



A Thematic Analysis of Theses Prepared on Mathematics Education with Gifted and Talented Students in Türkiye

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The aim of this research is to examine the postgraduate studies conducted in the field of mathematics education with individuals diagnosed as gifted and talented students in Türkiye. For this purpose, master's and doctoral studies in the database of the National Thesis Center of the Council of Higher Education [CHE] of Türkiye were examined. The first graduate thesis carried out in the field of mathematics education with gifted and talented students was carried out in 2009. In this context, the research includes 55 master's and doctoral studies from 2009 to 2020. In this study, in which the qualitative research approach was preferred, thematic content analysis (meta-synthesis) one of the content analysis types was used. The theses included in the scope of the study were examined under different headings such as year, type, subject, approach, research design, sample, data collection tool, and data analysis techniques. This research is important in terms of giving a general idea about the studies carried out in the field of gifted students and mathematics education, providing information pertaining to the relevant literature for the studies to be carried out, helping expand the field with studies with more different content by determining the subjects and scopes that have not been researched in the field, and giving inspiration related to different research ideas that will contribute to the literature.

Introduction

Intelligence is one of the most researched subjects in psychology and educational science. However, in the literature, there is no consensus on the definition of intelligence, and therefore, scientists have developed different theories and definitions of intelligence throughout the history (Gardner, 1993; Sternberg & Grigorenko, 2000). Sir Francis Galton, the owner of the work titled "Hereditary Genius", which is accepted as a beginning in the field of gifted people, expressed the question of whether intelligence is hereditary or environmental in 1869, and suggested that intelligence may be hereditary, and developed the

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“Consistency of Intelligence Theory” (Sternberg, 2000). In 1904, Spearman addressed intelligence in two structures as general and special mental abilities, which is affected by all kinds of mental activities, and introduced the General Theory of Intelligence, called the "two-factor theory", to the scientific world (Sak, 2008). Alfred Binet, on the other hand, drew attention to environmental stimuli and stated that the structure of intelligence can be revealed by studying complex mental functions. In 1905, Binet developed the Binet-Simon Intelligence test, which is accepted as the father of modern intelligence tests, with a study he carried out to identify students who were at a low level in learning within the scope of the education policies of the French government (Gardner, 1993). Lewis Terman, who was very impressed by Binet's work, revised the test developed by Binet by using the concept of IQ formulated by William Stern and developed the intelligence test known as the Stanford-Binet Intelligence Test (Terman, 1916). Thurstone (1931) gathered intelligence under seven factors, which he called basic mental abilities, with the statement “intelligence is not a single but a multiple structure” and suggested the Theory of Primary Mental Abilities (Sak, 2008). Raymond Cattell (1963), who suggested the theory of Fluent Intelligence and Crystallized Intelligence, named the biological component of intelligence transferred by heredity as fluid intelligence and the physiological component formed by experience as crystallized intelligence (Sak, 2012). In 1990, Gardner addressed intelligence with a holistic perspective that included the mind, body, and emotion components, and expressed the abilities and potentials of each individual in eight intelligence areas and suggested the Theory of Multiple Intelligences (Gardner, 1980).

In scientific field studies for the explanation of intelligence, in addition to gifted individuals with high-level skills, attention was drawn to individuals with special abilities, and a gifted individual was defined as a gift of God (Reis & Callahan, 1989). While superior mind is defined as individuals who consistently score 130 and above on various scales observed at high levels of cognitive, affective, psychomotor, and neural communication; gifted is the name given to superior individuals who have special abilities in fields such as fine arts, mathematics, and technique, and who have more specific skills than their peers with scores of 120 and above in measurements (Treffinger & Renzulli, 1986). Since the concept of gifted is affected by the social structure, the society in which the individuals live shapes the structure of this concept (Callahan, 2005).

Renzulli (1985), who has made important studies in the field of gifted individuals, defines gifted people as individuals who can use the interaction of talent, creativity, and motivation together. According to the American National Association for Gifted Children, a gifted individual was defined as a leader and creative individual who has special talents in the academic sense and general talents in the intellectual sense, who perform at a high level in areas such as visual art practices, and who use this potential to contribute positively to their country (VanTassel-Baska, 2007). According to the directive of the Science and Art Center (Bilim ve Sanat Merkezi, [BİLSEM]), which is managed by the Ministry of National Education (Milli Eğitim Bakanlığı, [MEB]) in Türkiye and provides education to gifted individuals, gifted people “defined as individuals who learn faster than their peers; who are ahead in creativity, art, and leadership capacity; have special academic abilities; can understand abstract ideas; like to act independently in their interests; and perform at a high level (T.R. Ministry of National Education Board of Education and Discipline [MEB], 2019).

When the literature is examined, gifted individuals, who make up 2% of the societies they live in, appear as human resources that are effective in the development and progress of countries by adding value to the societies in which they exist. In this respect, the education of gifted



individuals gains importance in terms of the fate of societies. For this reason, from past to present, countries use different education and training methods to identify talented individuals and then reveal their potential (Altun, 2015). There are different education systems that vary from country to country, such as schools for the gifted and talented students where curriculum for the skills of talented individuals are applied, enriched classroom programs in normal education institutions to keep them in touch with their peers, or out-of-school education programs (Ataman, Dağlıoğlu, & Şahin, 2014).

In Türkiye, very important steps have been taken from the past to the present regarding the education of gifted and talented individuals. The education process, which started with the application of homogeneous talent groups in 1959, continued with the establishment of Ankara Science High School (Ankara Fen Lisesi) in 1964, and the sending of talented individuals abroad in the fields of academic and art. In 2002, Beyazıt Ford-Otosan Primary School, the only official school offering special education opportunities for talented students, began to provide education within the scope of the Education of the Gifted and Talented Project carried out by the Hasan Ali Yücel Education Faculty of Istanbul University. The foundation of social sciences, fine arts and sports high schools by the Ministry of National Education is actually a continuation of this process. The General Directorate of Special Education and Guidance Services of the Ministry of National Education (Milli Eğitim Bakanlığı Özel Eğitim ve Rehberlik Hizmetleri Genel Müdürlüğü) continued to work on this issue and eventually founded the BİLSEM. Founded for the first time in 1995, BİLSEMs offer additional out-of-school education opportunities to selected students who continue to receive education in schools (Ataman, 2004; Çitil, 2018; Özer, 2020; Sak, 2020).

BİLSEMs are educational institutions affiliated to the General Directorate of Special Education and Guidance Services, which were opened to ensure that students who are diagnosed as talented in the fields of general mental ability, visual arts, and music are aware of their individual talents and use their capacities at the highest level while they continue their education in primary, middle, and high schools (MEB, 2018). BİLSEMs have been expanded in 81 provinces and there are still 182 BİLSEMs in service in Türkiye (Özer, 2021).

BİLSEMs are educational institutions that were opened to ensure that talented students (visual arts, music, and general mental ability) at the age of pre-school, primary, middle, and high school are aware of their individual talents and use their capacities at the highest level without disrupting their education in formal education institutions. BİLSEMs offer a differentiated education program beyond the education given in normal schools so that talented students can understand their own potential and contribute to themselves and the society (Ataman et al., 2014; Kurnaz & Ekici, 2020).

The diagnosis process for BİLSEMs begins with the registration of students who are considered to be highly different from their peers in general and special abilities, via the e-School Management Information System. The determined students are firstly taken into the group screening application, which is applied with tablet computers throughout the country. Then, the Anadolu-Sak Intelligence Scale (ASIS) and the Wechsler Nonverbal Scale of Ability (WNV) are applied to successful students by taking individual assessments according to their talent areas. Students who score above a certain threshold score as a result of the intelligence test applied in the field of general mental ability are entitled to be placed in BİLSEM. Evaluations of students who are put into practice in the field of visual arts and music talent are made by forming talent/skill commissions in the relevant field (Sak, 2020).

General framework curriculum and workshops regarding 19 branches such as Elementary Mathematics, High School Mathematics, Science, Physics, Chemistry, Biology, Turkish, Turkish Language and Literature, Philosophy, Geography, History, Music, Visual Arts, English, Social Sciences, pre-service Classroom Teacher, Information Technologies, Technology Design, and Guidance are implemented. Students who register to BİLSEM at the end of the diagnosis process are admitted to training programs such as the Integration Program, Support Education Program, Individual Talent Recognition Program, Special Talent Development Program, and Project Production and Management Program. These programs ensure that students realize their talents and receive training to develop these talents (Çamdeviren, 2014).

Russian psychologist Krutetskii (1976), who works on the diagnosis of gifted and talented students in mathematics, describes talented individuals in mathematics as special individuals who have a different mental structure from their peers, perceive the world with a mathematical perspective, and analyze the nature of mathematics and reconstruct it in different forms. The mathematics education of talented individuals who can think analytically, creatively, fluently, and flexibly in the field of mathematics, have high motivation, can make logical reasoning, have high reasoning and predictive power, develop original solution methods in the face of problems, and have spatial perception and intuitive power skills is important to improve their abilities (Chang, 1984; Goldberg, 2008; Miller 1990; Özyaprak, 2016; Sheffield, 2018; Wagner & Zimmermann, 1986; Young & Worrell, 2018).

Özdemir (2017) stated that the plans and programming of students who have special abilities in the field of mathematics should have a differentiated education and training quality that can meet their individual characteristics and needs. Differentiated instruction, which emerges at this stage, is the organization of educational experiences of individuals with different characteristics according to their learning styles to meet their learning needs (Kaplan, 2009), on the basis of their interests and academic readiness (Tomlinson, 2001). The purpose of differentiated instruction is to ensure that their academic potential is revealed at a high level by designing an appropriate education program with different content, processes, and products specific to individuals (Marsh, 2009; Powers, 2008). Differentiation in the education of gifted and talented individuals is made by studying broadly and in-depth in different subject areas (enrichment), progressing faster and at a higher level (acceleration), bringing together talented individuals with the same performance and ability levels (grouping), and using educational strategies in the light of the guidance with support of a counselor (mentoring) (VanTassel-Baska, 2000).

In this case, the importance of preparing personalized learning settings by the instructors who design the mathematics education process for individuals with different special abilities comes to the fore. For this, many scientific sources should be screened, the structure and content of the studies carried out in this field should be examined, and information should be obtained about the process (Dede, Doğan & Aslan Tutak, 2020). In this context, educators working in the field should explore the existing studies and consider the process holistically and plan the learning environments and activities in a multi-dimensional way in order to maximize the potential of the students (Karaduman & Davaslıgil, 2019). In the 21st century, where producing and owning knowledge makes a difference, determining the current situation by conducting studies in terms of various variables regarding the educating of gifted and talented students with different potentials and contributing to the process by making possible suggestions are important. In this respect, it is important to determine the subjects and scopes



of research in the field by examining the studies in the literature for gifted and talented individuals.

The Purpose and the Importance of the Research

This research was carried out in Türkiye in the field of mathematics education and for individuals diagnosed as talented, and examining postgraduate studies thematically was aimed. In this context, in the research, it is considered important to give a general idea about the studies in the field of mathematics education with gifted and talented students, to provide literature support for the studies to be carried out, to expand the subject area with studies with different content by determining the subjects and scopes that have not been researched in the field, and to reveal different research that will contribute to the literature. Within the scope of the purpose, the theses carried out at the relevant master's and doctorate level were examined in terms of different variables such as year, type, subject, approach, research design, sample, data collection tool, and data analysis techniques.

The Research Problem

The problem statement of the research is "What are the trends observed when the research on mathematics education of gifted and talented students in Türkiye are examined in various dimensions?" The sub-problems of the research to be answered in line with the purpose of the study were determined as follows:

How is the distribution of theses prepared in the field of mathematics education with gifted and talented students according to:

- (1) The types?
- (2) The years in terms of types?
- (3) The subjects?
- (4) The sample types and sample sizes?
- (5) The research approaches?
- (6) The research designs?
- (7) The data collection tools they used?
- (8) The data analysis techniques they used?

Method

Under the method title of the research, information is given about the research design, universe and sample, data collection process, and data analysis.

The Research Design

In this study, in which the qualitative research approach was preferred, thematic content analysis (meta-synthesis) that is one of the content analysis types was used. Thematic content analysis includes organizing the studies into themes or main templates, synthesizing and interpreting the data, and comparing similar or different aspects in the results. The purpose of this method is to provide a quality information to researchers from its source by a general evaluation of the research in the field (Çalik & Sözbilir, 2014).

The Universe and Sample

The universe of the study is the graduate theses that were conducted in the field of mathematics education with the gifted and talented students identified in Türkiye and published in the database of the National Thesis Center of the Council of Higher Education. In the literature, the studies in this field began to be carried out in 2009. Since theses prepared in 2021 continue to be uploaded to the system, theses prepared until 2021 were included in the study. For this reason, the sample group of the research consists of a total of 55 theses (34 master's and 21 doctoral) from 2009 to 2020, which can be accessed from the National Thesis Center of the Council of Higher Education.

Data Collection Process and Data Analysis

In order to determine the theses to be examined in the research, the database of National Thesis Center of the Council of Higher Education [CHE] was screened. While screening, the keywords "BİLSEM", "Üstün zekâlı (gifted)", "Üstün yetenekliler (highly talented)", "Özel yetenekliler (talented)" and "Matematik öğretimi (mathematics education)" were searched in Turkish. The CHE database was first screened on 17.06.2021 and finally on 23.06.2021 and a total of 55 theses were reached and the studies to be included in the research were determined.

In the studies reached in line with the purpose of the research, thematic analysis was carried out over the themes such as year, type, subject, approach, research design, sample, data collection tool, and data analysis techniques. Grouped data are expressed in terms of frequency and percentage and presented in tables.

Findings

In this part of the research, the distribution of the theses prepared on mathematics education with gifted and talented students according to type and year, subject, sample type and sample size, research approach, research design, data collection tools, and data analysis techniques are presented in tables.

Distribution of Theses by Types

Table 1 shows the distribution of the theses prepared on mathematics education with gifted and talented students according to their types.

Table 1. Distribution of theses prepared on mathematics education with gifted and talented students according to their types

Type of The Theses	f	%
Master's	34	62
Doctoral	21	38
Total	55	100

In Table 1, 34 of the 55 theses (62%) conducted in the field are in the type of master's thesis and 21 of them (38%) are in the type of doctoral thesis.

Distribution of Theses by Years in Terms of Types

The distribution of the theses prepared on mathematics education with gifted and talented students according to their years in terms of types is given in Table 2.



Table 2. Distribution of theses prepared on mathematics education with gifted and talented students according to their years in terms of types

Type of The Theses	Master's		Doctoral		Total	
Year of Theses	f	%	f	%	f	%
2020	4	11.76	0	0	4	7.27
2019	7	20.58	2	9.52	9	16.36
2018	4	11.76	2	9.52	6	10.90
2017	3	8.82	2	9.52	5	9.09
2016	1	2.94	2	9.52	3	5.45
2015	3	8.82	0	0	3	5.45
2014	3	8.82	6	28.57	9	16.36
2013	3	8.82	1	4.76	4	7.27
2012	2	5.88	5	23.81	7	12.72
2011	2	5.88	0	0	2	3.63
2010	1	2.94	1	4.76	2	3.63
2009	1	2.94	0	0	1	1.18
Total	34	100	21	100	55	100

In Table 2, the theses were prepared more than other years with a value of 16.36% in 2014 and 2019 and prepared less than other years with a value of 1.18% in 2009. Regarding the doctoral studies conducted in the subject area, more theses were published in 2014 with a value of 28.57% than in other years. No doctoral studies were found in 2009, 2011, 2015, and 2020. Regarding the master's studies conducted in the subject area, more theses were published in 2019 with a value of 20.58% than in other years. In 2009, 2010 and 2016, the master's studies conducted in the subject area were less than the other years with a value of 2.94%.

Distribution of Theses by Subjects

The distribution of the theses prepared on mathematics education with gifted and talented students according to their subjects is given in Table 3.

Table 3. Distribution of the theses prepared on mathematics education with gifted and talented students according to their subjects

Subject of Theses	f	%	Author(s)
Examining high-level thinking skills (metacognitive awareness, proportional reasoning, mathematical abstraction, Mathematical proof, mathematical ability, critical thinking, creative thinking, productivity)	13	23.64	Şimşekler (2017); Yavuz Açıł (2018); Taşkın (2016); Akgül (2014); Alkan (2014); Ayvaz (2014); Nemutlu İnanır (2019); Karaaslan (2019); Yurtkulu (2018); Kirişçi (2013); Kaygın (2012); Dinamit (2020); Altıntaş (2009)
Problem solving processes and skills	12	21.82	Dervişoğlu (2019); Öztelli Ünal (2019); Karabulut (2018); Boran (2016); Koçyiğit (2015); Durmaz (2014); Aydoğdu (2014); Yazgan Sağ (2012); Sezerel (2012); Sıdar (2011); Karabey (2010); Akkaş (2014)
Problem posing processes	3	5.45	Yılmaz (2019); Ayvaz (2019); Arıkan (2014)
Differentiated mathematics teaching	5	9.09	Özçelik (2017); Özdemir (2016); Altıntaş (2014); Karataş (2013); Özyaprak (2012)

Differentiated geometry teaching	2	3.64	Kök (2012); Karaduman (2012)
Gifted students and teachers' views on mathematics curriculum, mathematics activities, and mathematics teachers	5	9.09	Türk (2019); Saka Kılıç (2020); Aygün (2010); Susam (2012); Güler (2013)
Comparison of talented and non-talented individuals (self-regulated learning, motivational belief, mathematical anxiety, Number Sense)	4	7.27	Gürel (2011); Aksoy (2014); Dayan (2017); Tunalı (2018)
Attitudes towards mathematics and self-efficacy perceptions	2	3.64	Kocaoğlu (2020); Hızlı (2013)
Mathematics-based STEM activities	2	3.64	Külegen (2020); Akay (2018)
Spatial thinking skills of gifted students	2	3.64	Harput (2019); Sağır Gürlevik (2017)
Computer supported mathematics teaching and computational thinking skills	2	3.64	Taş (2018); Aydos (2015)
Use of concrete materials in mathematics teaching	1	1.82	Arikan (2019)
Mathematical modeling	1	1.82	Şengil Akar (2017)
Metaphorical perceptions of the concept of mathematics	1	1.82	Satmaz (2015)
Total	55	100	

In Table 3, the subjects of the theses conducted in the field are mostly related to examining high-level thinking skills of talented individuals with 13 studies and problem solving processes and skills with 12 studies. The gifted and talented individuals have different characteristics from their peers in terms of high-level thinking skills, and the realization of studies from different perspectives on this subject constitutes an important source of information for the literature. Considering other topics, the number of studies such as differentiated mathematics teaching, STEM and modeling is low.

Distribution of Theses by Sample Types and Sample Sizes

The distribution of the theses prepared on mathematics education with gifted and talented students according to their sample types is presented in Table 4.

Table 4. Distribution of the theses prepared on mathematics education with gifted and talented students according to their sample types

Sample Type of Theses	f	%
Primary school	24	31,16
Middle school	38	49,35
High school	11	14,28
Student, Teacher, Expert	4	5,19
Total	77	100

In Table 4, 24 of the theses carried out in the field used primary school students (31.16%), 38 of them used middle school students (49.35%), 11 of them used high school students (14.28%), and 4 of them mixed students, teachers, and experts (5.19%) as the sample groups. The reason why the total number of sample type differs from the total number of theses is due to the fact that two different sample groups were used in some studies. The theses were mostly conducted with middle school students, followed by the theses with primary school students and high school students. It is noteworthy that few studies were conducted with high school students and mixed sample groups of students, teachers, and experts.

The distribution of the theses prepared on mathematics education with gifted and talented students according to their sample sizes is presented in Table 5.



Table 5. Distribution of the theses prepared on mathematics education with gifted and talented students according to their sample sizes

Sample Size of Theses	f	%
0-25	21	38,18
26-50	6	10,9
51-100	3	5,45
101-150	6	10,9
151-200	4	7,27
201-250	3	5,45
251-300	3	5,45
301 and above	9	16,36
Total	55	100

According to Table 5, the sample size of most of the theses was 0-25 people. In addition, some theses were carried out with groups with a sample size of 301 and above.

Distribution of Theses by Approaches

The distribution of the theses prepared on mathematics education with gifted and talented students according to their approaches is presented in Table 6.

Table 6. Distribution of the theses prepared on mathematics education with gifted and talented students according to their approaches

Approaches of Theses	f	%
Qualitative Approach	15	27.27
Quantitative Approach	29	52.73
Mixed Method Approach	11	20
Total	55	100

In Table 6, 15 of the 55 theses carried out since 2009 were conducted with a qualitative approach (27.27%), 29 with a quantitative approach (52.72%), and 11 with a mixed method approach (20%). In this context, studies conducted with the quantitative research approach have a higher rate than the qualitative approach and the mixed method approach.

The distribution of the theses prepared on mathematics education with gifted and talented students according to their approaches in terms of years is presented in Table 7.

Table 7. Distribution of the theses prepared on mathematics education with gifted and talented students according to their approaches in terms of years

Year of theses	Qualitative Approach		Quantitative Approach		Mixed Method Approach		Total
	f	%	f	%	f	%	
2020	3	20	0	0	1	9.09	4
2019	5	33.33	2	6.89	2	18.18	9
2018	1	6.66	2	6.89	3	27.27	6
2017	1	6.66	3	10.34	1	9.09	5
2016	2	13.33	1	3.44	0	0	3
2015	2	13.33	1	3.44	0	0	3
2014	0	0	7	24.13	3	27.27	10
2013	0	0	3	10.34	0	0	3
2012	0	0	6	20.68	1	9.09	7
2011	0	0	2	6.89	0	0	2
2010	1	6.66	1	3.44	0	0	2
2009	0	0	1	3.44	0	0	1
Total	15	100	29	100	11	100	55

In Table 7, the number of theses carried out with a qualitative research approach in 2019 were more than other years with a value of 33.33% and qualitative studies were not conducted in 2009, 2011, 2012, 2013, and 2014. The number of theses carried out with a quantitative research approach in 2014 were more than other years with a value of 24.13% and it is less than other years with a value of 3.44% in 2009, 2010, 2015, and 2016, and there is no quantitative study in 2020. The number of theses carried out with a mixed method research approach in 2014 and 2018 were more than other years with a value of 27.27% and there is no mixed method study in 2009, 2010, 2011, 2013, 2015, and 2016.

Distribution of Theses by Research Design

The distribution of the theses prepared on mathematics education with gifted and talented students according to their research designs is presented in Table 8.

Table 8. Distribution of the theses prepared on mathematics education with gifted and talented students according to their research designs

Research Designs of Theses	f	%
Qualitative Research Design	Case study	12 21.81
	Action research	1 1.82
	Phenomenology	2 3.63
	Sub Total	15 27.27
Quantitative Research Design	Experimental research	9 16.36
	Relational screening	13 23.63
	Cross-sectional study	2 3.63
	Design based research	1 1.18
	Screening model	4 7.27
	Sub Total	29 52.72
Mixed Method Research Design	Convergent parallel design	2 3.63
	Explanatory sequential design	7 12.72
	Exploratory sequential design	2 3.63
	Sub total	11 20
	Total	55 100

According to Table 8, out of 55 theses conducted in the field, 13 (23.63%) used relational screening, 12 (21.81%) used case study, and 9 (16.36%) experimental research designs. Relational screening and experimental research among the quantitative research designs were mainly used in the theses, while case study among qualitative research designs and explanatory sequential design among mixed method research designs were used in the theses. This shows that the theses are progressing in a certain trend, and most theses follow the same path in terms of method and design.

Distribution of Theses by Data Collection Tools

The distribution of the theses prepared on mathematics education with gifted and talented students according to their data collection tools is presented in Table 9.



Table 9. Distribution of the theses prepared on mathematics education with gifted and talented students according to their data collection tools

Data Collection Tools	f	%
Personal information forms	17	8.76
Student logs	6	3.09
Interview/Interview forms	21	10.82
Focus group interviews	3	1.55
Observation/Observation forms/Observation charts	11	5.67
Self-evaluation forms	4	2.06
Video/ Audio Records	9	4.64
Rubrics	8	4.12
Mathematics attitude scales	10	5.15
Anxiety scales	2	1.03
Problem solving scales	10	5.15
Critical thinking scales	6	3.09
Self-efficacy scales	4	2.06
Metacognitive awareness scales	5	2.58
Mathematical creativity scales	7	3.61
Academic Self-Concept Scale	3	1.55
Other scales	5	2.58
Achievement tests	11	5.67
Problem posing/solving tests	8	4.12
Creative thinking tests	10	5.15
Raven standard progressive matrices test	2	1.03
Geometry tests	8	4.12
Mathematics aptitude tests	4	2.06
Intelligence tests	8	4.12
Other Tests	3	1.55
Metaphor questionnaire form	2	1.03
Worksheets-Teaching Materials	7	3.61
Total	194	100

In Table 9, many different data collection tools were used in the theses conducted in the field. Since more than one data collection tool was used in some studies, frequency and percentage results should be interpreted accordingly. When the data collection tools used were examined, data were collected mostly with the interview forms (10.82%). In addition, personal information forms (8.76%), achievement tests (5.67%), observation forms (5.67%), mathematics attitude scales (5.15%), critical thinking scales (5.15%), problem solving scales (5.15%), and creative thinking tests (5.15%) were the other frequently used data collection tools.

Distribution of Theses by Data Analysis Techniques

The distribution of the theses prepared on mathematics education with gifted and talented students according to their data analysis techniques is presented in Table 10.

Table 10. Distribution of the theses prepared on mathematics education with gifted and talented students according to their data analysis techniques

Data Analysis Techniques	f	%
t-test	19	17.43
Content analysis	16	14.68
Mann-Whitney U test	15	13.76
ANOVA	13	11.93
Wilcoxon signed-rank test	12	11.01
Descriptive analysis	10	9.17
Kruskal Wallis test	5	4.59
Pearson product of moments	5	4.59
Chi-square test	3	2.75
Multivariate linear regression analysis	2	1.83
Structural equation modeling (SEM) Path analysis	2	1.83
Constant comparative analysis	2	1.83
Inductive content analysis	1	0.92
Internal case and cross case analysis	1	0.92
Spearman-Brown rank-order correlation	1	0.92
AMOS	1	0.92
MANOVA	1	0.92
Total	109	100

In Table 10, different analysis techniques were used in the analysis of the data because different data collection tools were used in the theses conducted in the field. Since some studies used more than one data analysis techniques, frequency and percentage results should be interpreted accordingly. Considering the data analysis techniques used, the qualitative data analysis techniques mainly included content analysis (14.68%) and descriptive analysis (9.17%), while t-test (17.43%), Mann-Whitney U test (13.76%), ANOVA (11.93%) and Wilcoxon signed-rank test (11.01%) among the quantitative data analysis techniques were used.

Discussion and Conclusion

In this study, which was carried out to examine the theses conducted on mathematics education in terms of various variables with the gifted and talented students diagnosed in Türkiye and to guide the researchers who plan to conduct research in this field, a total of 55 theses were reached. In this part of the research, discussion and conclusion are given based on the findings obtained regarding the theses examined.

Within the scope of this research, when the theses published in the National Thesis Center of the Council of Higher Education in the field of mathematics education with gifted and talented students were examined, researchers determined that a thesis study was carried out in 2009 for the first time. As a conclusion, the number of theses prepared in the following years increased and the most studies were prepared in 2014 and the least in 2009. The increase in the number of studies conducted in recent years supports the need of research in this field.

The theses examined in the research mainly consist of master's theses. Considering that master's theses are carried out to specialize in the relevant field, and doctoral theses are carried out to contribute to qualified knowledge and the literature in the field, the studies conducted in our country were not concentrated enough to make a difference in the mathematics education literature for gifted and talented students. Güçin and Oruç (2015), who examined the academic research in the field of gifted and talented students, pointed out the importance of qualified studies that will contribute to the field by stating that doctoral theses



are few in number in their study.

When the theses conducted on mathematics education for gifted students are evaluated in terms of subject variable, researchers found that they were grouped under 14 different subjects. As a result of the examinations, the content of the studied subjects focuses on high-level thinking skills and problem-solving skills. In field studies, to develop the skills of talented individuals and to make them gain new competencies, the realization of studies on subjects such as computational thinking, proportional reasoning, abstraction, creativity, technology integration in education, STEM activities with a focus on mathematics applications, development of sample activities, and instructional designs will be beneficial for both in-service teachers and talented students who are the focus of the process. In the research conducted by Nacar (2017) in the field of mathematics education of the gifted, researcher emphasized that the studies in mathematics education are concentrated on some certain subjects and the importance of diversifying studies in different subjects in order to contribute to the field.

When the distribution of the theses conducted on mathematics education with gifted and talented students according to the approaches is examined, researchers revealed that the quantitative approach has a higher rate than the qualitative approach and the mixed method approach. Considering the number of study groups in BİLSEM, giving more space to qualitative studies in order to have in-depth information on the researched subject will contribute to the field (Çiltaş, Güler, & Sözbilir, 2012).

When the studies carried out in the related field are examined according to the research design, in most of the quantitative studies, relational screening and experimental research design was used; while the case study design was mainly used in qualitative studies and the explanatory sequential design was used in mixed method studies. This shows that the studies are progressing in a certain trend, and most studies follow the same path in terms of method and design. Considering that the main purpose of graduate studies is to use original subjects, methods and designs, it can be said that the studies conducted in the field of mathematics education talented students do not vary in method and design dimensions. In order to make a difference in the education of talented students, especially by including experimental studies and innovative techniques and methods based on different education models, studies can be carried out, the results can be compared with each other, and suggestions for implementation can be presented. In this context, Demiroğlu, Şahin, and Dilek (2013) drew attention to the importance of including experimental studies on the education of gifted and talented students in their research.

When the thesis studies conducted were examined in terms of sample type, researchers determined that they were generally carried out with middle school and primary school students, and very few studies were carried out with high school students. When the distribution of theses according to the sample sizes applied, most of the studies were carried out with sample groups between 0-25 people. Considering that quantitative design studies are predominant in the research methods as identified previously, the numerical multiplicity of the studies conducted with a small number of samples draws attention. In the research on gifted education in Türkiye conducted by Ateş and Mazi (2017), attention was drawn to the diversity of the sample type and the importance of working with equal sample types at high school, middle school, and primary education levels was emphasized in order to develop a holistic viewpoint of the field instead of focusing on a single group.

When the distribution of the theses covered in the research according to the data collection tools was examined, researchers concluded that the most qualitative data were collected through interview/interview forms and observations. In the qualitative data collection tools used, the problem-solving scales and achievement tests were among the data collection tools used. The other data tools were mostly foreign-sourced measurement tools adapted to Turkish. Since the concept of being talented is affected by the social structure and the definition of being gifted varies in terms of structure and content according to different countries and nations, it is important for the reliability of the research that the measurement tools applied to these individuals have a national structure. In the study of Ayvacı and Bebek (2019) examining the theses conducted on the subject of special talents in Türkiye, researchers determined that the majority of the scales applied were translated from foreign sources and adapted to Turkish, and it was noted that measurement tool development studies for the field should be carried out. Also in this study, since different data collection tools were used in the theses conducted in the field, researchers concluded that different analysis techniques were used in the analysis of the data.

Suggestions

In line with the results of the study, some suggestions were presented to the researchers who are considering doing studies on mathematics education for gifted and talented individuals.

In this research, graduate theses in the database of the National Thesis Center of the Council of Higher Education [CHE] were determined as the sample group. In order to expand the content and scope of the study, articles in the field of mathematics education for talented students and in the relevant national databases can be accessed and included in the study. In addition, the data obtained in different countries can be compared with each other by accessing international graduate theses and related articles in the field. Thus, by evaluating the application examples and results in different countries, the data obtained in the mathematics education activities and programs for gifted and talented students can be used functionally.

It is inevitable that studies in different types, subjects, content, and methods for the education of gifted and talented students will support the relevant field and create a rich literature. Academic field studies that support the increase in the number of graduate theses in which the related components of the curriculum designs and practices such as education strategies and instructional designs for the talented students are handled together should be given more attention.

In the distribution of the theses conducted according to the subjects, 55 studies were carried out under 14 different headings. While most studies were concentrated on certain subjects, a small number of studies were carried out in other subjects. Studies to be carried out as multidimensional, with different perspectives, and on different subjects for talented individuals, each of whom has different special talents, will enrich the relevant field. Particularly, giving more space to scientific research in the subjects such as modeling and STEM studies, where mathematics education is organized by the interaction of different disciplines and alternative solutions are sought to real life problems, will reveal talented students' potential strengths, and contribute their skill development.

It is important to develop an educational model in the field of mathematics education for talented individuals by considering the process holistically and to determine what kind of



changes this model will cause in individuals. For this reason, it is recommended to focus on different experimental studies that include instructional designs in which there are relationships between high-level thinking skills of gifted and talented individuals such as creativity, analytical thinking, analysis-synthesis and which are supported by various activities and practices.

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