Journal of Turkish Science Education, 2022, *19*(4), 1037-1071.
DOI no: 10.36681/tused.2022.162

A Thematic Content Analysis of Gifted and Talented Students in Science Education in Türkiye

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ABSTRACT

The aim of the study was to comprehensively examine the theses studies and articles in the field of gifted and talented education in Türkiye between the years 2018-2021. Thematic content analysis was applied to a total of 37 articles and 28 theses studies according to criteria determined by the researchers. A total of 65 research were examined by considering the parameters of research types, university distributions, publication years, subject, aims, keywords used, research methods, samples (type and size), data collection tools, data analysis method, results and suggestions. Theses and articles were analyzed using matrix. The data gathered was analyzed using descriptive statistcs method and content analysis. The majorities of the studies examined were Master's theses and were designed with descriptive and mixed research methods. In the studies, STEM, module/programme/activity development, environmental education, problem-based learning and project-based learning were frequently encountered, and it was aimed to develop skills and affective areas in students in related subjects. It was observed that there was no consensus in the use of keywords in terms of the sample group in the studies examined. In line with all the findings, it is recommended to include values education in the activities, to carry out studies on problem-based learning, argumentation, environmental education and out-of-school learning environments. In addition, it is recommended to provide consensus on the use of sampling keywords (gifted, gifted and talented… et al.) in order to facilitate the searches of researchers.

RESEARCH ARTICLE

ARTICLE INFORMATION
Received:
02.09.2022
Accepted:
01.10.2022

KEYWORDS:
Gifted and talented students, Türkiye, thematic content analysis.

To cite this article: Bayar, V., & Çepni, S. (2022). A thematic content analysis of gifted and talented students in science education in Türkiye. *Journal of Turkish Science Education, 19*(4), 1037-1071.

Introduction

Each individual is special and the education of each individual is important for society. Every society wants to develop in the fields of science and art, to become stronger in the field of industry, and to improve the quality of life of its individuals, and believes that the way to realize all these is through the education of gifted individuals. (Küçük, Gökdere & Çepni, 2005; Choi, 2009; Pekdoğan & Bozgün, 2017; Han & Shim, 2019). In the Marland Report published in 1972, it was stated that the education system at the time was not adequate for the talent development of gifted individuals (Marland, 1972). Since the learning speed and style of each individual differ, the education required also differs. For this reason, more comprehensive education opportunities should be provided for gifted and talented individuals so that they can reveal their patricular talents (Renzulli & Reis, 2021). These opportunities to be provided should not be seen as an instance of special education. The education of the gifted is actually an instance of equal education (Sumida, 2017). Otherwise, when

such high-performing individuals are not given the opportunity to develop their potential, their talents will not be noticed and they may even become harmful individuals to society (Gökdere & Çepni, 2003a; Gökdere & Çepni, 2003b). Politicians and administrators have struggled with this issue throughout history, but as a result of the struggle, the education of gifted individuals in schools began decades ago (Lockhart et al., 2022). In Türkiye, a special upper class application was started in the 1960s, but it was not successful; the application came to the fore again in 1990, and talent development centers were established under the name of Science and Art Center (BİLSEM) in five cities in 1993 (Gökdere & Küçük, 2003; Küçük et al., 2005). As of the end of 2021, 225 BİLSEMs continue to provide services to gifted individuals within the Ministry of National Education. It is planned that this number will increase to 355 by the end of 2022 (MEB, 2022).

The field of gifted and talented research is a relatively new one that has become an interdisciplinary field that includes elements of other disciplines such as medicine, sociology, psychology and pedagogy (Hernández-Torrano & Kuzhabekova, 2020). Despite its short history, there is a rich data base in the education of gifted learners stems from content analysis studies (Hays, 1993). The literature analysis of the studies carried out for gifted individuals provides information about the quality of the database, disciplinary trends, and its future (Carter & Lee Swansons, 1990). A significant number of studies have examined the status of gifted education research using content analysis (Hernández-Torrano & Kuzhabekova, 2020). Outside of the Türkiye, literature review for gifted education carried out in the 80s '. These studies are listed in Table 1.

Table 1

Literature Review Studies in the Field of Gifted Education

Author(s) & Year	Years Studied	Database(s) or Journal(s) Reviewed
Rogers (1989)	1975- 1986	Educational Resources Information Center (ERIC)
Carter & Lee Swanson (1990)	1972-1988	ERIC , Social Science Citation Index (SSCI, Roeper Review and Journal for the Education of the Gifted (500 journal articles)
Hays (1993)	from the first issue to 1989	Gifted Child Quarterly, Roeper Review and the Journal of Gifted Education (1773 journal article)
Ziegler & Raul (2000)	1997-1998	Gifted Child Quarterly, Gifted Education International, High Ability Studies, Journal for the Education of the Gifted, and Roeper Review (90 articles)
Paul & Plucker (2004)	1995-2000	Journal for the Education of the Gifted, Roeper Review, and Gifted Child Quarterly (effect size of articles)
Friedman-Nimz, O'Brien & Frey (2005)	1965-2000	ERIC, PsychINFO, and Exceptional Children Educational Resources
Coleman, Guo & Dabbs (2007	1985-2003	Gifted Child Quarterly, Journal for the Education of the Gifted, Roeper Review, and Journal of Secondary Gifted Education (40 qualitative research articles)
Parker, Jordan, Kirk, Aspiranti & Bain (2010)	2001-2006	Gifted Child Quarterly, Journal for the Education of the Gifted, Journal of Secondary Gifted Education, and Roeper Review (506 articles)
Dai, Swanson & Cheng (2011)	1998-2010 (April)	PsycINFO database and targeted journals (1234 empirical studies)
Carman (2013)	1995-2010	ERIC, Academic Search Complete, Educational Research Complete, and PsycInfo (104 empirically based articles)
Hernández-Torrano & Kuzhabekova (2020)	1957-2017	Gifted Child Quarterly, Roeper Review, High Ability Studies, and Journal for the Education of the Gifted (5515 studies)

In Türkiye, literature review studies in the field of gifted education have started more recently. The literature review studies carried out in the field of education of the gifted in Türkiye are given in Table 2.

Table 2

Literature Review Studies in the Field of Gifted Education in Türkiye

Author(s) & Year	Years Studied	Database(s) or Journal(s) Reviewed	Parameter(s)
Özenç & Özenç (2013)	1995-2011	Council of Higher Education (CoHE) National Thesis Center (38 theses)	Year, type, gender of author, advisor title, city, institute, department, method, data collection tool, sample group
Güçin & Oruç (2015)	until 2014	CoHE National Thesis Center and ULAKBIM (1449 studies)	Research type, publication year, and subject
Schreglmann (2016)	2010-2015	CoHE National Thesis Center (46 theses)	Publication year, university and department, subject, research method, sample type, data collection tool, and data analysis method
Pekdoğan & Bozgün (2017)	2010- 2016	CoHE National Thesis Center (94 theses)	Year, subject, research model, universe and sample, data collection tools, statistical techniques, and content research model
Dönmez & İdin (2017)	2004-2016	CoHE National Thesis Center (22 thesis) and Dergipark and Google academic databases (11 articles)	Thesis parameters: University, institute, department, publication year, sample, research method, model/technique, title of thesis advisor, data collection tools, and key concepts Article parameters: Year, subject, sample, and method
Kadıoğlu Ateş & Mazı (2017)	2010-2016	CoHE National Thesis Center (113 theses)	Subject, purpose, and finding
Kırnık & Susam (2018)	1995-2018	CoHE National Thesis Center (130 theses)	Thesis type, university, publication year, subject, study group, research method, method used in sample selection, and data collection tools
Kardes, Akman & Yazıcı (2018)	1990-2016	CoHE National Thesis Center (128 theses)	Publication year, university and department, subject, research design, sample size, and data collection tools
Ayvacı & Bebek (2019)	2010-2017	CoHE National Thesis Center (154 theses)	Year, type, subject, approach, model, sample, data collection tool, and results

Uzunboylu, Ozcinar, Kolotushkin, Kalugina & Zulfugarzade (2019)	1990- 2019	Web of Science index (200 studies)	Publication year, research areas, published languages, published sources, author information, country, institution, document types
Sayim & Işık (2020)	1995- 2019	CoHE National Thesis Center (45 theses)	Publication year, type of thesis, research method, subject, university, advisor title, work permit status, and result
Ulger & Çepni (2020)	2008-2019	Education Full Text (Wilson), Education Research Complete, ERIC (EBSCO), Scopus, Web of Science, Science Direct, Elsevier, and Google Academy (72 articles)	Type of journal and year, aims, research methods, samples or participants, results and suggestions
Çelik Şahin (2021)	2000-2020	TUBITAK, ULAKBIM, Dergipark, CoHE National Thesis Center, and ERIC (9 theses and 21 articles)	Aims, sample, methodology, and results
Kaya, Mertol, Turhan, Araz & Uçar (2022)	2001-2021	CoHE National Thesis Center (31 theses)	Thesis type, publication year, purpose, sample, and finding

The fact that both graduate theses and articles in different indexes were not examined together to determine the trend in the field led to the emergence of the current study. This study is underpinned by the view that the studies in the field of giftedness should be synthesised by considering a wider range in terms of research type (articles and postgraduate theses). On the other hand, the majority of the studies carried out their analyses in general terms in line with parameters such as publication year, university, sample, and method. However, in order to determine the trends in the research, it is necessary to examine the studies using different parameters (such as purpose, keyword, data analysis method, results, and recommendations). In this respect, this study differs from other studies in that it performs analyses in line with the structured parameters due to the nature of thematic content analysis. In addition, since the majority of the studies in the literature cover the pre-2018 years and it is thought that the last 4 years contain up-to-date information in order to determine the trends in the field, the studies published between the years 2018-2021 were examined. This thematic content analysis study examines the studies on gifted students in the field of science education in Türkiye for which purposes, with which keywords, on which subjects, with which methods, with which samples, with which data collection tools and data analysis methods, what results were obtained, and it is an original study that reveals what suggestions have been made. This study, which examines and compares the studies on gifted students in the field of science education in Türkiye and is thought to provide a holistic view of the studies, will reduce the workload by provide researchers and programme developers the opportunity to find detailed and explanatory information about current studies and trends in the field in a single source. As Steenbergen-Hu, Makel and Olszewski-Kubilius (2016) emphasized, the field of gifted education needs more meta-analysis to improve research and practice. In this context, in this study, the master and doctoral theses in the CoHE National Thesis Center and articles in the Education Research Complete, ERIC (EBSCO), Science Direct, Scopus, and Springer indexes in the field of science education of gifted students in Türkiye between the years 2018-2021 were examined in terms of university, publication year, subject,

purpose, keyword, research methods, sample (type and size), data collection tools, data analysis methods, results, and recommendations were analyzed in line with the parameters. The research questions in the study are as follows:

1. What were the general features (research types, university, and publication year) distributions of studies in field of gifted and talented education in science education?
2. What were the content features (subjects, aims, keywords, methodology/design, sample, data collection tools, data analysis methods, results and suggestions) of studies in the field of gifted and talented education in science education?

Methods

In this study, the thematic content analysis method was used. Thematic content analysis provides in-depth information about studies by critically synthesizing the findings of studies on the same subject within the scope of themes or matrices (Çalık, Ünal, Coştu, & Karataş, 2008; Çalık & Sözbilir 2014; Çepni, 2021). Thematic content analysis assists researchers in identifying future popular topics and alerts them to potential pitfalls in their work; it guides decision makers in seeing the "big picture" (Çalık, Ayas ve Ebenezer, 2005; Çalık ve Sözbilir, 2014; Ogurlu, 2020). In the study, it was found appropriate to use the thematic content analysis method since the thesis and article studies in the field of gifted and talented were examined one by one and focused on determining the trends.

Data Collection

This study searched the CoHE National Thesis Center and international databases to go over the studies on gifted and talented students in science education in Türkiye. Firstly, Master's and doctoral theses related to gifted and talented students in science education that were registered in the CoHE National Thesis Center database from 2018 to 2021 were scanned. As a result of the scanning performed by using keywords, a total of 165 theses were reached. Theses whose subject area was not "education and training" and "science education" were not included in the study. Twenty Master's theses and eight doctoral theses were included. In order to reach the studies conducted in Türkiye and published in the international literature between 2018-2021, databases were looked for, respectively: Education Research Complete, ERIC (EBSCO), Science Direct, Scopus, and Springer. The keywords gifted, gifted education, and gifted and talented were used as key words in databases for article searches. After the scan was carried out using keywords in the relevant databases, the studies carried out in Türkiye were included in this study by looking at the author of the study, the university where it was carried out, and its sample. As a result of the scanning 37 articles were included in the study. In all, this study thematically dealt with a total of 65 studies (28 theses and 37 articles). Studies that were subjected to thematic content analysis are given in the references as (*).

The Criteria of Inclusion and Exclusion for Theses and Article

Years: The theses and articles had to be published between the years 2018-2021 inclusive.

Sample: Study subjects had to be selected from the borders of Türkiye.

Research Area: Theses and articles made for gifted students in the field of science education were included in the analysis. Studies in other fields were excluded.

Databases: Only the articles published in the journals in Education Research Complete, ERIC (EBSCO), Science Direct, Scopus, and Springer databases selected by the researchers and the thesis studies in the CoHE National Thesis Center were included in the study. Scopus, as it includes interdisciplinary studies and is the most widely used in the literature; Eric and Education Research Complete, as it includes comprehensive studies specific to education; since it contains detailed studies of many disciplines, Science Direct and Springer databases were searched.

Limitations of the Study

The studies examined were selected from the science education department and the special education department. Theses in other departments (such as Social Studies Education, Turkish language education, visual arts education) were not included in the study due to the concern of not being able to perform a comprehensive analysis in thematic content analysis.

Master's and doctoral thesis studies were scanned using the Turkish words "üstün yetenekli (highly talented)", "özel yetenekli (special talent)", "üstün zekalı (gifted)" on the CoHE National Thesis Center website. The words "gifted and talented", "Gifted education", "gifted" were used in the article scan in the databases.

Data Analysis

1) A matrix was formed to examine the thesis and article studies for gifted students in the field of science education in Türkiye. The matrix includes both general and content features. The general features include research type, university and years. The content features include keywords, aim, research method, samples, data collection, data analysis methods, results and suggestions. The matrix is given in Appendix 1.

2) Parameters were determined for the thematic review. These parameters were: research type, university, publication years-, keywords, aim, research method, sample, data collection tools, data analysis methods, results, suggestions.

The data in parameters were analyzed using the content analysis method. In the content analysis process, the data obtained from theses and articles were first converted into codes and then the codes were brought together and themes were created. Frequency values for the codes and themes created were calculated.

The parameters are shown in Table 3.

Table 3

Thematic Review Matrix of Studies in the field Science Education of Gifted and Talented Students

Themes	Sub-Theme	Explanations
General Features	Type of publication	Master's or doctoral thesis and journal article
	University	University where the thesis was published and articles were studied
	Years	Year of publication
Content Features	Aims	Aim(s) of the research
	Keywords	Keywords used in theses and articles
	Methodology/Design	Qualitative, quantitative, mixed methods and others
	Sample	Preschool student, primary school students, middle school, high school students, teacher candidates, parent and sample numbers (1-10, 11-20, 21-40, 41-60, 61-80, 81-100, 101-200, 201-300, 301-500, 501-700, 701-1000, 1001 and up)
	Data Collections Tools	Scale, observations etc.
	Data Analysis Methods	Descriptive analyze, content analyze etc.
	Results	Main results
	Suggestions	Suggestions

Validity and Reliability of the Study

The theses and articles examined within the scope of this study have been carefully examined to avoid any data loss. In order to avoid mistakes in coding, coding of other study was not done before the coding of a study was finished. The verification process was completed after the codes were created. The two researchers individually examined two randomly selected studies. Inter-coder reliability was calculated using Cohen's kappa coefficient and was found to be 0.87.

Findings

Table 4 shows the distribution of the analysed studies according to the type of publication.

Table 4

Distribution of Research's Studies According to Type

Research Type	f
Master thesis	20
PhD thesis	8
Journal Article	37
Total	65

Table 4 shows the distribution of the analyzed studies according to the type of research. Between the years 2018-2021, 37 of the studies for gifted students in the field of science education are article studies, 20 are master's theses and 8 are doctoral thesis studies.

Table 5 shows the distribution of the thesis studies examined according to the universities in which they were published, and the distribution of the journal authors who carried published journal studies according to their university.

Table 5

The Distribution of Research's Studies According to Universities

University	Master and doctoral thesis f	Article f	Total f
Gazi University	-	7	7
Bursa Uludağ University	3	2	5
Balıkesir University	1	3	4
Erciyes University	1	3	4
Inönü University	2	2	4
Istanbul University	-	4	4
Necmettin Erbakan University	2	2	4
Süleyman Demirel University	-	4	4
Uşak University	2	2	4
Anadolu University	-	3	3
Hakkari University	-	3	3
Maltepe University	-	2	2
Niğde Ömer Halisdemir University	-	3	3
Sinop University	-	3	3
Van Yüzüncü Yıl University	-	3	3
Yıldız Teknik University	3	-	3
Amasya University	1	1	2
Aydın Adnan Menderes University	1	1	2
Hacettepe University	-	2	2
Hasan Kalyoncu University	-	2	2
Kocaeli University	2	-	2
Mersin University	-	2	2
Yozgat Bozok University	-	2	2
Aksaray University	-	1	1
Atatürk University	1	-	1
Bartın University	-	1	1
Biruni University	-	1	1
Boğaziçi University	-	1	1
Bolu Abant İzzet Baysal University	1	-	1
Cumhuriyet University	-	1	1
Ege University	1	-	1
Erzincan Binali Yıldırım University	1	-	1
Gaziosmanpaşa University	-	1	1
Karadeniz Teknik University	1	-	1

Manisa Celal Bayar University	1	-	1
Marmara University	-	1	1
Muş Alparslan University	-	1	1
Orta Doğu Teknik University	1	-	1
Recep Tayyip Erdoğan University	1	-	1
Sakarya University	1	-	1
Trabzon University	1	-	1
Total	28	64	92

Note. It was determined that 16 researchers were working as teachers in the Ministry of National Education.

As seen in Table 5, most of the postgraduate theses published for gifted and talented students in science education were published at Bursa Uludağ University and Yıldız Technical University (f=3). When the institutional distribution of researchers who published articles for gifted students in science education was examined, it was determined that the Ministry of National Education (f=12) Gazi University (f=6), Balıkesir University, Erciyes University, Inönü University, Istanbul University, Necmettin Erbakan University, Süleyman Demirel University and Uşak University (f=4) were.

The distribution of the journals in which the articles were published was given in Table 6.

Table 6

Distribution of Articles by Journals They Published

Journal Name	f
Journal for The Education of Gifted Young Scientists	3
Journal of National Education	3
Journal of Turkish Science Education	2
Talent Journal	2
Per Journal	2
Gifted Education International Journal	2
Education and Science Journal	2
Elementary Education Online Journal	2
Pegem Journal of Education and Instruction	2
International Online Journal of Education and Teaching	1
Bartın University Journal of Faculty of Education	1
Erzincan University Journal of Faculty of Education	1
Acta Didactica Napocensia Journal	1
Science & Education Journal	1
Science Education International Journal	1
Malaysian Online Journal of Educational Sciences	1
European Journal of Educational Sciences	1
International Journal of Progressive Education	1
Thinking Skills and Creativity Journal	1
Journal of Educatıonal and Instructıonal Studıes in The World	1
Educational Research and Reviews Journal	1
International Journal of Educational Methodology	1
Journal on Efficiency and Responsibility in Education and Science Journal	1
Education and Information Technologies Journal	1
Educational Studies Journal	1
Journal of Baltic Science Education	1
Total	37

As seen in Table 6, the articles were published in the Journal for the Education of Gifted Young Scientists and the Journal of National Education with a frequency of 3.

The frequency distribution of the codes created for the theme of the publication year was presented in Table 7.

Table 7

The Distribution of Studies Analyzed According to the Years of Publication

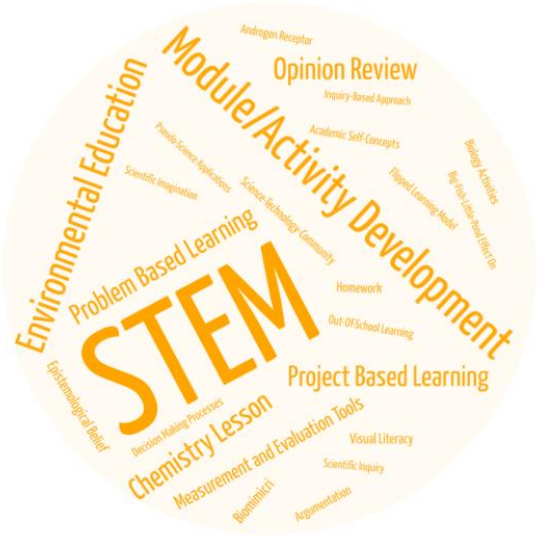
Theme	Codes	Research Type			Total f
		Master Thesis f	PhD Thesis f	Article f	
Years of Publication	2018	3	2	6	11
	2019	8	2	7	17
	2020	4	1	10	15
	2021	5	3	14	22
	Total	20	8	37	65

As seen in Table 7, 11 studies (5 thesis and 6 articles) were conducted in 2018, 17 studies (10 thesis and 7 articles) in 2019, 15 studies (5 thesis and 10 articles) in 2020 and 22 studies (8 thesis and 14 articles) in 2021.

The distribution of the codes created for the theme of the subject is presented in Figure 1.

Figure 1

The Distribution of Studies Examined According to Their Subject



According to Figure 1, studies on gifted education in science education have focused on STEM (f=11), module/activity development (f=10), environmental education (f=5), problem based learning (f=3), project based learning (f=3), chemistry lessons (f=3) and opinion reviews (f=3) were studied frequently.

The frequency distribution of the codes created for the theme of the aim was presented in Table 8.

Table 8

The Distribution of Study's on Gifted and Talented According to Their Aims

Theme	Sub-theme	Code	f	Total f
Effect on skill	Scientific Reasoning Skill	Examining the effect of science module on scientific reasoning skills	1	22
	Science Process Skills	Examining the effect of STEM instructional design based on the 5E model on SPS	1	
		Examining the effect of science module on SPS	1	
	Scientific Creativity	Examining the effect of STEM instructional design based on 5E model on students' scientific creativity	1	
		Examining the effect of STEM activity on scientific creativity	1	
	Engineering Skills	Examining the effect of STEM instructional design based on 5E model on engineering skills	1	
	Critical Thinking Skill	Examining the effect of differentiated science course curriculum based on integrated curriculum model on CTS	1	
		Examining the effect of STEM activity on CTS	1	
		Examining the effect of argumentation based on astronomy-chemistry thought experiments on CTS	1	
	Scientific Research/ Product Design Skill	Examining the effect of the module on scientific research/product design skills	1	
	Scientific Writing Skills	Examining the effect of the module on SWS	1	
	Scientific Imagination	Comparison of the scientific imagination of gifted and non-gifted students		
	Reflective Thinking Skill	Examining the effect of problem-based science teaching on RTS	1	
	21st Century Skills	Examining the effects of e-STEM activities on 21st century skills	1	
	Self-Regulation Skill	Examining the effect of flipped learning model on self-regulation skills	1	
		Examining the effect of homework on self-regulation skills	1	
		Examining the effect of STEM education on self-regulation skills	1	
	Academic Self-Efficacy	Examining the effect of differentiated science teaching module on academic self-efficacy of primary school teacher candidates	1	
	Creative Thinking Skill	Examining the effect of differentiated and enriched activities on creative thinking skills	1	
	Decision Making Skills	Examining the decision-making processes of gifted students and their parents in the context of epistemic profiles	1	
		Determining the effect of STEM practices on career choices	1	
	Discussion	Examining the reflection of biomimicry applications on discussions	1	
Effect on the affective domain	Attitude	Comparison of the attitudes of gifted and non-gifted students towards plants	1	14
		Examining the attitude of STEM education towards robotics and coding	1	
		Examining the gifted students' attitudes towards computer games assisted coding learning	1	
	Motivation	Examining the motivation of STEM education towards science teaching	1	
		Examining the effects of biology projects on their motivation to learn biology	1	
	Belief	Examining the effect of STEM education on epistemological beliefs	1	
		Examining the effect of differentiated science teaching module on the beliefs of primary school teacher candidates to perform science activities	1	
		Examining the effect of differentiated science teaching module on pre-service science teachers' science teaching efficacy beliefs	1	

	Perception	Examining of science teachers' perceptions of gifted children and their education	1	
		Examining the effect of e-STEM activities on the perception of the environment	1	
		Examining the effect of big-fish-little-pond effect on academic self-concepts in mathematics and science	1	
		Determination of students' pseudoscience perceptions	1	
	Value	Examining the effect of differentiated science course curriculum based on integrated curriculum model on value development	1	
	Concerns	Examining the effect of nature education on environmental awareness and concerns	1	
Developing a Program/Activity/ Assessment Tool	For Students	Curriculum/module development and evaluation	5	12
		Development of e-STEM / STEM based activities	2	
		Testing the UYUKEP model with the Structural Equation Model	1	
		Developing an analogy-focused activity	1	
	For Teachers	Developing an education model for science teachers	1	
		Development of guide materials for teachers	1	
	Test Adaptation	Adaptation of the SPS test into Turkish	1	
Effect on Opinion	Teacher Opinion	Examination of science teachers' views on science education of gifted students	2	10
	Student Opinion	Examination of opinions about chemistry course	1	
		Examination of opinions on project performances	1	
		Examining of opinions on the Science-Technology-Society approach	1	
		Examination of opinions on visuality in science course	1	
		Examination of opinions on scientific inquiry	1	
		Examination of opinions on biology activities	1	
		Examination of opinions on science education	1	
		Examination of opinions on out-of-school learning environment	1	
	Parent's Opinion	Examination of parents' opinions on science education of gifted children	1	
Examining the relationship	Receptor Gene and Science Attitude	Examination of the relationship between the Androgen Receptor gene CAG repeat polymorphisms of gifted and non-gifted students and their attitudes towards science	1	6
	Motivation to Learn Science-Risk-Taking Behaviors And Science Success	Examination of the relationship between perceptions of science learning environment and motivations for learning sciences with mental risk-taking behaviors and science achievement in science lesson	1	
	Intelligence and Creativity Level	Examining the relationship between the intelligence and creativity levels	1	
	Creativity Levels and Creative Problem Solving Skills	Examining the relationship between creativity level and creative problem solving skills	1	
	Scientific Epistemological Belief and Intellectual Risk Taking in Science Learning	Examining the relationship between scientific epistemological belief and intellectual risk taking	1	
	Scientific Epistemological Belief and Science Achievement	Examining the relationship between scientific epistemological belief and science achievement	1	
Determining the case /level	Science Process Skills	Determination of SPS levels of students through pseudo-scientific scenarios	1	6
	Computational Thinking Skills	Determining the computational thinking skills used by students in integrated STEM activities based on the Engineering design process	1	

	Problem Solving Skills	Analysis of students' creative problem-solving styles	1	
	Scientific Literacy Level	Determining students' visual literacy levels	1	
	Self-Efficacy	Determining the technology and design self-efficacy of students for educational technologies	1	
	Method and Technique	Determining the measurement evaluation methods and techniques used by science teachers	1	
Effect on Cognitive Domain	Cognitive Success	Examining the effect of STEM activity on cognitive achievement	1	4
		Examining the effect of flipped learning model on success	1	
	Conceptual Learning	Examining the effect of problem-based science learning on conceptual learning	1	
		Examining the effect of differentiated science teaching module on science learning of primary school teacher candidates	1	
Document analysis	Content analysis	Content analysis of 76 projects of students at the Science and Art Center	1	2
		Content analysis of STEM and giftedness studies	1	
Total				76

Note. Since there is more than one purpose in some studies, the number is different. SPS: science process skills, CTS: Critical Thinking Skill; SWS: Scientific Writing Skills; RTS: Reflective Thinking Skill.

Table 8 shows that 8 themes, 43 sub-themes and 71 codes were formed in the purpose distribution of the studies. These themes are the effect on the skill (f=22), the effect on the affective domain (f=14), the development of the programme/activity evaluation tool (f=12), the effect on the opnion (f=10), the examining the relationship (f=6), the determining the case/level (f=6), the effect on the cognitive domain (f=4) and the document analysis (f=2).

The frequency distributions of the sub-theme created for the keywords theme used in the studies were presented in Table 9 and Figure 2. The detailed distribution of the keywords used in each sub-themes and codes were shown in Appendix 2 in detail.

Table 9

The Distribution of Studies on Gifted and Talented According to Their Keywords

Theme	Sub-Theme	f
Keywords	Sample	66
	Skill	43
	Field	41
	Affective	24
	Teaching Approach-Method-Technic	24
	STEM	22
	Cognitive	15
	Subject	13
	Data Collection Tool	12
	Research Method/Variables	12
	Differentiation	12
	Institution	10
	Unspecified	1
Total		285

The keywords theme of the studies conducted for gifted students in the field of science education consists of 12 sub-themes (Table 9). These sub-themes are the sample (f=66), field (f=41), affective, teaching approach-method-technic (f=24), STEM (f=22), cognitive (f=15), subject (f=13), data collection tool, research method/variables, differentiation (f=12), institution (f=10). In addition, keyword in 1 study use has not been found.

Figure 2

Keywords Used in Theses on Gifted and Talented

As seen in Figure 2, it was determined that the keywords were preferred more in the themes of sample, skill, field, affective, teaching approach-method-technique and STEM in the studies examined.

The frequency distributions of the codes created for the theme of the methodology/design were presented in Table 10 and Figure 3.

Figure 3

Word Cloud of Studies on Gifted and Talented According to the Methodology/Design

The methodology/design theme of the studies conducted for gifted students in the field of science education consists of 6 sub-themes and 20 codes (Table 10). As seen in Figure 3, it was determined that the studies examined were mostly designed with descriptive research, mixed research and interpretive research.

Table 10

The Distribution of Studies on Gifted and Talented According to the Methodology/Design

Theme	Sub-Theme	Code	Research Type				Total
			Master	PhD	Article	Total	f
			f	f	f	f	
Methodology/Design	Descriptive Research	Case Study	4	1	9	14	31
		Survey	4	-	6	10	
		Correlational Research	2	1	3	6	
		Multiple Case-Holistic Design	1	-	-	1	
	Mixed Method Research	Design Not Specified	2	-	1	3	15
		Embedded Design	1	2	3	6	
		Convergent Parallel Design	2	-	-	2	
		Explanatory Design	1	-	2	3	
		Multistage Design	-	1	-	1	
	Interpretive Research	Action	2	2	-	4	8
		Phenomenographic	1	-	3	4	
	Analytical Research	Document Analysis	-	-	1	1	2
		Literature Review	-	-	1	1	
	Experimental Research	Semi Experimental	-	-	1	1	4
		Control Group Experimental Designs	-	-	2	2	
		One Group Experimental Designs	-	-	1	1	
	Others	Educational Design Research	-	1	-	1	5
		Path Analysis Approach	-	-	1	1	
		Adaptation of Scale and Test	-	-	1	1	
		A Time-Series Research	-	-	1	1	
		Unspecified	-	-	1	1	
	Total		20	8	37	65	65

Note. The sub-themes of the research methods were created according to Çepni (2021).

As seen in Table 10, 29 of the studies examined were carried out as descriptive research, 14 were mixed method research, and 6 were interpretative research. In addition, it is seen that 1 study specified the research method as educational design research, 1 study as a path analysis approach, 1 study as an adaptation of scale, and 1 study as a time-series research. It is seen in Table 10 that 16 studies were carried out with the case study design, 9 studies with the survey, 6 studies with the unspecified mixed method, and 5 studies with the embedded mixed design.

The frequency distribution of the codes created for the sample type theme was presented in Table 11.

Table 11

Distribution of the Studies Examined by Sample Type

Theme	Code	Master	PhD	Article	Total
		f	f	f	f
Sample Type	Pre-school	-	-	1	1
	Primary school	3	-	9	12
	Middle School	16	6	26	48
	High School	-	-	4	4
	Teacher Candidate	-	-	1	1
	Teachers	2	1	2	5
	Parent	1	1	1	3
	Document	-	-	2	2
	Unspecified	1	1	1	3

As seen in Table 11, studies for the gifted and talented were conducted with 48 middle school students, 12 with primary school students, 5 with teachers, 4 with high school students, and 3 with parents. In addition, documents were examined in 2 studies (there were no human subjects), and the

sample type was not specified in 3 studies. Middle school students were mostly preferred as samples in Master's and doctoral theses and in journal articles.

The frequency distribution of the codes created for the theme of number of sample was presented in Table 12.

Table 12

Distribution of the Studies Examined by Number of Sample

Theme	Code	Master Thesis f	PhD Thesis f	Article f	Total f
Number of Sample	1-10	2	1	4	7
	11-20	5	3	8	16
	21-40	5	-	4	9
	41-60	-	2	7	9
	61-80	1	-	6	7
	81-100	2	1	1	4
	101-200	3	1	2	6
	201-300	1	-	2	3
	701-1000	1	-	2	3
	1001 +	-	-	1	1

According to Table 12, the sample numbers of 16 of the studies conducted for the gifted are 11–20, the sample numbers of 9 of them are 41–60, and the sample numbers of 9 of them are 1–10 and 21–40. In addition, the sample number of 1 of them is 1001+.

The frequency distribution of the codes created for the theme of data collection tools were presented in Table 13 and Figure 4.

Figure 4

Distribution of Studies Examined According to Data Collection Tools

Data in the studies examined were frequently collected using a scale (f = 27), semi-structured interview form (f = 25), test (f = 19), student worksheet (f = 17), reflective student diary (f = 8), researchers' field notes (f = 8), and observation form (f = 8), as shown in Figure 4. Furthermore, data were collected in the studies using the peer evaluation form, self-assessment form, product development notebook, teaching material, scale development, structured interview form, clinical interviews, reflections, unstructured observation, control list, and sound recording.

Table 13

Distribution of Studies Examined According to Data Collection Tools

Theme	Sub-Theme	Code	Research Type				
			Master's f	Doctoral f	Article f	f	Total f
Data Collection Tools	Documents	Student Worksheet	4	6	7	17	45
		Reflective Student Diary	6	1	1	8	
		Researchers' Fieldnotes	1	4	3	8	
		Evaluation Form	1	3	1	5	
		Peer evaluation form	-	-	1	1	
		Document	-	-	2	2	
		Self-Assessment Form	1	-	-	1	
		Product Development Notebook	1	-	-	1	
		Teaching Material	-	1	-	1	
		Scale development	-	-	1	1	
	Interview	Semi-Structured Interview Form	12	3	10	25	41
		Observation Form	4	1	3	8	
		Focus Group İnterview	2	1	1	4	
		Structured Interview Form	-	-	1	1	
		Clinical İnterviews	-	1	-	1	
		Reflections	-	-	1	1	
		Unstructured Observation	-	-	1	1	
	Scale	Scale	9	5	13	27	27
	Multiple Evaluation	Video Recording	-	2	2	4	15
		Inventory	1	-	4	5	
		Rubric	1	1	-	2	
		Personal information form	2	-	-	2	
		Control List	-	1	-	1	
		Voice Recording	-	1	-	1	
	Test	Test	2	8	9	19	38
	Questionnaire	Questionnaire	2	-	5	7	11
		Open-ended questions	2	1	1	4	

Note. Since some studies have more than one data collection tool, the number is different.

As seen in Table 13, it can be seen that 6 sub-themes and 26 codes were formed for the data collection tools theme.

It was noticed that the terms 'questionnaire' and 'scale' are used interchangeably in 7 graduate theses and 1 article. Excerpts from the studies are given below.

"*The Epistemological Beliefs* ***Questionnaire*** *was developed by... This 5-point* ***Likert scale*** *ranges from strongly disagree to strongly agree*."

"*A* ***questionnaire*** *named Student Homework* ***Scale*** *was used to collect data in the study."*

"A ***questionnaire*** *named Scientific Epistemological Belief* ***Scale*** *was used."*

"In this study, a Plant Attitude ***Questionnaire*** *was used to reveal the attitudes of students towards the plants. The Cronbach Alpha reliability coefficient of the* ***scale*** *was .809"*

The frequency distribution of the codes created for the theme of data analysis methods is presented in Figure 5.

Figure 5

Distribution of Studies Examined According to Data Analysis Methods

As can be seen in Figure 5, content analysis, parametric tests, non-parametric tests and descriptive statistics were frequently used in the analysis of quantitative data of the studies on gifted students in science education. In addition, thematic analysis, structural equation model, path analysis and factor analysis methods were also used. The data analysis method was not specified in 4 journal articles. In one Master's thesis, it was determined that the data analysis method was confused with the research method. The excerpt from the study is as follows.

"Scanning method was used in the analysis of quantitative data."

The frequency distribution of the codes created for the theme of results was presented in Table 14.

Table 14

Distribution of Studies Examined According to the Results

Theme	Sub-theme	Code	f	Total f
Results	Positive effect on skills	Scientific creativity development	5	34
		Science process skills development	5	
		Problem solving skills development	3	
		Group work / cooperative work skill development	3	
		Critical thinking skills development	2	
		Responsibility development	2	
		Scientific reasoning skills development	2	
		Engineering skills development	2	
		Communication development	1	
		Entrepreneurship development	1	
		Leadership development	1	
		Thinking skills development	1	
		Scientific writing skills development	1	
		Scientific inquiry development	1	
		Self-regulation skill development	1	
		Visual literacy skill development	1	
		Creative thinking skills development	1	
		Life Skills Development	1	
	Negative Effect on Skills	Critical thinking skill	2	3
		Self-regulation skill	1	
	Positive effect on	Attitude towards science lesson	3	
		Robotics and coding attitude	3	

	Affective	Prone to believing pseudo-scientific claims	1	
		Motivation for science learning	2	17
		Epistemological belief	1	
		Perceptions of science teachers towards gifted students	2	
		Opinions of female students about chemistry education	1	
		Opinions of science-society-technology	1	
		Attitude towards mathematics lesson	1	
		attitude towards technology and engineering	1	
		Teachers' self-efficacy	1	
	Negative effect on Affective	Opinions of male students about chemistry education	1	3
		Teachers' self-efficacy	2	
	Positive effect on Cognitive	Conceptual understanding	6	
		Cognitive achievement	4	
		Academic success with the Flipped Learning Model	1	12
		Effective and permanent learning	1	
	Negative effect on Cognitive	Education for the education of gifted students	1	1
	Positive effect on Developing a Programme/Activity/Assessment Tool	Education model, curriculum, activity, module, materials, test applicable	12	
	Relationship between Variables	There is significant difference	3	
		There is no significant difference	3	
	Other	Materials and inadequacy of materials in BİLSEM	2	

Note. More than one outcome was achieved in some studies.

When Table 14 is examined, it is seen that there are eight different sub-themes related to the research result theme. While 37 of the examined studies revealed the effect of interventions on skills, 34 had positive effects and 3 had negative effects. 17 studies found a positive effect on the affective domain, 3 studies found a negative effect, and 12 studies resulted in a positive effect on the cognitive domain and 1 study found a negative effect. Furthermore, the program, module, activity, scale, and so on developed for gifted and talented students' science education. All 12 studies are applicable to gifted and talented students. Of the 6 studies examining the relationship between the variables, a significant relationship was found in 3, and an insignificant relationship in 3 of them. On the other hand, 2 studies determined that there is a lack of materials and equipment in BİLSEM, which is a teaching environment for gifted and talented students.

The frequency distribution of the sub-theme created for the theme of suggestions was presented in Table 15.

Table 15

Distribution of Studies Examined According to the Suggestions

Theme	Sub-Theme	f
Suggestions for Future Research	for the Methods Section	41
	for Research Topic	24
	for Activities/Material/ Programme/ Measurement Tool to be Developed	20
	for STEM	18
	for Leveling	7
	for Opinion Review	4
Suggestions for Decision Makers	for Teachers	20
	for Teaching Programs	17
	for Learning Environments	16
	for Teacher Candidates	6
	for Universities	4
	Diagnostics	3
	Budget	2
Total		180

When Table 15 is examined, it is seen that 2 themes and 14 sub-themes were formed in the recommendation parameter of the studies examined. In the studies examined according to Table 15, the most suggestions were made for the method sections (f=41) of the studies. In addition, in the theme of suggestions for future research of the studies examined, 24 suggestions were made for the research topic, 20 for developing programs, modules, activities, scales, etc., 18 for STEM, 7 for determining the level and 4 for examining opinions. In Table 15, in the theme of suggestions for decision makers, 20 suggestions for teachers, 17 for teaching programs, 16 for learning environments, 6 for teacher candidates, 4 for universities, 3 for the identification of gifted individuals, and 2 for the budget are presented. The detailed distribution of the suggestions used in each sub-themes and codes were shown in Appendix 3 in detail. Suggestions that are not frequently encountered in all studies and that are thought to be special are indicated in Appendix 2 with an (*) sign.

Discussion and Conclusion

In this study, analyses of 28 dissertations (20 masters and 8 doctoral) and 37 journal articles were conducted for gifted students in the field of science education between the years 2018-2021 using thematic content analysis.

When the studies on gifted students in the field of science education in Türkiye between the years 2018-2021 are examined, it is seen that journal article studies are carried out more often than graduate thesis studies. Master's thesis studies were, as expected, more common than doctoral thesis studies. Özenç and Özenç (2013), Ayvacı and Bebek (2019), Sayim and Işık (2020), Dönmez and İdin (2017) found that Master's studies were given more weight than doctoral studies in their studies. In the distribution of years, it was determined that the most postgraduate theses were carried out in 2019 and there was a decrease in 2020. It is thought that this result is due to the fact that the pandemic was declared in Türkiye in 2020, and that education was continued remotely. Journal article studies were mostly published in 2021.

The universities where the thesis studies had mostly been done were Yıldız Technical University and Bursa Uludag University, while the universities where the authors of journal articles were based were mostly Gazi University, Istanbul University, and Süleyman Demirel University. Schreglmann (2016) states that the universities where his gifted studies are published the most are Hacettepe University, Gazi University and Dokuz Eylül University; Sayim and Işık (2020) Istanbul University; Dönmez and Idin (2017) Istanbul University and Gazi university; Kardeş, Akman and Yazıcı (2018) Gazi University; Kırnık and Susam (2018) determined as Gazi University, Hacettepe University and Yıldız Technical University. The journals in which the articles are published the most are Journal for The Education of Gifted Young Scientists, Journal of National Education, Journal of Turkish Science Education, Talent Journal, Per Journal, Gifted Education International Journal, Education and Science Journal, Elementary Education Online Journal, Pegem Journal of it is designated as Education and Instruction.

Studies on examined for gifted individuals in science education were mostly carried out in the subjects STEM, module/activity development and evaluation, environmental education, problem-based learning and project-based learning. Studies show that the use of traditional methods in the education of gifted individuals leads to a loss of interest and academic failure in students, and they state that they should be engaged in quality STEM learning (Karahan & Ünal, 2019). As gifted individuals are individuals with a high sensitivity to global problems, and they are individuals who feel responsible for finding solutions to problems (Tallent-Runnels & Yarbrough, 1992), it is usual to study the subjects for problem-based learning. As a result of the content analysis studies they conducted in Ayvacı and Bebek (2019), they stated that in parallel with the findings of this study, a significant number of studies were conducted on the development and implementation of programmes/models/activity/methods for gifted students. Schreglmann (2016) scanned the studies conducted for the gifted in the last 5 years (2010-2015), and concluded that the majority of the subjects studied were on the development and evaluation of various education programmes. Dönmez and İdin

(2017), determined that studies were mostly conducted on perception and attitude towards science, problem-based learning and motivation. Studies examined in connection with the findings of the research topic mostly aimed to investigate the effect of research topics on skills and affective domains and to develop activities/modules/programs. Considering the educational goals of gifted individuals, it covers the aims of the research examined. Because the educational goals of gifted individuals include developing advanced skills, scientific process skills, scientific research skills, high-level thinking skills, flexible thinking skills, and innovative idea generation skills (Sak, 2009; Sak, 2011; MEB, 2013).

When we look at the keywords of studies on gifted education in science education in Türkiye, the keywords for the sample group were used the most. However, due to the use of 14 different concepts for the sample (highly talented, gifted individual, gifted child, gifted, giftedness, superior mind, gifted and talented, gifted and talented children, special skilled, developing special abilities, special talents, special skilled, gifted student, gifted students; and Turkish üstün yetenekli, üstün yetenekli birey, üstün yetenekli çocuk, üstün yetenekliler, üstün yeteneklilik, üstün zekâ, üstün zekâlı ve yetenekli, üstün zekâlı ve yetenekli çocuklar, özel yetenek, özel yetenekleri geliştirme, özel yetenekli, özel yetenekliler, özel yetenekli öğrenci, özel yetenekli öğrenciler,), it is thought that there is no consensus on the keywords and this situation is thought to create confusion. The majority of the difference in keywords is due to the use of plural letters in Turkish. Dönmez and İdin (2017) also support the findings of the study with suggestions for standards in the writing of keywords in which gifted individuals will be expressed in their studies. Dai, Swanson & Cheng (2011) stated that there is a difference of opinion in the terminology for gifted individuals. Renzulli & Reis (2021) stated this difference in terminology as the word gifted changes according to the use of a noun or adjective. Carman (2013), stated that researchers complain that the difference of opinion led to the use of different words in the selection of the sample and made it difficult to compare and generalise research results. Ziegler and Raul (2000) also emphasized that this situation is a major concern and that it fragments the field. The finding of a lack of consensus in keyword usage coincides with the lack of consensus in definitions of giftedness.

When we look at the results of the sample/study group of studies on gifted education in science education in Türkiye, it is seen that mostly secondary school students are studied, consistent with the target group of science education (5th to 8th grade pupils). Parallel to the findings of the study, Dönmez and Idin (2017) and Özenç and Özenç (2013) said that the research on gifted was mostly carried out with pupil groups; Ayvacı and Bebek (2019) and Kardeş et al. (2018) also found that middle school student groups were studied the most in student groups. When we look at the results of the sample number 11-20. The reason for the small number of samples is that the studies examined, which is another finding of the research, are mostly patterned as case studies. It is thought that due to its nature, the case study is a detailed and in-depth research method (Yildirim & Şimşek, 2008).

Most researchers preferred descriptive research methods and mixed research methods the most. Descriptive research methods describe and explain the phenomenon examined in detail without manipulating the variables (Crowe et al. 2011; Siedlecki, 2020; Çepni, 2021). With this more case studies and survey models were used in descriptive research methods. Ayvacı and Bebek (2019), Schreglmann (2016), Sayim and Işık (2020), Dönmez & idin (2017) and Türkay et al. (2021) reached the same conclusion in the analytical method analysis used in the studies. The reason for choosing mixed research methods is to collect and analyze data in detail based on qualitative and quantitative research processes (Ormancı, 2020). While the embedded mixed pattern is often preferred, there are postgraduate and article studies that do not specify the mixed method. Embedded mixed design is thought to be frequently preferred because it is based on supporting the experimental design with qualitative data (Ormancı, 2020). The data in the examined thesis and article studies were mostly collected using a scale, semi-structured interview form, test, and pupil worksheet. Considering that data collection tools such as tests, questionnaires, interviews, and observations are collected in descriptive research methods (Atmowardoyo, 2018), and both qualitative and quantitative data collection tools are used in mixed research methods, this is the most preferred data collection tool in

the studies examined. It is not a surprising result. In addition, diversity in different data collection tools creates a positive situation in terms of the originality of the studies and is important in terms of validity and reliability. Among other studies examining gifted students, Ayvacı and Bebek (2019) and Schreglmann (2016); Türkay et al. (2021) stated that scale, questionnaire, and interview; Dönmez and İdin (2017) semi-structured interview form and scale; Özenç and Özenç (2013) scale, observation, and interview were the most preferred data collection tools; another result of the studies examined is that the concepts of scale and questionnaire are used interchangeably in their Master's and doctoral theses. In addition, it was determined that the research method was mixed with the data analysis method in a master's thesis. This result shows that more emphasis should be placed on scientific research methods in graduate courses. It is a sad situation to encounter misconceptions about data collection tools and research methods in postgraduate thesis studies carried out to specialize in the field and doctoral thesis studies carried out to contribute to the field. Studies that collect their data with scales, semi-structured interview forms, tests, and student worksheets frequently use content analysis, parametric and nonparametric tests, and descriptive statistics in their analysis.

Most of the published papers claimed to have had a positive effect on skill development (Table 14). These skills were mostly scientific creativity, science process skills, problem solving skills and group work/cooperative work skill. These skills are among the skills recommended to be developed in gifted students. The positive effects on the affective and cognitive areas of gifted students are also quite high. The positive effects on the affective and cognitive areas of gifted students and the results that activity/module/program/scale studies developed for gifted individuals are applicable are also quite high. The training provided for gifted individuals is not sufficient (Çelik Şahin, 2021); considering that there is no special education program (Kaya, Mertol, Turhan, Araz and Uçar, 2022) due to the fact that the education of gifted students is based on recent times in Türkiye, it is a necessity as a result of developing an activity/program/scale for gifted individuals.

In the studies examined, suggestions were made for future studies (researchers) and decision makers. Working with different sample types and numbers for the method sections in the future studies; comparison of gifted and non-gifted students as research subjects; there are suggestions for the development of materials/programs/measurement tools. In the subject suggestions, "The effect of out-of-school learning environments on skills" and "Online and face-to-face education practices can be compared" suggestions were made; in the activity development suggestions, the suggestion of "inclusion of values education in the activities" was found to be more original and original by the researchers of this article (As see Appendix 3). Because the research carried out to date (Loye, 1990; Roeper, 1988; Lovecky, 1994; Kurnaz, Çiftçi, & Karapazar, 2013) has shown that values education is lacking in the education of gifted individuals. For this reason, it would be appropriate for researchers to design activities and programs for gifted students by considering values education. When the suggestions for STEM activities were examined, suggestions were made to design activities that will develop 21st century skills, to expand e-STEM activities, and to prepare lesson plans. The suggestion of "disseminating e-STEM activities", which is among these suggestions, was found original by the researchers considering the difficulties in online course processing during the time period when face-to-face education was suspended in our country during the pandemic period. The reviewed studies made suggestions for decision makers, mostly on organizing training for teachers. This result supports Ayvacı and Bebek (2019)'s finding that teachers who teach gifted and talented individuals should be trained, and Kaya et al.'s suggestion that teachers should undergo comprehensive training on current practices in the education of gifted students. Among the suggestions made for teacher training, "In-service training for teaching methods that can be used in the education of gifted students" and "Distance education programs should be developed that teachers can easily access" were found to be original by the researchers. When the suggestions made for the gifted education program for the decision makers are examined, the majority of the suggestions are to add the modules and activities developed in the graduate theses to the curriculum. Another suggestion is to create a special education program for gifted students, as emphasized by many researchers in the literature (Çelik Şahin, 2021; Kaya, Mertol, Turhan, Araz and Uçar, 2022). In addition, among the suggestions made for

the curriculum, "Increasing innovative innovation project practices", "Separate procedures in university exams", "Organizing a single and separate educational activity", "creating educational standards" were found to be original by the researchers.

Suggestions

When thesis and journal article studies on gifted and talented students in science education in Türkiye between the years 2018-2021 are examined; the scarcity of doctoral thesis studies draws attention. However, considering the contribution of doctoral thesis studies to the field, it is thought that the number of studies to be carried out for gifted students in science education should be increased. Considering that the studies examined are generally aimed at skill and affective domain development, it is recommended that future studies be designed to examine the effects of activities on the cognitive domain, to determine the situation/levels of students in different variables, and to analyze documents from different subject domains. It is recommended to carry out studies on problem-based learning, argumentation, and environmental education activities related to the education of gifted students in science education and the use of out-of-school learning environments, and it is to include values education in the activities. Considering that descriptive research methods are frequently used as a method in the studies examined, it is recommended that future studies should be conducted using analytical and interpretative research methods. For the misconceptions in the methods and data collection tools identified in 9 of the 65 studies, it is thought that applied education should be given to the students during the graduate education process. In addition, it is thought that it will be important to develop a standard label with a common view in Türkiye regarding the difference determined in the keywords used for the sample group for gifted and individuals. It is suggested that this moniker be "gifted and talented". Finally, it is thought that making more specific suggestions experienced in the study instead of general suggestions such as "sample number and type can be changed", which is found in almost half of the studies examined, will be useful in terms of guiding researchers who will conduct research in the future.

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Appendix 1: Matrix Developed by the Researchers and Used in the Research

A. Çalışma Künyesi			
Çalışmanın Kodu			
Çalışmanın Adı			
Çalışmanın Yazarı			
Tez Danışmanın Adı			
İkinci Danışmanın Adı (Var ise)			
Üniversitenin Adı			
Çalışma Türü	Yüksek Lisans ☐	Doktora ☐	Makale ☐
Çalışmanın Yayın Yılı			

B. Çalışmanın Amacı

C. Çalışmanın Değişkenleri
Bağımlı:
Bağımsız:
Kontrol:

D. Çalışmanın Araştırma Yöntemi/Deseni					
Betimsel Arş.	Karma Arş.	Yorumlayıcı Arş.	Analitik Arş.	Deneysel Arş.	Diğer:
Survey ☐ (Alan Taraması)	Yakınsak Paralel ☐	Fenomenografik ☐	Doküman Analizi ☐	Tam ☐	
Özel Durum ☐	Dönüştürücü ☐	Gelişimci ☐	Tarihsel Araştırma ☐	Yarı ☐	
İlişkisel ☐	Açımlayıcı ☐	Aksiyon ☐	Meta Sentez ☐	Basit ☐	
Diğer:	Keşfedici ☐	Etnografik ☐	İçerik Analizi ☐	Tek Denekli ☐	
	Çok Aşamalı ☐	Diğer:	Tematik Analiz ☐		
	İç İçe (Gömülü) ☐		Betimsel Analiz ☐		
	Diğer:		Meta Analiz ☐		
			Diğer:		

E. Örneklem Grubu				
Okul öncesi ☐	Ortaokul☐	Lisans Öğrencileri ☐	Yönetici☒	Ziyaretçi ☐
İlkokul☐	Lise☐	Öğretmen☐	Veli ☐	Diğer ☐

F. Örneklem Büyüklüğü				
1-10 arası☐	21-40 arası ☐	61-80 arası☐	101-200 arası ☐	701-1000 arası ☐
11-20 arası☐	41-60 arası☐	81-100 arası ☐	201-300 arası ☐	1001 ve fazlası ☐

G. Veri Toplama Araçları			
Ölçek ☐	Gözlem ☐	Görüşme ☐	Çoklu Değerlendirme ☐
Anket☐	Katılımlı☐	Online☐	Performans☐
Test ☐	Katılımsız☐	Yapılandırılmış☒	Kavram Haritası☐
Doküman ☐	Öğrenci Çalışma Kâğıdı ☐	Yarı Yapılandırılmış☐	Portfolyo☐
Değerlendirme Formu ☐	Günlük ☐	Yapılandırılmamış☐	Rubrik ☐
Araştırmacı Notu ☒		Odak Grup ☐	Envanter ☐
		Diğer:	Diğer:
Diğer:			

H. Veri Analiz Yöntemi			
Nicel Veri Analizi☐		Nitel Veri Analizi☐	
Betimsel İstatistik ☐	Faktör Analizi☐	İçerik analiz☐	Tematik Analiz ☐
Parametrik Testler ☐	Yapısal Eşitlik Modeli ☐	Betimsel analiz☐	Diğer:
Nonparametrik Testler ☐	Diğer:		

I. Çalışmanın Sonuçları

J. Çalışmanın Önerileri

Appendix 2: The Distribution of Studies on Gifted and Talented According to Their Keywords

Theme	Sub-Theme	Code	f	Total f
Keywords	Sample	Gifted Students	14	66
		Gifted Student	9	
		Gifted And Talented Students	7	
		Talent	3	
		Gifted Education	3	
		Special Skilled	2	
		Special Talents	2	
		Non-Gifted Students	2	
		Gifted Child	2	
		Gifted And Talented	2	
		Gifted	2	
		Giftedness	2	
		Normally Developing Student	1	
		Middle School Students	1	
		Gifted And Special Talents	1	
		Gifted Individual	1	
		Non-Gifted Child	1	
		Gifted Students And Their Parents	1	
		Gifted And Intelligent Individual	1	
		Gifted Children	1	
		Superior Mind	1	
		Gifted And Talented Children	1	
		Parent	1	
		Parents	1	
		Teacher	1	
		Science Teacher	1	
		Science Teachers	1	
		Prospective Classroom Teachers	1	
	Skill	Science Process Skills	6	43
		Critical Thinking	3	
		Special Ability	2	
		Self Editing	2	
		Creativity	2	
		Scientific Reasoning	2	
		Self-Efficacy	2	
		Self-Regulation Skills	2	
		Scientific Creativity	2	
		Environmental Literacy	1	
		Scientific Imagination	1	
		Scientific Literacy	1	
		Scientific Inquiry	1	
		Computational Thinking Skills	1	
		Creative Problem Solving	1	
		Creativity Relationship	1	
		Engineering Skills	1	
		Creative Thinking Skills	1	
		STEM Talent	1	
		Creative Problem Solving	1	
		Creative Problem Solving Styles	1	
		Reflective Problem Solving Skill	1	
		Reflective Thinking	1	
		Problem Solving Skills	1	
		Mental Risk Taking In Learning Science	1	
		Competence	1	
		Visual Literacy	1	
		Developing Special Abilities	1	
		Skill	1	

Field	Science Education	10	41
	Science	5	
	Environmental Education	5	
	STEM Education	3	
	Science Teaching	3	
	Chemistry Education	2	
	Values Education	1	
	Gifted Education	1	
	Nature Education	1	
	Astronomy	1	
	Astronomy Teaching	1	
	Engineering Education	1	
	The Education of Gifted Students	1	
	Differentiated Science Teaching	1	
	Gifted And Talented Education	1	
	Special Education	1	
	Primary Education	1	
	Programming Education in K12	1	
	Science Lesson	1	
STEM	STEM	4	22
	STEM Activity	2	
	Coding	2	
	e-STEM	1	
	FETEMM	1	
	Integrated Disciplines	1	
	Integrated STEM	1	
	Interdisciplinary Relationships	1	
	3D Technologies	1	
	Robotics	1	
	STEAM	1	
	Engineering Design Process	1	
	Career Planning	1	
	Educational Technologies	1	
	Technology And Design	1	
	Technology	1	
	Scratch	1	
Affective	Epistemological Belief	3	24
	Attitude	3	
	Motivation For Learning Science	1	
	Science Teaching Efficacy Belief	1	
	Motivational Beliefs	1	
	Anxiety	1	
	Environmental Sensitivity	1	
	Irrational Belief	1	
	Perception	1	
	Attitude Towards Plants	1	
	Science Attitude	1	
	Awareness Levels	1	
	Motivation	1	
	Interest in Astronomy	1	
	Environmental Awareness	1	
	Epistemic Decision Making	1	
	Epistemic Bias	1	
	Constructivist Science Learning Environment Perception	1	
	Motivation Toward Learning Biology	1	
	Sense	1	
	Problem Based Learning	2	
	Project Based Learning	2	
	Argumentation	1	
	Integrated Curriculum Model	1	
	FETEMM Approach	1	

Teaching Approach-Method-Technic	Constructivist Approach	1	24
	Inquiry-based	1	
	UYEP Curriculum Model	1	
	UYUKEP	1	
	Flip Learning	1	
	Controversial Text	1	
	Inquiry-Based Approach	1	
	Project Approach	1	
	Biomimicry	1	
	Big Fish Small Pond Effect	1	
	Thought Experiments	1	
	Blending	1	
	Grid Model	1	
	Augmented Reality	1	
	Interdisciplinary Learning And Teaching	1	
	Evaluation	1	
	True Experimental Design	1	
Cognitive	Academic Success	1	15
	Cognitive Success	1	
	Astronomy Achievement	1	
	Success in Science	1	
	Learning Concepts	1	
	Environmental Education Concepts	1	
	Activities for Gifted Students	1	
	Science and Engineering Activities	1	
	Biology Activities	1	
	Educational Events	1	
	Event Workshop	1	
	Academic Self-Concepts	1	
	Intelligence	1	
	Knowledge	1	
	Metacogntion	1	
Data Collection Tool	Opinion on Science-Technology-Society	1	12
	Motivation Scale Toward Learning Biology	1	
	The Diet Cola Test	1	
	VOSTS Survey	1	
	Interview	1	
	Evaluation	1	
	Science Homework	1	
	Project Studies	1	
	Student Projects	1	
	Draw-Write Tell Technique	1	
	Torrance Creative Thinking Scale	1	
	Opinion	1	
Research Method/ Variables	Action Research	2	12
	Multiple Case Study	1	
	Qualitative Method	1	
	Structural Equation Model	1	
	Thematic Review	1	
	Test Adaptation	1	
	Phenomenology	1	
	Grade Level	1	
	Gender	1	
	Survey	1	
	Programming Education in K12	1	
Subject	Animals and Plants	1	13
	Genetic	1	
	Climate Change	1	
	Keystone Species	1	
	Matter and Change	1	
	Natural Stones	1	
	Nature of Science	1	

		Renewable Energy Sources	1	
		Androjen Receptor	1	
		Learning Style	1	
		Global Warming	1	
		Conceptual Learning	1	
		Recognizing Individual Talents	1	
	Differentiation	Differentiated Instruction	2	12
		Differentiation	2	
		Blended Learning	1	
		Differentiated Education	1	
		Program Differentiation	1	
		Program Evaluation	1	
		Program Development	1	
		Module Development	1	
		Science Lesson Modules	1	
		Early Intervention Program	1	
	Institution	Science and Art Center	5	10
		BİLSEM (Turkish abbreviation of Science and Art Center)	3	
		Out-of School Learning Environments	2	
		Unspecified		1
	Total			271

Appendix 3: Distribution of Studies Examined According To the Suggestions

Theme	Sub-Theme	Code	f	Total f
Suggestions for future research	For the Methods section	The number of samples can be increased.	12	41
		It can be worked with different class level/division/city.	14	
		Different variables can be examined.	6	
		The work can be done over a longer period of time.	3	
		In addition to quantitative data, qualitative data can be used.	2	
		A pilot study should be done.	1	
		Longitudinal studies can be done.	1	
		An experimental study with a control group should be done to evaluate the effectiveness of the activity.	1	
		The opinions of each stakeholder regarding the subject area should be taken into account the designed teaching material.	1	
	For STEM	STEM activities that support 21st century and entrepreneurship skills and introduce professions can be developed.	6	18
		*e-STEM applications can be dissemination	3	
		Lesson plans and activities for STEM should be prepared.	3	
		*STEM/FETEMM lesson plans and activities should be prepared.	1	
		STEM activities that allow critical thinking should be designed.	1	
		Advanced level STEM activities should be developed.	1	
		STEM information conferences for students can be organized.	1	
		STEM activities with parent participation can be developed.	1	
		Applications that center technology, engineering and mathematics can be developed.	1	
	For Activities/Material/ Program/ measurement tool to be Developed	The activity/material should be designed according to the characteristics of the gifted.	2	20
		Activities that include six thinking techniques should be designed.	2	
		Problem-based activities should be designed	2	
		Activities for the use of 3D technologies can be developed.	1	
		Before the application, the misconceptions should be identified and the activities should be arranged according to the misconceptions.	1	
		Deepening activities should be included more in differentiation programs.	1	
		*Values education should be included in the activities.	1	
		The scientific research process should be emphasized in these activities.	1	
		Activities based on scientific inquiry can be developed.	1	

		Activities that develop creativity can be designed.	1	
		Activities that enable the development of mental models should be designed.	1	
		Plant-themed activities can be developed in the fields of biology and the environment.	1	
		Activities that support creative thinking skills should be designed.	1	
		A measurement tool should be developed for critical thinking skills.	2	
		A measurement tool should be developed for science process skills.	1	
		Gifted students should be evaluated with open-ended questions.	1	
	for Leveling	Students' interests should be determined by developing multiple skills areas.	1	7
		The visual literacy levels of students in different school types can be determined.	1	
		The reasons affecting students' perceptions of pseudoscience can be determined.	1	
		In the study group, a study can be carried out in terms of sub-dimensions of visual literacy proficiency.	1	
		The visual literacy levels and competencies of BİLSEM science teachers can be determined.	1	
		The visual literacy levels of students who took ASIS and different intelligence tests can be examined.	1	
		The situation of meeting the needs of gifted students in the science curriculum can be examined.	1	
	for Opinion Review	Student opinions about the activities can be examined.	3	4
		The views of science teachers about BİLSEM can be researched.	1	
	for Research Subject	Flipped Learning Model	1	24
		Critical thinking skills in the context of pseudo-scientific issues	1	
		Problem-based learning method	1	
		In-class materials or teaching techniques used by science teachers in the education of gifted children	1	
		Evidence-based successful practices	1	
		Epistemological belief	1	
		Misconceptions about nuclear energy	1	
		Visual literacy	1	
		Intelligence and genetics of gifted students	1	
		The effectiveness of the ÜYÜKEP model	1	
		Academic self-concepts	1	
		The effectiveness of the framework program	1	
		21st century skills	1	
		* The effect of out-of-school learning environments on skills	1	
		Programming education	1	
		Comparison of gifted and non-gifted students	4	
		*Online and face-to-face training applications can be compared.	1	
		Students with and without robotic coding training can be compared.	1	
		Comparison of STEM applications in Türkiye and abroad	1	
		Comparisons of students' academic achievements with visual literacy levels can be made.	1	
		Factors affecting the attitudes of gifted and non-gifted students towards plants can be determined.	1	
Suggestions for decision makers	for Teacher Candidates	Lectures on pseudoscience should be given.	1	6
		STEM oriented lesson should be given	1	
		Training should be given on the use of 3D technologies.	1	
		STEM laboratories should be established in education faculties.	1	
		Guidance teachers should be trained in gifted students' needs	1	
		A certified program should be created for the characteristics and education of gifted children.	1	
	for Teachers	In-service training should be provided for the identification process of gifted students and teaching programs.	3	
		* In-service training should be provided for teaching methods that can be used in the education of gifted students.	4	
		In-service training for STEM education should be given	3	
		In-service training should be provided for the characteristics of gifted students.	2	
		In-service training on the use of 3D technologies should be provided.	1	
		BİLSEM should provide in-service training to inform	1	

	In-service training on science literacy should be given	1	
	In-service training should be given for scientific imagination.	1	
	In-service training should be provided to support students' creativity.	1	
	They can use differentiated education models in lessons.	1	
	Developed UAP Curriculum Model should be used	1	20
	*It should develop distance education programs that teachers can easily access.	1	
for Learning Environments	The number of materials should be increased in BİLSEMs	2	
	Environments should be created where students can be challenged and develop themselves.	1	
	Learning environments suitable for STEM education should be created.	1	
	* Special classes should be opened for gifted students in schools.	1	
	Learning environments that will support the epistemic development of gifted individuals should be created.	1	
	BİLSEM class sizes can be reduced.	1	15
	* Laboratory or classroom environments containing the necessary infrastructure should be provided in BİLSEMs.	1	
	Organizing the teaching in BİLSEMs to be at least half a day.	1	
	Students' access to Science and Art Centers should be facilitated.	1	
	The number of Science and Art Centers should be increased.	1	
	* Schools providing education for gifted children should be opened.	1	
	Enriched and differentiated classrooms using problem-solving techniques should be designed.	1	
	A blended learning environment should be used.	1	
	*Use of out-of-school learning environments.	1	
for Teaching Programs	Modules and activities developed in research should be evaluated in curricula.	5	
	A special education program should be established.	4	
	*Increasing innovative innovation project practices	1	
	Training activities and needs must be completed	1	
	*In university exams, separate procedures should be used.	1	
	Class skipping should be applied	1	
	* A single and separate training activity should be organized	1	16
	The curriculum should be arranged in accordance with the STEM approach	1	
	* UZÜY education standards should be established	1	
Diagnostics	* their creativity should be measured	1	
	*Student opinions on science-technology-attitude should be taken	1	
	An interdisciplinary test should be developed for diagnosis	1	3
for Universities	STEM Education centers should be established in universities	1	
	Summer camps should be organized for gifted students at universities.	1	
	Program differentiation trainings can be given regularly with university-school cooperation.	1	
	Education, conference, congress and academic publications for STEM approach should be supported.	1	4
Budget	The budgets allocated to R&D studies should be increased.	1	2
	STEM festivals/festivals should be organized.	1	
Unspecified	There were no suggestions made.	1	2
	TÜBİTAK can increase the number of projects related to out-of-school learning environments.	1	

Note. Since there is more than one suggestion in some studies, the number is different. * Recommendations specifically accepted by researchers.