtained in each analysis. In this study, it was found that 3364 different publications were cited in the bibliographies of 104 mathematics studies conducted with gifted students. The majority of these references were to MONE publications (Mathematics Course Curriculum Curriculum and Science and Art Center Directive). The authors preferred to present data on gifted students by utilizing official sources. The authors referred to when explaining the characteristics of gifted students in the studies were Davis G. A. and Rimm S.B., Miller R. C., Sak U., Clark B. and Renzullı J. S. This result shows that researchers who intend to conduct a study on this subject should examine the sources of these authors and master the field.

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Appendix 1. Studies evaluated in the research

No.	Imprint
A1	Tertemiz, N., Doğan, A., & Karakaş, H. (2017). Comparison of 4th Grade Gifted Students and Their Successful Peers' Problem Solving Strategies. *International Journal of Curriculum and Instruction Studies*, *7*(13).
A2	Öztürk, M., Akkan, Y., & Kaplan, A. (2018). 6-8. Grade 6-8 Gifted Students' Metacognitive Skills While Solving Problems: The Case of Gümüşhane. *Journal of Aegean Education*, *19*(2), 446-469.
A3	Aydoğdu, M. Z., & Keşan, C. (2016). 9th Grade Gifted Students' Geometry Problem Solving Strategies. Journal of Education and Instructional Research, 5(2), 48-55.
A4	Nacar, S. (2017). Studies on Mathematics Education of Gifted Students between 20052014. *Journal of Inonu University Graduate School of Educational Sciences, 4 (8)*, 48-65. doi: 10.29129/İnujgse.370573
A5	Bulut, A. S., Yıldız, A., & Baltacı, S. (2020). A Comparison Of Mathematics Learning Approaches Of Gifted And Non-Gifted Students. *Turkish Journal Of Computer And Mathematics Education (Turcomat)*, *11*(2), 461-491.
A6	Yildiz, A., Baltaci, S., & Aytekin, C. (2019). A Comparison Of Parents Of Gifted Students And Non-Gifted Students: A Case Of Expectations From Mathematics Education. *Cukurova University Faculty Of Education Journal*, *48*(1), 452-497.
A7	Inan, E. & Mert Uyangör, S. (2022). A Thematic Analysis Of Theses Prepared On Mathematics Education With Gifted And Talented Students In Turkey. *Participatory Educational Research, 9 (6)*, 19-40. doi: 10.17275/Per.22.127.9.6
A8	Özdemir, D., & Işıksal, M. (2021). Adaptation Study Of Mathematical Ability Test (Tomags) To Turkish. *Bartın University Journal Of Faculty Of Education*, *2021*(1), 200-217.
A9	Çıldır, M. (2017). An Investigation Into The Creative Problem Solving Skills Of Gifted Students. *Journal Of Gifted Education And Creativity*, *4*(1), 1-12.
A10	Erdoğan, F., & Gül, N. (2020). An Investigation Of Mathematical Problem Posing Skills Of Gifted Students. *Pegem Journal Of Education And Instruction*, *10*(3), 655-696.
A11	Erdoğan, F. & Erben, T. (2020). An Investigation Of The Measurement Estimation Strategies Used By Gifted Students. Journal Of Computer And Education Research, 8 (15), 201-223. doi: 10.18009/Jcer.680284
A12	Akdeniz, H., & Bangir Alpan, G. (2020). Analysis Of Gifted And Talented Students' Creative Problem Solving Styles. Talent, 10(1), 79-94. doi: Https://Doi.Org/10.46893/Talent.758416
A13	Dönmez, İ. & Yalmancı-Yücel, S. (2020). Analysis Of Scientific Epistemological Beliefs And Stem Attitudes Of The Gifted Students. Bartın University Journal Of Faculty Of Education, 9(3), 515-526.
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Research Article

An investigation on the mathematics teaching programs for gifted students based on teachers' opinions

Derya Zengin [1] and Menekşe Seden Tapan Broutin [2]

Bursa Halil İnalcık Science and Art Center, Bursa, Turkiye

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Abstract

This study reflects teachers' opinions about the mathematics teaching programs for gifted students. As a method, " a case study", which is qualitative research, was used to reveal the existing problems related to a problem or situation in detail and to offer solutions. During the academic year 2022-2023, a study was conducted in Türkiye with 57 mathematics teachers who work with gifted students in support education rooms and Science and Art Centers (SAC). Data were collected using a structured interview form prepared on Google Forms. The content analysis method was used to interpret and make sense of the data. Participants' opinions on the educational needs, teacher competencies, mental and physical characteristics of gifted students, software use and mathematical proof processes were analyzed and various results were obtained. In this study, to increase the effectiveness of the program, it was suggested that the program should be updated by taking teachers' opinions into consideration, differentiated and enriched activities should be prepared by integrating technology, workshops should be equipped, and in-service training should be provided in various fields. It was also suggested that it would be beneficial to use a common program accepted all over the world in the education process of these children. Recommendations also include a common pathway for students, directing them to universities in line with their abilities and creating specific employment opportunities after graduation.

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Introduction

For centuries, the definition of intelligence has been one of the most interesting and discussed topics. In general, intelligence consists of the abilities that individuals have to adapt to the changing world through culture, environment and experiences, which stem from their hereditary characteristics (Çevik, 2006). Binet (1916) emphasizes complex mental functions when expressing intelligence. According to Binet, complex functions involving high-level mental skills are required for the development of intelligence rather than simple functions. Binet is also a scientist who conducted various studies and developed scales to measure intelligence." The Binet-Simon test" was developed as a pen-and-paper test to measure intelligence and was soon accepted as proof of intellectual abilities (Binet & Simon, 1916). Gardner (2006) refers to intelligence; as the ability to shape a product, as well as the ability to overcome problems. Piaget (1971) considers intelligence as a mental activity that provides a balance between the individual and the environment. Piaget examines the development of basic concepts in two ways: adaptation and assimilation. While assimilation is expressed

[1] Corresponding Author: Doctorant, Teacher, Bursa Halil İnalcık Science and Art Center, Bursa, Turkiye. E-mail: derya_bilir@windowslive.com. ORCID: 0000-0001-9854-9664
[2] Assoc.Prof., Bursa Uludağ University, Faculty of Education, Math Education Department, Bursa, Turkiye. E-mail: tapan@uludag.edu.tr. ORCID: 0000-0002-1860-852X

as the placement of new situations encountered by the individual into the existing schema, adaptation is the change or expansion of existing schemas as a result of new situations encountered by the individual.

The term "giftedness" includes many different characteristics along with intelligence. According to Renzulli (2005), gifted individuals have three distinct intertwined characteristics. These characteristics are superior talent, creativity, and motivation. According to Brody and Stanley (2005), giftedness means individuals with high reasoning power and advanced development compared to their peers in areas such as verbal logic, mathematics, and visual and mechanical abilities. Since there are different characteristics of especially talented individuals, their educational needs also vary. Therefore, a special program for teaching these children is needed (Levent, 2014).

Differentiating teaching programs due to the high-level skills possessed by gifted students is very beneficial for the teaching process (Akkaş & Tortop, 2015). Differentiated instruction is a learning experience in which learning environments are organized in line with the readiness, attitudes, and needs of individuals, different learning strategies are used in the teaching process, students are allowed to learn by doing and experiencing, and students can make choices to show and display what they have learned (Şaldırak, 2012). Therefore, teaching program differentiation for gifted students should be at the forefront by using enrichment and acceleration strategies (Sak, 2012; Tomlinson & Strickland, 2005). In this teaching process, the personal and professional competencies of teachers who teach gifted children must be at a high level. Therefore, these teachers should have intellectual interest, high sensitivity, self-renewal, adaptability, a sense of duty and high technological equipment (Lindsay, 1980).

Although the field of mathematics and mathematics teaching is intertwined with daily life, it is universally difficult to learn and poses various obstacles in the teaching process. Although learning mathematics is a discipline based on logic, it is also a science that encourages mental development and creates a consistent and systematic thinking environment (İnam & Ünsal, 2017). Interdisciplinary connections play a very important role in creating a thinking environment for gifted students in mathematics teaching. Mathematics programs, which are prepared by taking into account the characteristics of gifted students in the teaching process, are based on making differences in content, process, and product according to student's readiness, interests, and learning styles. At the same time, Integrating technology into the learning process makes it more engaging and helps gifted students develop a concrete and experimental approach. This approach allows the learner to progress gradually toward more complex and abstract concepts through certain steps (Flores, 2006). This statement emphasizes the importance of considering the dynamic changes in mathematical relationships, conceptual understanding, and procedural knowledge to develop mathematical process skills and can facilitate students' progress in this area (Trigo & Perez, 2002). It has been observed that the use of technology-supported instruction in mathematics education can facilitate individualized learning and result in a more effective education process (Baki, Yalçınkaya, Özpınar, & Uzun, 2009). However, it is equally as important for gifted students to mentally construct the knowledge they learn in the process of studying mathematics. Mental development comes into play when students begin to grasp mathematical concepts with concrete materials at an early age. Students who build a strong foundation of understanding using these materials can easily understand abstract concepts as they progress. At the same time, structuring in the mind is realized by the student himself/herself, but it is also seen that external factors such as teacher guidance, equipped learning environment, variety of materials, technological equipment, and social interaction are important in the structuring process (Ding & Li, 2014).

Piaget (1986) stated that mental development is fundamentally related to heredity and divided this process into four parts. These parts are “the sensorimotor stage (0-2 years old), preoperational stage (2-7 years old), concrete operational stage (7-11 years old,) and formal operational stage (11 years old through adulthood)” (Huitt & Hummel, 2003). Accordingly, Piaget shaped the development of "spatial and geometric thinking" skills according to these stages. Studies have shown that gifted students go through the same cognitive development stages but enter the abstract processing stage earlier. It has been stated that geometric thinking skills develop earlier with abstract processes because these students enter the abstract thinking process earlier (Mason, 1997). Hence, it has been observed that these students, whose various abilities come to the forefront, can make logical inferences about proof during the abstract operations period and make connections between concepts in line with these inferences, so they are ready for a proof-based

geometric program (Öztürk, 2017). Accordingly, gifted students need to experience different possible forms of shapes in appropriate learning environments using a proof-based geometry program. In the transition to the complex and abstract field of mathematics, students should be supported with different course materials such as appropriate learning environments, concrete materials and dynamic software (Olkun & Toluk, 2007).

In Türkiye, gifted students attend the Science and Art Center (SAC) along with formal education institutions affiliated with the Ministry of National Education. SAC is an independent educational institution that allows gifted students to realize their abilities, reveal their special abilities and produce projects by developing their high-level skills (Science and Art Centers Directive, 2015). In this educational institution, gifted students are educated in groups of 5-6 students with their friends and field teachers from different schools in line with their interests and abilities and according to their learning speed . The education process in SAC progresses in five stages: starting with the adaptation process for beginners, these studies continue with the support process, students become aware of their abilities, develop their special abilities and end with project studies (Ministry of National Education, 2019). At the same time, gifted students receive training in support education rooms in line with the enriched education programs of formal education institutions.

After conducting a thorough literature review, different studies on the evaluation of mathematics teaching programs were found. Some of these studies include the opinions of mathematics teachers regarding these programs (Aközbek,2008; Altındağ & Korkmaz, 2019; Anderson, 2013; Avcu, 2009; Berkant & İncecik, 2018; Bütün & Gültepe, 2 016; Çelen, 2011; Demir, 2021; Eroğlu, 2019; Karakoç, 2019; Keskin & Yazar, 2019; Sargın, 2016; Şen & Peker-Ünal, 2021; Uludağ, 2012). Some studies also include teachers' views on whether these programs are appropriate for gifted students or not (Yetim-Karaca & Türk,2020). However, there are few studies on the views of mathematics teachers or gifted students on the gifted education program (GEP) (Howley, Pendarvis & Gholson, 2005; Ilik, 2019; Jarrah & Almarashdi, 2019). Therefore, the need to evaluate the effectiveness of the Gifted Education Program (GEP), which is also used in science and art centers, has emerged. Considering these literature reviews, it is thought that a study that includes detailed information about the mathematics teaching program, has a large sample size and takes into account the views of mathematics teachers who teach gifted students, will be an example for future studies and will be a useful study for the literature.

Purpose of the Research

The research aims to examine the mathematics teaching programs for gifted students based on teachers' views. In line with this purpose, the problem statement was determined as "What are the opinions of teachers about the mathematics teaching program for gifted students?".

Method

Research Model

A qualitative research method was used in this study. This method allows us to establish connections between different disciplines and to study the events or phenomena encountered in the natural environment and social realities (Merriam & Grenier, 2019; Morgan, 1996). As the study aims to examine the education programs prepared for gifted students based on teachers' opinions, the case study design was considered to be appropriate. Case studies are used to conduct comprehensive analyses by collecting information about the functioning of a limited system (Chmiliar, 2010).

Participants

There were 57 mathematics teachers involved in the study, all of whom taught gifted students in SaAC and support education rooms throughout Türkiye. The study utilized the typical sampling method, which falls under criterion sampling, to select participating teachers. When selecting participants for a study, it is common to use various criteria for selection. According to Yıldırım and Şimşek (2016), the typical sampling method involves careful consideration of factors such as experience working with gifted students and being a mathematics teacher. These criteria are important to ensure that the study results are meaningful and applicable to the target population. In addition, participants were selected voluntarily. The universities from which the participants graduated are Gazi University (7 people), Atatürk University (5 people), Selçuk University (4 people), Cumhuriyet University (4 people), Balıkesir University (4 people),

Yalova University (4 people), On Dokuz Mayıs University (4 people), Dokuz Eylül University (4 people), Anadolu University (3 people), Ankara University (3 persons), Uludağ University (3 persons), Hacettepe University (3 persons), Amasya University (2 persons), Fırat University (2 persons), Kahramanmaraş Sütçü İmam University (2 persons), Mehmet Akif Ersoy University (1 person), Erciyes University (1 person), Karadeniz Technical University (1 person). The study found that the 57 mathematics teachers who participated in the research graduated from various universities located in different cities across Türkiye. At the same time, coding in the form of P1, P2, P3... P57 was used to identify the participating mathematics teachers. Demographic information about the identified participants is shown in Table 1.

Table 1. Demographic information of participants

Variables		**f**
Working field	Secondary Mathematics	37
	High School Mathematics	20
Gender	Female	32
	Male	25
Years of Teaching Experience	0-5 years	4
	6-10 years	14
	11-15 years	13
	16 + years	26
Yearly Working Experiences at SAC	0-3 years	24
	4-6 years	15
	7-9 years	11
	10 + years	7
Yearly Working Experiences in the Support Education Room or Classroom with Gifted Students	0-3 years	23
	4-6 years	15
	7-9 years	10
	10 + years	9
Dynamic Software Usage in the Teaching Process	Yes	32
	No	25
	Total Participants	57

Based on the data presented in Table 1, there were 37 of the participants were secondary school mathematics teachers and 20 participants were high school mathematics teachers among the participants. The gender distribution among the participants is quite balanced, with almost equal numbers of men and women. Additionally, 26 teachers have 16 or more years of experience working. The participants mostly have 0-3 years of SaAC experience, and similarly, the participants working with gifted students in support education rooms have been working between 0-3 years at most. 32 teachers used dynamic geometry software in the Teaching Process.

Data Collection Tools

In the research, a Google form, which was prepared as a structured interview form, was used to reveal the perspectives of the participants about the Gifted Education Program (GEP). This form consists of a first section containing general details about the participants and a second section containing 13 questions about the mathematics teaching program for gifted students. While preparing this interview form, literature research was conducted on students with special abilities, problems were identified, arrangements were made by expert opinions, and a pilot application was realized with a SaAC mathematics teacher before the main application. Furthermore, the opinions of a faculty member who is an expert in her field were consulted while analyzing the participants' views after the implementation.

Data Analysis

Voluntary participation was taken into consideration while collecting research data through interview forms. This form was sent to the participants via Google form and their answers were recorded on the computer. The data was analyzed using content analysis to identify different categories and codes based on the participants' perspectives. Because in this analysis method, the data obtained are examined in depth and unnoticed concepts are revealed. Thus, the data obtained

with this method are conceptualized and placed in a logical framework (Şimşek & Yıldırım, 2016). The data obtained through the forms were analyzed by dividing them into word, sentence and paragraph analysis units and various codes were obtained. The codes were deciphered, brought together and divided into subcategories under basic categories (themes). These categories and codes were arranged and tabulated. For example, when the teachers' views about gifted students were analyzed, codes such as creative thinking, extreme curiosity, broad perspective, analytical thinking, social communication difficulty, and high anxiety were obtained; these codes were organized into sub-categories "supportive characteristics" and "compulsive characteristics"; and finally the category "different characteristics" englobing these sub-categories was created. In addition, direct excerpts from the teachers' answers were also included to exemplify the categorization process.

Validity and Reliability

For validity and reliability in qualitative research, it is very important to present the data obtained in the research process in detail and to take various measures to ensure the accuracy of the information (Yıldırım & Şimşek, 2013). In qualitative research, using categories such as reliability instead of internal reliability, confirmability instead of external reliability, credibility instead of internal validity, and transferability instead of external validity is more functional in terms of detailing the process (Lincoln & Guba, 1985). The measures taken within the scope of validity and reliability in the research are as follows:

Reliability; The first measure taken to ensure reliability was to collect the data through structured interview forms voluntarily. The forms were sent to the teachers via Google form and their answers were recorded on the computer. The data obtained through the forms were analyzed by dividing them into word, sentence, and paragraph analysis units. In addition, direct quotations from the participants' answers were included in the findings section. Another measure taken to increase the reliability of the research is that the data obtained as a result of the content analysis is examined by two different experts. The data examined by the experts were divided into subcategories under the name of the main category (theme) and the categories and codes were organized in an interrelated manner and tabulated.

Verifiability; To ensure verifiability, the researchers reported the research process as a whole clearly and concisely, leaving no room for any questions. At the same time, expert opinion was consulted throughout the process to ensure the consistency of the relationships between the findings obtained as a result of the research and the interpretations made. At this stage, approximately 85% agreement was achieved between the researcher and the expert opinion. Thus, it is thought that when an expert evaluates or supervises the research process, its clarity, accuracy, and consistency can be accepted.

Credibility; In this study, the interview method was used to collect data. In the interviews, participants working in different provinces of Türkiye were selected for the research group, thus ensuring a diversity of data sources. At the same time, during the research process, the opinions of a faculty member who is an expert in the field were consulted during the preparation of the interview questions and the analysis of the data. After finalizing the form, a pilot study was conducted with a SaAC teacher with a Ph.D. in mathematics education about the comprehensibility of the questions in the structured interview form. In addition, while creating various categories and codes in the process of analyzing the data obtained in the research, the researcher consulted expert opinion. Another measure taken to increase the credibility of the research was to check and analyze the data immediately after the interview, thus confirming whether the views expressed were correctly understood by the researcher.

Transferability; To ensure transferability, the criterion sampling method, one of the purposeful sampling methods, was used to determine the participants in the research group. The criteria in the study were determined as follows: Having worked with gifted students and the participants being mathematics teachers. With these criteria, it is thought that it will contribute to collecting the most appropriate data for the qualitative research design and providing the most comprehensive information to the researchers. In addition, all participants of the research group were informed about the purpose and process of the research by observing the principle of voluntariness during the research group selection phase. Another measure to ensure transferability is to increase the chance of transferability of the research to other environments by explaining the research processes, selection of the research group, research method, data collection

tools, data analysis methods, codes, and themes obtained from the analyzed data in detail. In addition, all participants of the research group were informed about the purpose and process of the research by observing the principle of voluntariness during the research group selection phase.

Results

In this section, findings related to the problem of the study and interpretations based on these findings are presented. At the same time, the findings are organized according to various categories and codes. The findings are interpreted and presented under six different categories. These categories are: “teachers’ opinions on different characteristics of gifted students”, “teachers’ opinions on the educational needs of gifted students”, “teachers' opinions on supporting activities in the classroom during the geometry teaching process”, “teachers' opinions about the use of dynamic geometry software”, “teachers' opinions on supporting activities in the classroom during the geometry teaching process” and “teachers' opinions about the mathematical proof process”.

Different characteristics of gifted students

The findings regarding the different characteristics of the students are presented under various codes and categories in Table 2.

Table 2. Teachers' opinions on different characteristics of gifted students

Category	Subcategory	Codes	Stating teachers	*f*
Different Features	Supporting Features	Quick learning	P1, P6, P12, P13, P25, P26, P28, P32, P38, P40, P41, P49, P51, P53	14
		Extreme curiosity	P1, P2, P18, P20, P24, P50, P51, P54, P55	9
		Wide perspective	P4, P5, P13, P28, P32, P48, P50, P52, P53	9
		Abstract thinking	P22, P41, P51	3
		Problem-solving ability	P5, P21, P35	3
		Reasoning power	P1, P5, P7, P8, P17, P23, P56, P57	8
		Motivation	P2, P7, P16, P31, P44, P52	6
		Attention	P3, P5, P6, P9, P55	5
		Analytical thinking	P3, P20, P29, P47, P55, P56	6
		Leadership	P7, P28, P51, P54	4
		Original idea	P15, P35, P36, P42, P51	5
		Sensitivity	P8, P14, P16, P20, P47, P55	6
		Fast action	P7, P19, P23, P31, P33, P40, P48	7
	Challenging Features	Perfectionism	P1, P17	2
		Social communication difficulty	P7, P11, P34, P37, P45, P49, P50	7
		Supersensitive	P14, P15, P28	3
		High anxiety	P17, P20, P46, P56	4
		Distractibility	P17, P25, P54	3

As seen in Table 2, the main category of "Different characteristics of gifted students" was formed by two sub-categories: "Support characteristics" and "Compulsive characteristics". When participants' opinions were analyzed, among the supportive characteristics; were quick learning (14 participants), extreme curiosity (9 participants), wide perspective (9 participants), analytical thinking (6 participants), fast action (7 participants), and reasoning power (8 participants) came to the fore. Among the compelling characteristics, the prominent characteristics were social communication difficulties (7 participants) and high anxiety (4 participants). For example, P57 from participants expressed his opinion: “I've seen the students with the highest talent focus for a long time, they're very curious, they question everything and they're very careful. I also saw that nature's love is high, emotional, and sensitive...”. When the

answer of Participant P57 was evaluated, it was concluded that they were extremely curious according to the section "Gifted students focus on the subjects they are interested in for a long time, they are curious about everything and question everything". P57 continued to express his opinion as follows "I found that they were careful and detail-oriented." the code of analytical thinking was determined through the sentence. The participant P45 expressed that "Students are introverted, bored easily and have difficulty in social communication." These and similar expressions were analyzed and the social communication difficulty code was determined.

Educational needs of gifted students

The subcategories and codes of the main category created under the name of educational needs by analyzing teacher opinions are shown in Table 3.

Table 3. Teachers' opinions about the educational needs of gifted students

Category	Subcategory	Codes	Stating teachers	*f*
Educational Needs	Educational Needs in the General Field	Update the education program	P7, P8, P20, P23, P24, P36, P52, P47, P50, P51, P55, P57	12
		Homogeneous groups	P2, P6, P8, P17, P53	5
		Lack of resources, materials and equipment	P4, P15, P21, P24, P25, P28, P29, P33, P34, P35, P39, P41, P48, P49, P50, P51, P36, P52, P53	19
		Enriched and differentiated activities	P3, P5, P6, P8, P11, P17, P18, P23, P24, P34, P35, P42, P46, P50, P51, P52, P56	17
		Teacher education	P21, P37, P48	3
		Increasing motivation	P12, P16, P25, P28, P33, P35, P40, P55, P56, P57	10
		Desire to be understood	P1, P10, P30, P35, P45, P54, P56, P57	8
		Desire to be successful	P1, P33, P55	3
		Measuing tools	P13, P25, P33, P57	4
	Educational Needs in Mathematics	Updating programs	P3, P5, P6, P16, P44	5
		Homogeneous math groups	P7, P9, P11, P23	4
		Equipped workshops	P1, P15, P25, P36, P49, P53	6
		Use of dynamic software	P8, P12, P25, P26, P49, P55	6
		Enriched and differentiated math activities	P9, P14, P15, P35, P38, P41, P44, P50	8
		Mathematical proof teaching	P8, P20, P22, P28, P29, P45, P51	7
		Include real-life problems	P8, P12, P22, P28, P45, P51, P56	7
		Increasing their interest in mathematics	P3, P5, P7, P14, P17, P21, P24, P27, P32, P36, P38, P48, P54, P56, P57	15

As seen in Table 3, the main category of "educational needs of gifted students" was formed by two sub-categories: "Educational Needs in General Field" and "Educational Needs in the Field of Mathematics". When the data on general educational needs were examined, the prominent codes were: the need to update the education program (12 participants), the need for enriched and differentiated activities (17 participants), the need to eliminate the equipment needs in the workshops (19 participants), the need to increase students' motivation (10 participants) and the need to satisfy students' desire to be understood (8 participants). For example, the expression of participant P8 can be given as an example of a response: "Since gifted students learn faster, it is necessary to design different activities, these activities should be more complex and up-to-date. In general, it is necessary to arrange activities that employ higher-order thinking skills. This is a process that takes time and competence". When these and similar expressions are analyzed, it is concluded that it is necessary to prepare enriched and differentiated activities. P56, one of the participants, expressed, "Students should be given feedback frequently because they are quickly bored. Motivation must also be increased. They have a lot of instability,

so students need to understand." From these and similar expressions like this last one, codes "need to increase motivation and students' need for understanding" were obtained.

When teachers' opinions on the needs of mathematics education are analyzed, the prominent codes are as follows: increasing their interest in mathematics (15 participants), designing enriched and differentiated mathematics activities (8 participants), teaching proof (7 participants), creating well-equipped mathematics workshops (6 participants) and using dynamic software (6 participants). Participant P27's expression is given as an example: "They can adapt to the subject earlier. Unfortunately, they are easily distracted. When they can't, their cravings dwindle. For this reason, it is necessary to keep their interest in mathematics alive." According to these and similar expressions, the code of increasing their interest in mathematics was reached. One of the participants, P8, states; "In mathematics, it is necessary to present complex and real-life problems to students. In addition, dynamic software environments are very important for mathematics lessons. Likewise, the environment is critical for them to learn how to prove." The codes for teaching proof and the use of dynamic software were obtained from these and similar expressions.

Supportive activities in the geometry teaching process

The codes and categories obtained when the teachers' views on the supportive activities carried out in the lesson during the geometry teaching process were analyzed are shown in Table 4.

Table 4. Teachers' opinions on supporting activities in the classroom during the geometry teaching process

Category	Codes	Stating teachers	*f*
Supporting Activities in the Classroom	Basic geometry knowledge	P10, P29, P44, P46	4
	Real-Life problems	P3, P34, P35, P51	4
	Dynamic software activities	P2, P8, P9, P11, P12, P13, P21, P24, P26, P27, P30, P31, P32, P33, P39, P48, P53	17
	Application workshops	P7, P14, P36, P37, P41, P43, P51, P55	8
	Tangible materials	P5, P8, P9, P12, P24, P25, P32, P33, P45, P49, P52, P55	12
	Making proof	P16, P18, P23, P34, P40, P45, P46, P48, P53, P54, P55, P56	12

As seen in Table 4, various codes were obtained when the teachers' views on the supportive activities carried out in the lesson during the geometry teaching process were analyzed. It is seen that teachers have common views on the codes of designing activities suitable for dynamic geometry software (17 participants), using concrete materials (12 participants) and making proof (12 participants) among these codes. About these common views, P9 from the participants; "Because geometry is an abstract subject, it can be difficult to focus students on the process, so more tangible materials or software can be used." These and similar expressions mentioned the importance of tangible materials and dynamic geometry software. P53; "The course teacher should give extra activities suitable for dynamic software that will require research, use technology, make inferences to questions, etc." In his statement, he stated that activities suitable for dynamic software should be designed and students' proof skills should be developed by questioning.

Use of Dynamic Geometry Software:

The codes generated by analyzing the data obtained in line with the teacher's opinions on the use of dynamic geometry software and the categories they belong to are shown in Table 5.

Table 5. Teachers' opinions on the use of dynamic geometry software

Category	Subcategory	Codes	Stating teachers	*f*
Using Dynami Geometry Software Thoughts on	The Convenienc Provided by the Use of Dynamic Geometry Software	Convenient interfaces	P8, P12, P15, P17, P18, P19, P21, P22, P25, P27, P28, P29, P30, P32, P33, P35, P38, P54	18
		Enriched events	P4, P15, P24, P26, P31, P35, P36	7
		Concretization	P4, P5, P8, P12, P13, P16, P21, P24, P25, P26, P27, P28, P29, P30, P31, P32, P33, P36, P37, P38, P39, P40, P41, P44	24
		Reasoning process facilitation	P19, P20, P22, P24, P25, P26, P31, P44, P46	9
		Making the lesson fun	P3, P6, P7, P14, P15, P18, P33, P34, P38, P40, P49	11
		Saving time	P1, P10, P14, P20, P22, P25, P34	7
		Getting the answer quickly	P1, P4, P10, P12, P22, P25	6
		Focus on the process	P1, P4, P6, P20, P22, P25, P40	7
		Keeping motivation high	P14, P15, P16, P17, P19, P20, P21, P22, P23, P25, P31, P34, P55	13
		Content creation	P4, P14, P18, P21, P23	5
		Ultimate skill development	P11, P18, P22, P23, P33	5
		Active participation	P10, P32, P33, P41	4
		Ease of detection	P11, P13, P15, P17, P19, P22, P25, P27, P31, P33, P37, P39, P40, P41, P42, P44, P45	17
	Challenges Using Dynamic Geome Software	Scarcity of equipped workshops	P2, P5, P6, P8, P13, P18, P20, P25, P53	9
		Student education	P3, P4, P5, P12, P14, P15, P24, P25, P28, P31, P38	11
		Teacher Education	P7, P8, P12, P13, P14, P16, P17, P18, P20, P38, P47, P50	12
		Difficulty in content creation	P1, P4, P5, P7, P9, P10, P11, P14, P15, P17, P21, P23, P25, P27, P32, P46	16
		Waste of time explaining the software	P1, P12, P30	3

The main category of "Thoughts on the use of dynamic geometry software" was analyzed by dividing it into two sub-categories "Ease of using dynamic geometry software" and "Difficulties in using dynamic geometry software". When the codes that stand out for the convenience provided by dynamic geometry software are examined; 18 participants stated that the software had useful interfaces, 24 participants stated that they embodied geometry, which is an abstract lesson, 13 participants stated that they increased the motivation of the students and 17 participants stated that they facilitated perception. For example, in P34; "specially gifted children are accustomed to combining their lessons with technology or other courses. It helps them to be more satisfied with what they had learned and increases their motivation." When these and similar expressions were analyzed, dynamic software was determined to increase students' motivation. From P8's statement; "With the drag movement, the process is kept alive and the chance to see the useful conceptual background is obtained. It is also very effective for proof processes and helps students understand what and why." When these and similar expressions were analyzed, codes were obtained that the software has useful functional interfaces, facilitates perception, and embodies geometry.

Regarding the difficulties teachers experienced in using dynamic geometry software (such as Geogebra, Cabri), 9 participants talked about the scarcity of equipped workshops, 16 participants talked about difficulties in preparing content and 13 participants talked about the necessity of student and teacher education. For example, P2; "The most challenging part is that every student cannot provide an equipped environment to access." and P18; "Computer and tablet are required, it can be difficult to find." When these and similar expressions were analyzed, the code of scarcity of equipping workshops was reached. P32; "The content preparation part about geometry education for students is very difficult for us." It was determined from these and similar expressions that teachers had difficulties in preparing content

When examining the difficulties that teachers encounter when using dynamic geometry software, it's important to consider the learning curve associated with the technology. While these tools can be incredibly powerful, they can also be complex and challenging to navigate at first. Additionally, some teachers may struggle to integrate the software into their lesson plans and teaching styles. However, with the right training and support, many educators can successfully incorporate dynamic geometry software into their classrooms and enhance their students' learning experiences.

Competencies for effective use of dynamic geometry technologies

According to the analysis of teachers' views, Table 6 shows the codes and categories corresponding to the competencies required to effectively use dynamic geometry technologies.

Table 6. Teachers' views on competencies for effective use of dynamic geometry technologies

Category	Subcategory	Codes	Stating teachers	*f*
Competences/Knowledge for Effective Use of Dynamic Geometry Technologies	Teacher Competencies	Software usage	P1, P2, P3, P4, P5, P6, P7, P8, P10, P11, P12, P13, P16, P19, P20, P22, P23, P24, P25, P26, P28, P29, P30, P31, P33, P34, P35, P36, P38, P39, P40, P41, P42, P44, P45, P48, P49, P50, P51, P52, P53	44
		Content creation	P1, P5, P6, P8, P11, P17, P19, P21, P22, P25, P27, P29, P3(P33, P36, P37, P39, P45, P47	20
		Area information	P1, P17, P25, P29, P30, P32, P35, P44, P55, P56	10
		Coding skill	P20, P31, P34, P35, P36, P54	6
		Effective use of time	P28, P29, P47, P49, P55, P56	6
		Pedagogical content knowledge	P9, P17, P25, P29, P38	5
		Being open to innovations	P2, P3, P4, P8, P10, P12, P14, P19, P21, P27, P29, P30, P39, P41, P43, P53	16
	Teaching Methods Used	Learning by living	P1, P2, P4, P10, P12, P20, P33, P36, P46, P49, P50, P56	12
		Show and make	P23, P24, P25, P27, P32, P34, P37, P39, P42, P43, P45, P51, P53	13
		Presentation method	P1, P8, P21, P39, P54	5
		Invention method	P3, P5, P8, P9, P12, P19, P22, P28, P41, P45, P50	11
		Problem-solving	P17, P25, P34, P52	4
		5E model	P6, P15, P29	3
		Question -answer	P1, P24, P32, P50, P55	5
	Preparation for the Teaching Process	Equipped workshops	P2, P8, P9, P11, P13, P19, P24, P29, P30, P36, P38, P39, P53, P54	14
		Software information	P2, P3, P4, P6, P7, P12, P33, P39, P40, P46, P47, P48, P49, P54	14
		Current programs	P4, P9, P11, P16, P17, P19, P21, P24, P27, P29, P31, P49, P50, P55	14
		Pilot application	P9, P14, P15, P20, P22, P24, P28, P29, P31, P34, P37, P40, P45, P49, P54, P55, P56	17
		Enriched and differentiated events	P5, P7, P9, P15, P19, P21, P22, P24, P26, P29, P31, P33, P31, P39, P44, P45, P47, P49, P51, P53, P54	21

The main category of "Qualifications for the effective use of dynamic geometry technologies" was examined into three sub-categories "Teacher competencies", "Teaching methods used" and "Preparation for the teaching process". When the data obtained from the interview forms were analyzed, various codes were determined in line with the subcategory of teacher competencies. Among these codes, 44 teachers talked about the importance of using software, 20 teachers talked about the importance of content production, 10 teachers talked about the importance of field knowledge and 16 teachers talked about the importance of being open to innovations. For example, P1's; "The teacher himself should know in the field at the level of being able to use the mentioned applications effectively and prepare activities." When these and similar expressions were analyzed, the codes for the teachers' opinions about the importance of using software, field knowledge, and content production were obtained.

Based on the research, it was found that different codes were determined according to the sub-category of teaching methods. Out of these codes, 12 teachers reported using the learning-by-doing method, 13 teachers preferred the demonstration method, and 11 teachers utilized the discovery method. Teachers' views on these findings were examined. For example, in P7; "When I teach with Geogebra, I use the show-and-make method. Then I allow the student to produce their content." When these and similar expressions were analyzed, it was determined that the teachers used the show-and-make method. P50's; "Learning by doing and taking an active role in the creation process using software will be a developer in terms of its ability to embody." His statement determined that they used the method of learning by living.

In the research, teachers stated that various preparations should be made before using dynamic geometry software. Among these preparations, 22 teachers stated that enriched and differentiated activities should be prepared before the lesson, 17 teachers stated that a pilot application could be made with the activities prepared before the lesson, and 14 teachers stated that the workshops should be equipped physically and technically. For example, the P45; "First of all, when technology is involved, a long preliminary preparation should be made for the subject to be explained in the lesson. Because the use of technology is not like plain subject expression. It is necessary to prepare activities. It is necessary to be constantly active and not to make mistakes." When these and similar expressions were examined, teachers mentioned the importance and contributions of enriched and differentiated activities in the teaching process. P40's; "Of course, it will have to adapt the technology to the activities and apply the teacher himself as a preliminary preparation, so he should practice the activity beforehand. I think the lessons are more interactive when technology is added." When his statement was analyzed, the teachers stated that a pilot application could be made beforehand.

Mathematical Proof Process:

Teachers' views on the mathematical proof process were analyzed, and the codes and the categories they belong to are shown in Table 7.

Table 7. Teachers' opinions about the mathematical proof process

Category	Subcategory	Codes	Stating teachers	*f*
Mathematical Proof process	The Meaning of Mathematical Proof	Derivative reasoning	P1, P2, P8, P17, P41, P46, P50, P51, P55	9
		Logical description	P1, P2, P6, P8, P11, P20, P21, P28, P32, P34, P39, P40, P41, P55	14
		Meaning of formulas	P3, P5, P7, P15, P18, P22, P29, P35, P37, P38, P42, P49, P52, P56	14
	The Importance of Mathematical Proof	Learning by doing	P2, P3, P9, P35	4
		Permanent learning	P1, P4, P5, P11, P24, P25, P26, P27, P28, P45, P52, P55, P56	14
		Reinforcing what you've learned	P8, P14, P18, P54	4
		Making sense of formulas	P3, P20, P21, P22, P23, P38, P41, P49	8
		To convince	P4, P29, P32	3
	Technology Integration into Mathematic Proof Process	Concretization	P2, P19, P21, P22, P24, P25, P44, P55	8
		Artificial intelligence	P9, P33, P56	3
		Coding	P36, P38	2
		Calculation and graphics tools	P15, P47, P54	3
		Using GeoGebra	P1, P3, P4, P7, P8, P10, P11, P15, P19, P21, P27, P34, P35, P47, P50, P54	17
		Using Cabri	P1, P2, P3, P4, P7, P17, P26, P44, P50, P54	10

As seen in Table 7, the main category of "mathematical proof process" was examined into three sub-categories "meaning of mathematical proof", "the importance of mathematical proof" and " Technology Integration into Mathematical Proof Process ". First of all, the teachers were asked what mathematical proof means, and various codes were obtained by examining the answers received. The Meaning of Mathematical Proof; 14 teachers expressed logical

explanation, 9 teachers as derivational reasoning, and 14 teachers expressed the meaning of formulas. For example, P21; "Mathematical proofs are logical explanations and justifications starting from axioms. It would be better to embody this verification." From these and similar statements, it was determined that the participants define mathematical proof as a logical explanation. P41; "Another argument that shows the conclusion that the assumptions derived for mathematical proof are logically correct." When his statement was analyzed, he stated the mathematical proof as derivational reasoning. As a result of the analysis of the data obtained under the heading of the importance of mathematical proof, it is seen that the codes of permanent learning (14 participants) and making sense of formulas (8 participants) come to the fore. P55 one of the participants;" By questioning with proof, we also reinforce intellectual skill and reasoning. Different mathematics and geometry software also help us in making these proofs, allowing students to embody the proofs and see the results with their eyes." He stated that the proofs can be made concrete with his opinion. P27; "I think that more permanent learning will be provided as students are involved in the process of creating the rule instead of memorizing the rule directly." He stated that children can realize permanent learning by making proof.

Teachers resort to different ways when integrating technology into the mathematical proof process. Teachers stated that they use dynamic software such as Geogebra (17 participants) and Cabri (10 participants), especially when doing mathematical proofs. For example, one of the participants, P7; "It should include studies to discover why and the reasons for a mathematical rule. Technology can be used here to validate the proof. For example, a circle's circumference/diameter ratio gives the pi number. With the Geogebra software, we can have the difference discovered through the calculation of the circles, and find that this constant ratio expresses the pi number." When these and similar statements were analyzed, it was found that they mostly used GeoGebra and Cabri programs.

Discussion and Conclusion

This study comprehensively evaluated mathematics teachers' views on various issues related to gifted students. The study focused on various topics under the headings of students' personality traits, educational needs, teacher competencies, geometry software and mathematical proof processes. As a result of the study, various conclusions were reached about how teachers perceive and approach these important issues in their work with gifted students.

Regarding the different characteristics of gifted students, teachers stated that they learn quickly, can easily solve complex problems, can focus for long periods, have higher-order thinking skills, have a strong memory, and have no difficulty generating original ideas. At the same time, teachers concluded that gifted students have supportive personal characteristics such as extreme curiosity, high motivation, leadership and sensitivity, as well as challenging personal characteristics such as perfectionism, difficulty in social communication, excessive emotionality, high anxiety, irresponsibility, boredom and distractibility. Various studies supporting these results were found when the literature was examined. These studies indicate that gifted students have various cognitive characteristics. These characteristics include high academic achievement (Akkanat, 2004; Davis & Rimm, 2004), use of problem-solving skills (Ataman, 2009; Doğan & Çetin, 2018; Sisk, 1987), ability to focus attention for a long time (Çağlar, 2004; Sriraman, 2004), learning easily (Calero, Belen, & Robles, 2011; Levent, 2013), higher-order thinking skills (Bonner 2000; Kettler, 2014) and generating original ideas (Çitil & Ataman, 2018; Janos, Fung, & Robinson, 1985; Özbay, 2013).

In addition, the findings obtained from the research are similar to the studies emphasizing the affective characteristics of gifted students such as hypersensitivity, high motivation (Renzulli, 1978), leadership (Bain & Bell, 2004), boredom, social communication difficulties (Bahtiyar & Şahin, 2017; Çetin & Doğan, 2018; Özbay, 2013) and perfectionism (Clark, 2002; Çitil & Ataman, 2018; Davis & Rimm, 2004; Saranlı & Metin, 2012). Talas, Talas and Sönmez (2013) found in their studies that, unlike our work, communication between gifted students and their friends who are like them is good, but they have problems with other peers and prefer to be alone. Examining the characteristics of the peers with whom gifted students communicate in studies conducted in this respect will be very useful to get a detailed idea about the characteristics of these children.

Various needs were identified in the fields of general education and mathematics education. Regarding general education needs, teachers stated that the identification process should be updated when selecting students for SACs and

that it is important to create homogeneous student groups in SACs as a result of identification. Teachers emphasized that parent training should be given for parents to adapt to the SAC process. At the same time, teachers emphasized that their colleagues should be educated when necessary to keep up with the age and be aware of innovations. In addition, the teachers also stated that the updated education programs using enriched and differentiated activities would improve the quality of teaching. Regarding physical equipment, the teachers expressed that the materials and technical equipment deficiencies of the workshops should be eliminated. Teachers also stated that the emotional needs of students such as making them feel special, increasing their motivation, wanting to be understood, controlling anxiety, and wanting to be successful should not be ignored. These results align with the studies that contain similar results in the literature. These studies include needs such as; updating teaching programs in line with the educational needs of gifted children (Baykoç-Dönmez, 2009; Davaslıgil 2004; Heward & Orlansky, 1980), enriched and differentiated activities, workshops, out-of-school practices, etc. standards should be established (Ataman, 2009; Davis & Rimm,2004; Göktepe-Yıldız & Özdemir, 2018; Kanlı, 2011), eliminating the lack of resources, materials, and equipment (Şenol, 2011), training teachers (Levent, 2014; Manning,2006), making students feel special and increasing motivation (Gross, 2002; Kelly & Jordan, 1990; Levine & Tucker, 1986; Özsoy, Özyürek & Eripek, 1998). However, in our study, only teacher and student competencies were mentioned. According to Summak and Çelik-Şahin (2013), SaAC directors should possess strong instructional leadership skills to effectively meet educational needs. To truly understand the needs of these centers, it is important to conduct thorough studies that examine all aspects of SaACs and reveal general needs as a whole.

As for the educational needs in the field of mathematics; teachers stated that it is important to update mathematics programs, prepare enriched mathematics activities that include real-life problems, and use dynamic software to make abstract geometry subjects concrete. In addition, teachers emphasized that teaching mathematical proof is very important for students to establish meaningful relationships between mathematical expressions. It is also among the important needs that mathematics workshops should be equipped with. In the literature, similar studies have been found for the educational needs in the field of mathematics; equipping mathematics workshops (Çakır, 2009; Kazu & Şenol, 2012; Sezginsoy, 2007; Tantay, 2010), creating enriched and differentiated mathematics activities (Even, Karsenty ve Friedlander, 2009; Kurtdede-Fidan, 2008), and creating environments that will increase students' interest in mathematics (Camcı-Erdoğan, 2014; Mesh, 2008; Orbeyi, 2007).

In line with the study, teachers stated that students should gain basic geometry knowledge and technical drawing skills regarding the supporting activities carried out in the course during the geometry teaching process. In addition, teachers mentioned the importance of developing complex activities involving real-life problems and three-dimensional objects for students' visual-spatial abilities. Teachers stated that while designing these activities, it is necessary to benefit from the opportunities provided by concrete materials and dynamic geometry software (GeoGebra, Cabri...). Teachers also mentioned the importance of supporting the teaching process with proof studies. Various studies supporting these results were found in the literature (Baydaş, 2010; Güven & Karataş, 2003).

One of the results obtained from the research is the advantages and disadvantages of dynamic geometry software. While talking about the advantages of the software, teachers said that it has a user interface, concretizes the teaching process, facilitates perception, supports the proof and reasoning process, saves time, makes the lesson fun and increases students' motivation. In addition, the teachers stated that the disadvantages caused by dynamic geometry software could disrupt the motivation of students and teachers and cause a loss of time. In parallel with these results, Genç (2010) stated that the Geogebra program which is dynamic geometry software has an easy interface, its language is Turkish, and it is free, creating positive thoughts in students. Cengiz (2017) also stated that with dynamic geometry software, students could move shapes quickly and learn formulas easily, making the learning process fun.

In the research, teachers said that various preparations should be made to effectively use dynamic geometry software. Regarding these preparations; teachers stated that the workshops should be equipped materially and technically, the programs should be updated, the teachers and students should be trained about the software, the technology should be integrated into the activities and if necessary, a pilot application should be made beforehand. Similarly, Kocasaraç (2003)

stated that teachers do not have sufficient computer-assisted teaching skills and should receive an education. Bozkurt, Bindak, and Demir (2011) stated that activities should be prepared to use dynamic geometry software and teachers and students should also receive training to use the software. According to Kazu and Şenol (2012) and Tantay (2010), the workshops in SACs are facing numerous equipment-related deficiencies.

While expressing mathematical proof, teachers used expressions like validation of formulas, logical explanations and derivative reasoning. At the same time, teachers stated that mathematical proof is very important because it provides opportunities such as learning by doing, consolidating what has been learned, connecting disciplines, making sense of formulas, and persuading. Teachers also stated that dynamic software such as GeoGebra and Cabri used in the mathematical proof process are very useful in modelling shapes, giving dynamic structures to forms, and concretizing the process. Various studies in the literature have supported these results. It was determined by Harel and Sowder (1998) that dynamic visualization skills were improved by students' rotating and moving shapes by dragging, and it had positive effects on spatial reasoning. Similarly, Güven and Karataş (2003) found that dynamic software such as GeoGebra and Cabri changed students' perceptions of mathematical expressions and that they began to see mathematical expressions as a set of meaningful relationships rather than something to be memorized.

Recommendations

After analyzing the findings of the study in depth, various conclusions were reached. In line with these conclusions, various suggestions were made considering the characteristics of gifted students. Teachers stated that the teaching programs and activities used in SACs are insufficient. In this direction, it should be ensured that the curriculum applied in SACs is updated by considering the teachers' opinions. At the same time, differentiated and enriched activities prepared by integrating with technology should be presented to students. Teachers also stated that the workshops used in SACs are insufficient. Therefore, the workshops used in SACs should be ensured that they are physically and technically equipped. Teachers said that they should constantly update their knowledge through in-service training programs to improve the quality of education and to be informed about the latest developments in education. Thus, regular in-service training programs should be organized by the Ministry of National Education in various fields.

Today, private schools and universi:ties have been established in countries such as ABD, China, Russia, Sweden, Germany, and Finland using programs such as "International Baccalaureate IB (International Baccalaureate), Study of Mathematically Precocious Youth and Talent Search (SMPY), Study of Gifted Youth in Mathematics and Talent Pooling Project, Europe Private the Council for the Talented (ECHA) and Dalton school "has been established. In Türkiye, the gifted education program (GEP) is an education program that was founded in 2007 and started to be implemented in 2014. GEP can be accepted as Türkiye 's first and only training program in this field in terms of its content and scope. Türkiye has very little experience in gifted education. For this reason, it may be more beneficial to implement a common program accepted all over the world in Türkiye. At the same time, a common path should be followed for gifted students in Türkiye, they should be directed to universities in line with their abilities and special employment opportunities should be created after graduation.

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Biodata of Authors

Derya Zengin is a mathematics teacher at the Halil Inalcık Science and Art Center (SaAC) in the Ministry of National Education. She is also a Ph.D. student in the faculty of education at Uludag University. She studies in the field of Social Sciences and Humanities. **Affiliation**: Bursa Halil İnalcık Science and Art Center, Türkiye. **E-mai**l: derya_bilir@windowslive.com **ORCID**: 0000-0001-9854-9664,

Menekşe Seden Tapan Broutin is an associate professor at Uludağ University, Faculty of Education. Her research interests include Social Sciences and Humanities. **Affiliation**: Bursa Uludağ University, Türkiye. **ORCID**: 0000-0002-1860-852X **E-mail**: tapan@uludag.edu.tr

Ethics Statements

Our study is part of a PhD thesis in preparation and ethics committee permission (Bursa Uludag University Rectorate, Student Affairs Department is notified with the letter dated 8.4.2022 and numbered 53989) was obtained from Uludağ University.

Conflict of Interest

I confirm that there is no personal or financial relationship or conflict of interest between the researchers and any other person or organization involved in the research

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Research Article

Analysis of Turkish language teacher candidates' speech anxiety in terms of various variables in the context of 21st century skills

Emre Dağaşan [1]

Kafkas University, Kars, Turkiye

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Abstract

The requirements of the 21st century encompass not only grammar and vocabulary but also effective communication through oral, written, and ICT-mediated processes. The teaching profession should be embraced as an art of addressing the student's soul and nurturing individuals. Speech anxiety is a common condition encountered in communication, language learning, and teaching processes, which can negatively affect students' language skills. The aim of this article is to analyze the speech anxiety of Turkish language teacher candidates in terms of various variables. The research was conducted using a survey model where the 'Speech Anxiety Scale,' a 5-point Likert-type scale, was employed. The sample of the study consisted of 200 voluntary Turkish language teacher candidates continuing their education at two different universities in the Eastern Anatolia and Central Anatolia regions in 2023. Descriptive statistics (% and f), independent samples t-test to determine changes in scores based on participants' gender, one-way ANOVA for class levels, and one-way ANOVA analyses to determine score differences based on the grade variable were used in the data analysis. After ANOVA, Dunnett C test was used for determining the differences that emerged. The research examined the levels of speech anxiety of teacher candidates and found that this anxiety was especially prevalent in items such as 'Fear of speaking in front of an audience,' 'Feeling embarrassed when talking about myself to people,' and 'Getting excited when talking to someone of the opposite sex' with 'Always' responses. While no significant differences were found between gender and class levels, factor analysis results revealed that the FF and DC groups had lower environmental-focused anxiety and overall speech anxiety compared to the BA group.

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Introduction

Language plays a fundamental role in communication among human communities, conveying thoughts, and preserving cultural heritage. The teaching and learning of language aim to ensure the effective use of this means of communication. In particular, the teaching and learning of the native language, Turkish, are critical processes that affect individuals' communication skills and intellectual development.

The National Research Council (NRC) has identified various skills necessary to prepare individuals for life and work. These skills are categorized as cognitive skills, interpersonal skills, and intrapersonal skills. Within the framework of skill dimensions, cognitive skills encompass abstract reasoning about events, judgment, decision-making, system analysis, and system evaluation, along with abstract reasoning about how different elements of a business process interact. Interpersonal skills include active listening, effective verbal communication, clear writing, explaining one's thoughts

[1] Corresponding Author: Kafkas University, Kars, Turkiye. E-mail: emredagasan_25@hotmail.com ORCID: 0000-0003-3200-6602

effectively and respectfully without causing harm, using non-verbal skills effectively, collaborating and organizing, building trust, being sensitive to intercultural differences, respecting ideas, and creating social impact. Intrapersonal skills involve being organized, self-disciplined, self-regulating, self-improving, time management, and adaptability.

The Partnership for 21st Century Skills (P21) framework is one of the most extensively studied and accepted frameworks for competencies and skills. Among the identified skills, learning and innovation skills refer to being ready for work environments and enhancing learning and innovation related to increasingly complex life. Information, media, and technology skills are some skills that individuals need to have in rapidly evolving technological fields such as information literacy and media literacy. These two sets of skills have communication skills in common, covering a broad spectrum of areas. Communication skills encompass effectively expressing thoughts and ideas in various contexts, using verbal, written, and non-verbal communication skills, effective listening skills, and the ability to communicate effectively in different settings, including multilingualism (Partnership for 21st Century Learning, 2015).

The American Association of Colleges and Universities (AACU) has also defined 21st-century skills within specific frameworks. According to AACU, these skills can manifest differently depending on the context. For example, the communication skills used by engineers differ from those used by anthropologists. Similarly, effective writing can take different forms in different contexts. Skills should be considered appropriately within this context. Fundamental learning outcomes define capacities that will be important for every student's future and society's vitality. These skills also provide a common direction and framework for lifelong learning (American Association of Colleges and Universities, 2007).

In 2003, the North Central Regional Educational Laboratory (NCREL) examined 21st-century skills in four dimensions in line with the global and digital change. These dimensions are digital literacy, innovative thinking, effective communication, and high productivity. Effective communication emphasizes individuals' abilities to work in teams, learn together, establish positive relationships with others, behave effectively individually, and use technology responsibly in this context. High productivity highlights individuals' ability to plan and complete a project, effectively use technology to solve problems, and develop real, intellectual, informative, or material products (Cansoy, 2018; EnGauge, 2003). In the context of the requirements of the 21st century, communication and language skills encompass not only grammar and vocabulary but also effective communication processes through oral, written, and ICT-mediated means.

In our daily lives, sudden or prepared speeches aim to achieve effective communication. However, research (Akkaya, 2012; Sallabaş, 2011; Yıldız, 2008; Gündüz, 2007) sometimes shows that individuals may encounter problems in the speech process that can hinder communication. Some of these problems include unnecessary word usage, pronunciation errors, word confusions, shyness, regional dialect usage, short and incomplete speech, irregular speech, limited vocabulary, deficiencies in cognitive organization, inadequate mastery of language rules, and the inability to apply grammar rules. These speech problems may have physiological causes (problems in the mouth, teeth, vocal cords, etc.) and sociological factors (language diversity, environmental factors, etc.), as well as psychological causes such as motivation, attitude, and anxiety. Factors affecting speech motivation and attitude, self-esteem regarding speaking competence, anxiety levels before and during speaking form the emotional dimension of speaking (Hamzadayı, Bayat & Gölpınar, 2018). Anxiety is the feeling of fear and apprehension experienced by individuals. Different emotional characteristics accompany this feeling and manifest in various ways in individuals. Some examples include a feeling of tightness in the chest, palpitations, sweating, headaches, feeling of emptiness in the stomach, and an immediate need to go to the restroom (Türkçapar, 2004). Therefore, it can be stated that anxiety can have a significant impact on speech performance.

The purpose of this article is to analyze the speech anxiety of Turkish language teacher candidates in terms of various variables. The teaching profession should be embraced as an art of addressing the student's soul and nurturing individuals. Speech anxiety is a common condition encountered in communication, language learning, and teaching processes, which can negatively affect students' language skills. Therefore, examining the variables that affect the speech anxiety of Turkish language teacher candidates and strategies to reduce this anxiety can serve the purpose of improving language education and communication.

In this context, the following research questions were addressed:

- What are the levels of speech anxiety of Turkish language teacher candidates?
- Does speech anxiety of Turkish language teacher candidates differ by gender?
- Does speech anxiety of Turkish language teacher candidates differ by class level?
- Does the speech anxiety of Turkish language teacher candidates vary according to their achievements in Turkish Language, Oral Expression, and/or Speech Education?

The following hypotheses were developed for this research:

- H_1: There is no significant difference in the scores obtained from the Speech Anxiety Scale between female and male Turkish language teacher candidates.
- H_2: There is no significant difference in the scores obtained from the Speech Anxiety Scale between Turkish language teacher candidates studying in different classes.
- H_3: There is no significant difference in the scores obtained from the Speech Anxiety Scale between Turkish language teacher candidates with different achievements in Turkish Language, Oral Expression, and/or Speech Education.

Method

Research Design

In this study, quantitative research was employed. Quantitative research is an approach where numerical data is collected, analyzed, and interpreted. It is commonly used when obtaining numerical results through hypothesis testing, surveys, and measurement tools (Karasar, 2009). The research design used in this study is the survey model, which aims to guide the data collection process to identify specific characteristics of large sample groups. The survey model is a research design suitable for broad participant groups and aims to collect data to "determine the characteristics of a specific group" (Büyüköztürk et al., 2011). This study selected the survey model as the most suitable research design for the nature of the research since a Likert-type scale was used to measure teacher candidates' speech anxiety.

Sampling

The population of the research can be defined as Turkish language teacher candidates who are studying at universities in Turkey. The sample consists of a total of 200 volunteer Turkish language teacher candidates who were reached through a convenience sampling method in the year 2023, from two different universities in the Eastern Anatolia and Central Anatolia regions. The participants filled out the scale items in an online form format with informed consent, and they were provided an unlimited amount of time to do so. Demographic information of the participants is presented in Table 1.

Table 1. Demographic information of the participants

Variables		1	2	3	4	5	6	7	8	9	Total
Class		First	Second	Third	Fourth						-
	n	38	59	29	74						200
	%	19	29.5	14.5	37						100
Gender		Female	Male								-
	n	96	104								200
	%	48	52								100
Note		AA	AB	BA	BB	BC	CB	CC	DC	FF	-
	n	37	16	33	32	11	14	24	13	20	62
	%	18.5	8.0	16.5	16.0	5.5	7.0	12.0	6.5	10	100
Age	$\bar{X}$										22.21

Data Collection Tools

The research data was collected using the "Speech Anxiety Scale for Teacher Candidates" developed by Sevim (2012) to assess students' speech anxiety. This scale was designed using a five-point Likert scale to evaluate students' speech anxiety, offering participants rating options such as "Never, Very Little, Sometimes, Often, Always." As a result of factor analysis,

the scale items were grouped into three different factors. The first factor included items 15, 16, 19, 21, 25, 26, 27, 29, 31, and 32, while the second factor included items 1, 8, 9, 10, 11, and 12. The third factor consisted of items 23, 34, and 35. According to the reliability analysis results of the scale, the Cronbach's alpha reliability coefficient was calculated as 0.89 for the first factor, 0.82 for the second factor, and 0.87 for the third factor. The overall Cronbach's alpha reliability coefficient of the scale was found to be 0.912. These high reliability values indicate that this scale, used to assess teacher candidates' speech anxiety, is a reliable tool. The scale consists of a total of 20 items, with 19 containing positive statements and one item containing a negative statement.

Data Analysis

In the analysis of the data obtained in the research, SPSS 26 statistical software was used. First, reverse items were organized, and checks for missing and erroneous data were conducted. Descriptive statistics (% and f), independent samples t-tests were used to determine changes in scores based on participants' gender, one-way ANOVA for class levels, and one-way ANOVA analyses were used to determine score differences based on the grade variable. The Dunnett C test was used in the Post Hoc analysis since the homogeneity of variances was not ensured after ANOVA.

Findings

Findings related to the first sub-problem of the research

The descriptive analysis results for the speech anxiety levels of Turkish language teacher candidates are presented in Table 2.

Table 2. Percentage (%) and frequency (f) findings regarding the speech anxiety levels of Turkish language teacher candidates in terms of items

	Never		Rarely		Sometimes		Often		Always	
Items	f	%	f	%	f	%	f	%	f	%
I hesitate to use body language while speaking.	0	0	12	6,0	38	19,0	48	24,0	102	51,0
I hesitate to look into the eyes of the person I'm speaking to.	4	2,0	11	5,5	27	13,5	67	33,5	91	45,5
Speaking without a text in front of me makes me anxious.	11	5,5	25	12,5	59	29,5	67	33,5	38	19,0
The thought of speaking at events like symposiums, panels, or conferences makes me tense.	24	12,0	40	20,0	92	46,0	35	17,5	9	4,5
The idea that I cannot approach the topic from different perspectives worries me.	12	6,0	15	7,5	70	35,0	73	36,5	30	15,0
The idea that I cannot approach the topic from different perspectives worries me.	0	0	27	13,5	44	22,0	83	41,5	46	23,0
The thought of seeing myself through the eyes of the listeners and facing criticism makes me uncomfortable.	4	2,0	40	20,0	43	21,5	63	31,5	50	25,0
When I cannot adjust my speaking pace properly, I become nervous.	7	3,5	30	15,0	76	38,0	58	29,0	29	14,5
I'm afraid of speaking in front of an audience.	6	3,0	30	15,0	59	29,5	65	32,5	40	20,0
I have difficulty using the right words and sentences to express what's on my mind when speaking.	3	1,5	20	10,0	75	37,5	74	37,0	28	14,0
I hesitate to participate in discussions by taking the floor.	6	3,0	29	14,5	30	15,0	58	29,0	77	38,5
I feel embarrassed when speaking in front of people I don't know.	10	5,0	19	9,5	43	21,5	71	35,5	57	28,5
I get anxious when asked to speak suddenly on a topic.	15	7,5	31	15,5	70	35,0	44	22,0	40	20,0
I get nervous when speaking with someone of the opposite gender.	0	0	5	2,5	36	18,0	62	31,0	97	48,5
I feel anxious when I need to speak with a teacher or my superior.	6	3,0	17	8,5	54	27,0	69	34,5	54	27,0
I feel anxious when talking on the phone with someone I don't know well.	2	1,0	12	6,0	48	24,0	76	38,0	62	31,0
I feel anxious when speaking with someone in an authoritative position.	6	3,0	31	15,5	67	33,5	69	34,5	27	13,5

I'm afraid that the time allocated for my speech won't be enough.	2	1,0	14	7,0	70	35,0	79	39,5	35	17,5
I feel embarrassed when talking about myself to others.	2	1,0	5	2,5	24	12,0	69	34,5	100	50,0
Being interrupted while speaking worries me.	12	6,0	46	23,0	37	18,5	60	30,0	45	22,5

As can be seen at Table2 the speech anxiety levels of teacher candidates, it can be observed that the responses "Always" are quite prevalent for items such as "I am afraid to speak in front of an audience," "I feel embarrassed when talking to people about myself," and "I get nervous when talking to someone of the opposite sex." However, for items like "I hesitate to use body language while speaking," "The idea that I cannot approach the speech topic from different perspectives worries me," and "I get nervous when talking to someone of the opposite sex," there are no "Never" responses.

Findings related to the second sub-problem of the research

The second sub-problem of the research, which examines the change in speech anxiety of Turkish language teacher candidates by gender and tests the H0 hypothesis created based on this problem, is presented in Table 3.

Table 3. Findings regarding changes in the speech anxiety levels of Turkish language teacher candidates by gender.

Factor	Gender	N	$\bar{X}$	SS	df	t	p
Environmental Concern	Female	96	40,03	8,15	198	0,58	,557
	Male	104	39,37	7,62			
Speech Psychology	Female	96	11,51	2,33	198	0,95	,342
	Male	104	11,21	2,10			
Speaker-focused anxiety	Female	96	40,03	8,15	198	0,58	,557
	Male	104	39,37	7,62			
Total	Female	96	91,57	17,82	198	0,66	,509
	Male	104	89,96	16,62			

In the Environment-Focused Anxiety factor, it can be observed that females ($\bar{X}$= 40.03) have slightly higher average scores compared to males ($\bar{X}$= 39.37). However, this difference is not statistically significant ($t_{(198)}$= 0.58, p = 0.557). Therefore, we can conclude that gender does not have a significant effect on environment-focused anxiety. Similarly, in the Speech Psychology factor, the difference is not statistically significant ($t_{(198)}$= 0.95, p = 0.342). The same situation applies to the Speaker-Focused Anxiety factor and the Total factor. In both factors, the score differences between genders are not statistically significant (p>0.05). Therefore, based on these t-test results, we can conclude that gender does not have a significant effect on the speech anxiety factors examined in this study. In this context, the H0 hypothesis has been accepted.

Regarding the third sub-problem of the research

The findings related to the research question about the potential difference in the scores obtained from the Speech Anxiety Scale by Turkish language teacher candidates who receive education in different classes and the hypothesis created for this purpose are presented in Table 4.

Table 4. Findings regarding the difference in scores obtained from the Speech Anxiety Scale by Turkish language teacher candidates receiving education in different classes.

Factors	Groups	N	$\bar{X}$	SS	F	p
Environmental Concern	1st Grade	38	39,39	8,70	0,35	0,78
	2nd Grade	59	39,50	8,33		
	3rd Grade	29	38,72	7,98		
	4th Grade	74	40,36	7,07		
	Total	200	39,69	7,87		
Speech Psychology	1st Grade	38	11,52	2,00	0,58	0,62
	2nd Grade	59	11,08	2,50		
	3rd Grade	29	11,20	2,17		
	4th Grade	74	11,54	2,09		
	Total	200	11,35	2,21		
Speaker-focused anxiety	1st Grade	38	39,39	8,70	0,35	0,78
	2nd Grade	59	39,50	8,33		
	3rd Grade	29	38,72	7,98		
	4th Grade	74	40,36	7,07		
	Total	200	39,69	7,87		
Total	1st Grade	38	90,31	18,81	0,36	0,77
	2nd Grade	59	90,10	18,43		
	3rd Grade	29	88,65	17,25		
	4th Grade	74	92,27	15,39		
	Total	200	90,73	17,18		

As can be seen at Table 4 in the context of the Environment-Focused Anxiety factor, there is no significant difference in the average scores among students at different class levels ($F_{(196,3)} = 0.35$, $p = 0.78$). Similarly, in the context of the Speech Psychology factor, there is no significant difference in the average scores among students at different class levels ($F_{(196,3)} = 0.58$, $p = 0.62$). Additionally, in the context of the Speaker-Focused Anxiety factor, there is no significant difference in the average scores among students at different class levels ($F_{(196,3)} = 0.35$, $p = 0.78$). There is also no significant difference in the total scale ($F_{(196,3)} = 0.36$, $p = 0.77$). Therefore, students' class levels do not create a significant difference in these speech anxiety factors. In this context, H0 has been accepted.

Findings for the fourth sub-problem of the study

The ANOVA results related to the potential differences in the scores obtained from the Speech Anxiety Scale by Turkish language teacher candidates with varying levels of achievement in Turkish Language, Oral Expression, and/or Speech Education are presented in Table 5.

Table 5. Findings regarding the differences in scores obtained from the Speech Anxiety Scale by Turkish language teacher candidates with varying levels of achievement in Turkish Language, Oral Expression, and/or Speech Education.

Factors	Groups	N	$\overline{X}$	SS	F	p	Differences
Environmental Concern	FF	20	39,1000	7,77242	2.88	0,005*	
	DC	13	36,7692	7,51835			FF<BA
	CC	24	35,6250	9,71244			DC<BA
	CB	14	36,2143	5,10171			CC<BA
	BC	11	40,1818	5,51032			CC<BB
	BB	32	39,8750	6,36903			CC<AA
	BA	33	43,7879	7,86510			CB<BA
	AB	16	39,2500	7,21572			CB<AA
	AA	37	41,2162	8,06961			BB<BA
	Total	200	39,6900	7,87170			
Speech Psychology	FF	20	11,4000	1,90291	1.296	0.248	
	DC	13	10,8462	2,15430			
	CC	24	10,3750	2,79460			
	CB	14	10,9286	,91687			
	BC	11	11,3636	2,06265			
	BB	32	11,9688	2,02380			
	BA	33	11,8485	2,33347			
	AB	16	11,5625	2,09662			
	AA	37	11,2432	2,36180			
	Total	200	11,3550	2,21438			
Speaker-focused anxiety	FF	20	39,1000	7,77242	2.88	0,005*	
	DC	13	36,7692	7,51835			FF<BA
	CC	24	35,6250	9,71244			DC<BA
	CB	14	36,2143	5,10171			CC<BB
	BC	11	40,1818	5,51032			CC<BA
	BB	32	39,8750	6,36903			CC<AA
	BA	33	43,7879	7,86510			CB<BA
	AB	16	39,2500	7,21572			CB<AA
	AA	37	41,2162	8,06961			
	Total	200	39,6900	7,87170			
Total	FF	20	89,6000	16,38485	2.79	0,006*	
	DC	13	84,3846	16,07036			FF<BA
	CC	24	81,6250	21,96403			DC<BA
	CB	14	83,3571	10,58742			CC<BB
	BC	11	91,7273	12,62609			CC<BA
	BB	32	91,7188	13,56997			CC<AA
	BA	33	99,4242	17,73068			CB<BA
	AB	16	90,0625	15,07523			CB<AA
	AA	37	93,6757	17,55793			
	Total	200	90,7350	17,18755			

Discussion and Conclusion

This study presents the findings of research aimed at examining the speech anxiety levels of teacher candidates. According to the findings, for items such as "I am afraid to speak in front of a group," "I feel embarrassed when talking about myself to people," and "I get nervous when talking to someone of the opposite sex," teacher candidates often responded with "Always." However, for items like "I am hesitant to use body language while speaking," "The thought of not being able to approach the speech topic from different perspectives worries me," and "I get nervous when talking to someone of the opposite sex," there were no "Never" responses.

The gender analysis indicated that there was no significant difference in speech anxiety levels among teacher candidates. In other words, there was no statistically significant difference in these speech anxiety factors between male

and female teacher candidates. This finding does not align with the results of the study conducted by Kumar, Kaur & Thakur (2017), where they found no significant difference in speech anxiety concerning gender and age but did find significant differences in speech anxiety among students of different socioeconomic levels. Similarly, Özkan & Kınay (2015) and Gaibani & Elmenfi (2014) found in their studies that being male or female did not have an impact on speech anxiety.

Furthermore, there was no significant difference in speech anxiety factors among students at different class levels. This suggests that students, regardless of their class level, had similar levels of speech anxiety. However, according to the factor analysis results, there were significant differences among different subgroups in "Environment-Focused Anxiety" and "Total Factor." Specifically, the FF and DC groups had lower environmental anxiety levels than the BA group, and the FF, DC, and CC groups had lower total speech anxiety compared to the BA group. This finding is consistent with the results of the study conducted by Menzel & Carrell (1994), which found a negative and significant relationship between speech anxiety and speech performance quality.

In conclusion, these findings indicate that teacher candidates generally have similar levels of speech anxiety, but some subgroups are less anxious in this regard. These findings can guide the development of educational programs to help teacher candidates cope with speech anxiety and enhance their speaking skills.

Recommendations

Based on the results of this study, the following recommendations can be made to researchers, linguists, teacher candidates, and program developers:

Program Sensitivity; It is important for educational programs to be sensitive to alleviating this anxiety. Special classes or workshops that include elements such as improving speech skills, increasing self-confidence, and teaching relaxation techniques can help teacher candidates overcome this anxiety.

Understanding Individual Differences; Although the findings show no general differences in terms of gender or class level, they emphasize significant differences among subgroups. Therefore, program developers and educators should understand students' individual differences and develop approaches that are sensitive to these differences.

Support and Counseling Services; Providing support and counseling services to teacher candidates in coping with speech anxiety is important. These services can guide students in understanding, managing, and overcoming their anxieties. Additionally, by providing opportunities to boost students' confidence, they can strengthen their speaking skills.

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Research Article

Examining the effect of the future readiness psychoeducation program on gifted students' career decision-making competencies and future expectations

Abdullah Eker[1]

Kilis 7 Aralık University, Education Faculty, Special Education Department, Kilis, Turkiye

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Abstract

There is a great need for intervention programs related to career studies in today's world where the importance of career studies is increasing day by day. Gifted children also feel necessary to career guidance more due to many factors such as their special talents, multi-potentials and early career awareness. The purpose of this study is to examine the effect of the "Turkish Science and Art Centers (SAC) Future Readiness Psychoeducation Program" developed for gifted middle school students who also continuing education in SAC. The aims of program are increasing career awareness, decreasing career decision making difficulties and effecting positively to future expectations. Thirty-two 7th grade students who were identified as gifted in Kilis province participated in the study. The study was designed in a pre-test post-test one-group quasi-experimental design. The data were analyzed using Mann Whitney U and Wilcoxon Signed Ranks Test from non-parametric techniques according to group structure. Career Decision Difficulties Scale (CDDS), Adolescent Future Expectations Scale (FESA) and program evaluation form were used as data collection tools. When the results of the study were evaluated, it was seen that the career development program prepared for gifted students reduced their career decision-making difficulties and positively affected their future expectations. It was observed that gifted female students had higher career decision-making difficulties than male students, while there was no significant difference in terms of future expectations. When the evaluation form data and opinions of the participants were examined, it was seen that the satisfaction with the program was high, the activities could be enriched in terms of practice, and it would be more beneficial to spread the activities over a wider period of time and implement them as a single activity in each session.

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Introduction

One of the main purpose of human in life is self-satisfaction. Therefore making meaningful to our lives is closely related to the Jobs and the specialties that we choose according to our abilities. The need for vocational guidance and career counseling services is increasing day by day due to reasons such as the rapid increase in information, globalization, transformations in society and individual life, the increase in options and the difficulty of decision-making processes. Deciding on a successful and fulfilling career in line with their own abilities and potentials is a developmental task for gifted children as well as for every student. However, supporting the career development of gifted students, who have higher career anxiety and career ambivalence due to multipotentiality, is of special importance. Studies conducted with

[1] Corresponding Author: Kilis 7 Aralık University, Education Faculty, Special Education Department, Kilis, Turkiye E-mail: aeker38@gmail.com ORCID: 0000-0002-6409-7732

gifted children show that gifted children do not need less career guidance than their normal peers, in fact they need it more because of their 'higher level potential' (Silverman, 1993). Career development is generally defined as a lifelong process. There is a great need for intervention programs related to career studies in today's world where the importance of career studies is increasing day by day. Gifted children also feel necessary to career guidance more due to many factors such as their special talents, multi-potentials and early career awareness. (Milgram 1991). Many genetic, physical, personal, social, educational, economic and cultural factors affect career development. Career education can be defined as all the knowledge, skills and ideas that individuals acquire in order to choose a suitable profession.

Due to their individual characteristics, gifted students show some differences from their peers in the field of career development as in other developmental areas. For example, these students may have an earlier career awareness due to their early cognitive maturation. However, the fact that they have different abilities at the same time and show interest in more than one subject due to their versatility may cause them to experience more confusion in vocational orientation. These students may also experience emotional problems in the face of high expectations from their families, peers and even society in general (Achter & Lubinski, 2005, Robinson, Shore & Enerson, 2007, Stewart, 1999, Ogurlu, 2016). Studies show that although gifted students have higher positive planning skills (Güleç, Karaburçak, Tatar, & Akalan, 2020), these students narrow their career options in much earlier years without considering all possible career options, focus only on professions with high status and income, and fail to develop appropriate coping methods against the pressures of their environment in this direction (Greene, 2003, Grothaus, McAuliffe, & Craigen, 2012, Sürücü, Kontaş, & Bacanlı, 2015, Özcan, 2017).

Multipotentiality is the state of being successful and talented in many different areas (Greene, 2006) and researchers emphasize that this is a common characteristic of gifted individuals (Kerr, 1998). At first glance, this seems to be a positive characteristic, but it poses difficulties for gifted individuals when choosing a career. When choosing a career, gifted individuals may make early decisions, make wrong decisions, and sacrifice some of their abilities due to their multiple potentialities (Wessel 1999). Individuals with talents in many fields are often directed by their parents and teachers to popular professions that are considered more suitable for them, such as medicine, engineering and science. Greene (2003) argues in his article that gifted individuals can make better decisions about their future by encouraging them to think about their own values, life goals and leisure activities rather than their different potentials. In addition to the above, in his 2006 article, he emphasizes that gifted children and their parents should be told that career development today is not limited to a single profession and that people can choose different professions in different periods.

Some gifted children decide on their future careers as early as their primary school years due to their early intellectual development. This situation is called early decision-making or early identification in the field. Students who experience this situation are passionately attached to their chosen profession and work excessively. Kerr (1991) stated that early career choice and focus, especially in artistic fields, are key to life success.

In addition to talents, interests and values, there are also personality traits that are effective in determining the careers of gifted individuals. The most important of these is perfectionism. Perfectionism is a bidirectional trait that pushes a person to think in a success-oriented manner; in other words, it can have both positive and negative effects on a person. A positive vision of perfectionism enables a person to accomplish very successful things. However, a negative perfectionism creates fear of failure, fear of making mistakes, fear of not doing well, and causes the person to postpone decisions. In other words, negative perfectionism causes gifted individuals to postpone decisions about career choices or to ask others - parents, teachers - to take responsibility for them. In addition to perfectionism, traits such as being too sensitive, being too innovative, and having an excessive sense of justice are personality traits that affect career development in gifted individuals (Berger,1989: 19).

In 1986, Schroer and Dorn (1986) conducted a career motivation program in which 39 girls and 32 boys participated and it was found that after the program, the girls' indecision about career choice increased due to the awareness they gained about the future. Many studies have shown the positive effects of the systematic implementation of a program for gifted students in order to get to know their personalities and professions on their career and future plans. Career counseling programs have been established since 1980, especially in the United States, within the institutions that

provide education for gifted students. One of these programs was opened by Barbara Kerr as GIFTS in Nebraska. These programs are research- and experiential-based programs that aim to overcome students' career-related problems. Kerr and Ghrist-Priebe (1988) investigated the benefits of this program on 87 gifted children, 56 in the experimental group and 31 in the control group. The results of the study showed that the career program contributed positively to the gifted children's career awareness.

The concept of career decision-making difficulties has an important place in individuals' career processes. Sampson, Peterson, Lenz, and Reardon (1992) explained career decision-making as an individual's choice of profession or education program, job or school. In cases where the individual cannot make a decision, it causes him/her not to enjoy life and to experience daily life stresses more intensely, while making a healthy decision enables him/her to perceive life positively and to be happy (Çolakkadıoğlu & Güçray, 2007). Career indecision is defined as all the problems experienced before, after and during the process together with the difficulties experienced by the individual during the decision-making phase in the career process (Gati and Saka. 2001). The decisions made in this process have a significant long-term impact on the individual's lifestyle, emotional state, economic situation, productivity, and careers (Campbell & Cellini, 1981).

Gati and Saka (2001) conducted a study on 95 career counselors and 259 young adults to examine the validity of the Career Decision Making Difficulties Scale. As a result of their study, it was found that the opinions of career counselors and young adults (clients) were close to the opinions of career counselors and clients that difficulties caused by inconsistent information and lack of preparation were experienced more than difficulties caused by lack of information.

SAC career psychoeducation programs have been established in order to support the career development of gifted students who were attended to science and art centers and to help them make the most appropriate career choice for their potential. In this context, "Future Readiness Psychoeducation Program" was prepared for middle school students attending science and art centers. Student application booklets were also created for each of the psychoeducation programs for ease of implementation (NME, 2022).

The basic approach of the SAC Program is based on Parsons' three-stage vocational guidance model, which is briefly expressed as self-knowledge, option recognition and decision making. In addition, qualitative applications of Holland typology, narrative approach and other postmodern approaches were utilized in order to achieve the outcomes in the activity process. In the decision-making step, which is the third stage of the Parsons model, in addition to the acquisition of decision-making skills, developmental studies on the personal characteristics of the students that will provide the necessary competencies of the students were included in the Basic Approach and Principles of the SAC Future Readiness Psychoeducation Program (NME, 2022).

This program has been prepared based on the basic needs for career development of students attending support education programs in SACs. The general aim of the program is to support students' self and professional development, to help them make the most appropriate career choice for their potential and to enable them to structure their careers as productive individuals. In line with this general aim, it is envisaged that students will gain the following objectives. 1. To enable them to recognize themselves in terms of their interests and abilities. 2. To enable them to recognize vocational options. 3. To contribute to the development of decision-making skills (NME, 2022)..

The comprehensive guidance and psychological counseling programs model was taken as a basis in the design of the SAC future readiness psychoeducation program. It was also important to ensure that the program was carried out in coordination with the activities in the classroom guidance program and structured in a way to support the achievements in the field of career development in the classroom guidance program. In the process of designing the program, we first tried to determine the needs of the students for career guidance. Then, the competencies (objectives and outcomes) that we want students to gain were identified. Then, it was determined in which content the determined competencies would be presented, which activities would be used in the presentation of the content and how to evaluate whether the goals were achieved or not.

Research Problem

The problem of the study is "What is the effect of SAC future readiness psychoeducation program on gifted students' career decision-making competencies and future expectations?" Depending on the problem of the study, answers to the following sub-problems searched:

- What is the distribution of difficulty levels according to the scores obtained after the Career Decision Making Difficulties Scale and Adolescent Future Expectations Scale were administered to gifted students as pre-test?
- What is the distribution of difficulty levels according to the scores obtained after the post-test of the Career Decision Difficulties Scale and Adolescent Future Expectations Scale administered to gifted students?
- Is there a significant difference between the mean scores of the scales applied before and after the experiment?
- What are the evaluations of the gifted student group about the program implemented?

Method

In this section, the research model is explained, the sample group participating in the study, the scales used in the study, the techniques of analyzing the data obtained and the application process are explained.

Research Model

This study designed with pretest-posttest one-group semi-experimental method. In the one-group pre-test and post-test model, an independent variable is applied to a group and measurement is made before and after the application. In the model, if there is a significant difference between the arithmetic mean of the pre-test and post-test scores of the group from the measurement tools, it is accepted that the application is effective (Balcı, 2004: 142).

Participants

This study was conducted in the spring semester of the 2022-2023 academic year with a total of 32 students, 18 girls and 14 boys, in the 7th grade level attending Kilis Science and Art Center. Since the most appropriate age group as the target group of the program content was seen as the 7th grade, the 7th grade level was selected in the study. The sample group was selected according to the purposeful sampling method. All participants involved all application sessions.

Data Collection Tool

Three different data collection tools (two scales and one form) were used to solve the problems addressed in the study. The first scale is CDDS, which was developed by Gati and Saka (2001) and adapted into Turkish by Bacanlı (2008). The Turkish form of the scale consists of 34 items. The items are scored on a 7-point Likert scale. Secondly, the "Adolescent Future Expectations Scale (FESA)" was used to predict the perceived effect of the career development program on the future expectations of gifted students. Developed by McWhirter and McWhirter (2008) (FESA-Future Expectations Scale for Adolescents) and adapted into Turkish by Tuncer (2011) in 2011, the "Adolescent Future Expectations Scale" consists of four subscales. "Work and Education" subscale consists of 11 items, "Marriage and Family" subscale consists of 7 items, "Religion and Society" subscale consists of 3 items and "Health and Life" subscale consists of 4 items. Cronbach's alpha coefficient of this four-factor structure was found to be 0.925 (Tuncer, 2011). The total score of the scale is obtained by summing all item scores in the scale and dividing by the total number of items. An increase in the scale score indicates an optimistic attitude about the future (Tuncer, 2011). Finally, the evaluation findings of the participants regarding the program process were collected with the program evaluation form developed by MoNE. This form was developed in 10-point scoring type. It also included a question asking for written evaluation opinions.

Data Analysis

In this study, in the analysis of the data obtained as a result of the application of the scales as pre-test and post-test, percentage, frequency, arithmetic mean, standard deviation values were found in accordance with the sub-objectives of the research. In addition, non-parametric statistics were applied since the data did not show normal distribution according to the one-sample Kolmogorov-Smirnov Test. Variance analyses of the participants' pre-test and post-test scores were calculated using the SPSS package program. Sub-themes were formed by content analysis of the opinions stated by the candidates in the evaluation form. In the content analysis method, similar data are brought together within the framework of certain concepts and themes and interpreted by organizing them in a way that the reader can

understand (Yıldırım & Şimşek, 2005). Within the sub-themes created, direct quotations from the views of the candidates without changing their meanings were made and presented to the reader as S1, S2...Sn

Intervention Process

The applications carried out in the research were carried out by the Kilis SAC guidance service and the researcher in a 4-week, 8-session process in the spring semester of the 2022-2023 academic year. The content determined for the competencies and outcomes of the SAC future readiness psychoeducation program was designed to be presented to students through activities. Within the scope of the program, a total of 8 activities were conducted with the participants.

Findings

Before analyzing the pre-test and post-test data obtained from the CDDS and FESA scales, the Kolmogrov-Smirnov (KS) test was applied to determine whether the data were normally distributed. Since $p<0.05$ in both scales, it was observed that the data did not show normal distribution. Since the data did not show normal distribution, Wilcoxon Signed Ranks Test was used for nonparametric dependent sample analysis.

Comparison of the experimental group's pre- and post-experimental CDDS scale scores

The table below shows the Wilcoxon Signed Rank Test results of the scores of the experimental group before and after the experiment on the CDDS for Grade 7.

Table 1. Wilcoxon Signed-Ranks test results of career decision difficulty scale scores before and after the experiment

Posttest-Pretest	n	Rank Mean	Rank Sum	Z	p
Negative Rank	29	12,60	378		
Positive Rank	3	2,60	5	2.87*	,00
Equal	0	-	-		

*Based on negative ranks

The results of the Wilcoxon Signed Ranks Test regarding whether the pre- and post-experiment scores of 7th grade gifted students showed a significant difference are given in Table 1. The results of the analysis show that there is a significant difference between the pre- and post-experiment scores of the students who participated in the career decision-making program on the career decision-making difficulties test, $z=2.87$, $p<.01$. When the rank means and sums of the difference scores are considered, it is seen that this difference is in favor of negative ranks, that is, the post-test. Because as the score obtained from the career decision-making difficulty test increases, the difficulty of the student increases. According to these results, the career education program had an effect on reducing the career decision-making difficulties of 7th grade gifted students.

Comparison of the Experimental Group's Pre- and Post-Experimental FESA Scale Scores

The following table shows the Wilcoxon Signed-Ranks Test results of the scores of the experimental group before and after the experiment.

Table 2. Wilcoxon Signed-Ranks test results of future expectations scale scores before and after the experiment

Posttest-Pretest	n	Rank Mean	Rank Sum	Z	p
Negative Rank	15	16,88	253,2		
Positive Rank	16	17,73	283,68	,43*	3,1
Equal	1	-	-		

*Based on negative ranks

The results of the Wilcoxon Signed Ranks Test regarding whether the students' future expectancy scores before and after the experiment showed a significant difference are given in Table 2. The results of the analysis showed that there was no significant difference between the pre- and post-experiment scores of the gifted students who participated in the career education program at SAC ($z=,43$, $p>.05$). When the rank averages and sums of the difference scores are considered, it is seen that this result, although not significant, is in favor of positive ranks, that is, the post-test. This is because as the score obtained from the FESA test increases, the student's future expectation increases positively. According to these results, it is seen that the career education program did not have a significant effect on the positive increase in the future expectations of the students.

The examination of the experimental group's CDDS and FESA scores according to gender variable

The Mann Whitney U-test results of the pre-test scores obtained from the CDDS and FESA scales according to gender groups are given below.

Table 3. U-test results of pre-test scores of CDDS and FESA scales by gender

	Gender	n	Rank Mean	Rank Sum	U	p
CDDS	Female	18	22,73	318,22	153,5	,01
	Male	14	17,32	311,76		
FESA	Female	18	20,16	362,88	158,4	,90
	Male	14	22,14	309,96		

*p<0.05

The Mann-Whitney U-test results of the total scores of gifted male and female students on the CDDS before the program are given in Table 3. Accordingly, it was found that the decision-making difficulties of female students before the program were significantly higher than male students, U=153,50, p<.05. This finding shows that the career indecision experienced by female students before the program was higher than male students.

According to the Mann-Whitney U-test results of the total scores of gifted male and female students on the FESA before the intervention, it was found that there was no significant difference between the future expectancy levels of male and female students before the experimental study, U=158,4, p>.05. This finding indicates that there was no significant difference between the gender groups in terms of future expectancy scores before the program. The comparison of the post-test scores of male and female students on the CDDS and the FESA post-test is given in Table 4.

Table 4. U-test results of the post-test scores of the CDDS and FESA according to gender

	Gender	n	Rank Mean	Rank Sum	U	p
CDDS	Female	18	13,32	239,76	101,5	2,61
	Male	14	13,13	183,82		
FESA	Female	18	28,26	508,68	217	2,32
	Male	14	29,01	406,14		

*p<0.05

The Mann-Whitney U-test results of the total scores of gifted male and female students on the CDDS after the program are given in Table 4. Accordingly, while the decision-making difficulties of female students were significantly higher than male students before the program, there was no significant difference after the program (U=101.50, p>.05). This finding reveals that the positive effect of the program was higher in reducing the career indecision experienced by female students before the program. As stated in the previous analyses, the program had a significant effect on both gender groups in reducing career decision-making difficulties, but it can be said that the effect on female students was higher.

According to the Mann-Whitney U-test results of the total scores of gifted male and female students on the FESA before the intervention, it was found that there was no significant difference between the perceived future expectancy levels of male and female students after the experimental study (U=217, p>.05). This finding reveals that the program had a similar effect on the future expectations of the gender groups.

Analyzing the evaluation form assessments of the experimental group

The activity evaluation form for each of the 8 different activities developed within the scope of the SAC Preparation for the Future Program was filled out by the students. Accordingly, students were asked to rate how they found the activity from one to ten and to report their opinions in writing. An average score of 6 out of 10 points was taken as the criterion for liking the activity. Rating averages are given in Table 5.

Table 5. Descriptive analysis results of program rating scores of events

	Events	$\bar{x}$	Median	Min.	Max.	Ss
1st Session	Career Self Assessment - DNA Tree	9,32	8,61	7,23	10	3,83
	Career Self Assessment – My Window	8,47	8,56	7,12	10	3,76
2nd Session	Awareness of Options-Career Path	7,83	7,4	5,81	10	4,02
	Awareness of Options-Awareness Stops	5,74	6,5	3,63	9,4	4,78
3rd Session	Awareness of Options - Step by Step to Tomorrow	7,91	8,41	7,12	9,7	3,1
	Awareness of Options-Career Festival	8,10	8,7	7,40	10	3,44
4th Session	Decision Making Competence - My Decision Cycle	8,40	8,27	6,54	10	3,67
	Decision Making Competence - Decisive Steps	8,32	8,25	6,49	10	3,69
	Program Overall	8,11	8,2	6,41	9,89	3,32

On average, students gave the highest average score to Activity 1, while the lowest average score was for Activity 4. On average, seven of the activities were above the "6" points accepted as the satisfaction criterion, while one activity was slightly below six points. When we look at the student opinions about the activities, it is seen that the students had a little more difficulty and boredom in the awareness stops activity and stated that it was too abstract.

Gifted students' opinions on SAC preparation for the future program

All of the students in the experimental group who participated in the program activities stated that they found the SAC Preparation for the Future Program useful. In particular, they stated that they gained sufficient information about the importance of the concept of career and its value for them and that the activities related to this subject should continue in an applied manner. Another issue that the majority of the students stated was that the program was too tight and they sometimes had difficulty in doing two separate activities in one session. They also stated that they could do the activities in a more detailed and applied way. Some excerpts from the opinions of the students in the experimental group are presented below.

> *"The psychoeducation program coincided with a period when I was very indecisive and it was very useful for me. We are going to the eighth grade and we are worried about our future. The program helped me to know my self-awareness and my options better. " S3*

> *"The program was conducted in the evening when we were mentally tired. Although we did the activities with fun, we had difficulty doing two activities in one lesson. It was rushed. Thanks to the student workbooks, we actively participated in the process. I would like these activities and the activities of recognizing-experiencing professions to continue at certain intervals in the following years. " S14*

Conclusion and Discussion

The aim of this study was to examine the effect of the "SAC Future Readiness Psychoeducation Program", which was prepared to increase the career and future awareness of gifted students receiving support education in SAC, on the career decision-making difficulties and future expectancy levels of the students. In the context of the target outcomes of the psychoeducation program, career indecision and future expectations were determined as dependent variables, and data were collected before and after the experiment with the CDDS and FESA scales, whose Turkish psychometric standardization had been previously performed. According to the findings of the study, the psychoeducation program was found to be effective in reducing the career decision-making difficulties of gifted students. When the results of the study are examined, it is observed that the career decision-making difficulties scale scores of the students who participated in the program decreased significantly after the experimental procedure compared to their career decision-making difficulties scores before participating in the program.

Considering these findings, it can be said that the program was effective in reducing the career decision-making difficulties of 7th grade gifted students. As Reese and Miller (2010) stated, there is a great need for intervention programs related to career studies in today's world where the importance of career studies is increasing day by day. Many studies that are effective in reducing career decision-making difficulties support the findings of this study. The effect of these programs on different age groups has been proven. In the studies conducted by Savickas (1990), Lam and Santos (2017),

Mitchell and Krumboltz (1987), it is seen that the programs prepared are effective in reducing career decision-making difficulties.

In addition to successful programs, there are also programs that are ineffective in reducing career decision-making difficulties. One of these is the program prepared by Gati, Ryzhik, and Vertsberger (2013). This program, which was prepared to reduce career decision-making difficulties, was implemented in an intensive manner in five days. The fact that this program was not effective showed that long-term programs are more useful in reducing career decision-making difficulties.

Since gifted students demonstrate their need to discover their interests at an early age, the career development process starts earlier than expected (Matthews & Foster, 2005). However, it is known that gifted students differ from their peers in terms of psychosocial development, cognitive development and learning needs (Reis & Renzulli, 2010). Therefore, it is important to conduct studies on the career development of gifted students. Guiding gifted students to discover their interests and aspirations positively affects their beliefs about the future (Emerich, 1992; Muratori & Smith, 2015). This study is the first study in terms of evaluating the effect of the program on career decision-making difficulties in gifted students. Aydoğdu (2022) examined the relationship between career decision-making difficulties and perfectionism characteristics of gifted students and found that career decision-making difficulties increased as negative perfectionism tendencies increased.

The fact that the decision-making difficulties experienced by gifted female students according to the pre-test results of the scale were significantly higher can be interpreted as a result of the fact that career and future anxiety is higher in gifted girls than boys. In support of these findings, Kerr (1988) indicates that gifted girls are more open to external influences in their career span and gifted girls have higher future concerns than gifted boys. Therefore Greene (2003) emphasized that gifted adolescent girls may have higher career imbalance, due to situations such as desiring to be perfect in every field, setting ideals that they cannot achieve or oppositely low expectations for their selves.

When the results of the study were examined, it was observed that the positive future expectations scale scores of the students who participated in the program increased significantly, after the experimental process compared to the scores they received before participating in the program. Tallent-Runnels and Yarbrough (1992) found that gifted children who participated in a future problem-solving program were more interested in the future than students who did not participate in this program.

Persson (2009) stated that gifted children enjoy pursuing a goal and thinking about the future. Oğurlu (2016) conducted a study with 65 gifted children and found that there is no hopelessness among gifted students in Turkey and that gifted adolescents have positive future expectations. According to the results of the research, it can be said that SAC Preparation for the Future psychoeducation program is useful in terms of achieving the target outcomes related to creating future awareness. When the related literature is examined, it is seen that there are many studies that support these findings.

When the participants' evaluation form assessment form and their opinions about the activities were examined, it was predominantly stated that the satisfaction with the program was high, the activities could be enriched for practice, and it would be more useful to spread the activities over a wider period of time and implement them as a single activity in each session.

When the results of this study were evaluated in general, it was seen that the SAC Future Readiness Psychoeducation Program prepared for gifted students was effective in reducing students' decision-making difficulties and increasing their future expectations positively. It was observed that gifted female students had higher career decision-making difficulties than male students, and there was no significant difference in terms of future expectations.

Recommendations

- In future research, the study can be conducted with a control group and with different samples. The effects of the program in terms of different variables can also be investigated.

- The differences between students with normal development and gifted students in terms of career ambivalence and future expectations can be examined comparatively.
- In future studies, its effectiveness in other grades and levels can be evaluated. A follow-up study can be conducted to observe the long-term benefits of the practices in which areas.

Limitations of Study

The study is limited to a single group of 32 seventh grade gifted middle school students and the intervention process. For this reason, a simple experimental design was used to determine the effectiveness of the support psychoeducation program and since there was no control group. The effect of the support education program in different SACs could not be compared**.**

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