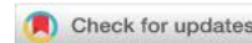


Makale

By Makale Makale



Content Analysis of Science Education Research in Special Education Journals

¹
Author^{1*}, Co-Author²

¹ Author Affiliation (10pt regular, center align), mail

² Co-Author Affiliation (if different from Author Affiliation) (10pt regular, center align), mail

Abstract: This study is about examining the special education studies on science education in the ERIC database. For this reason, the main facts tried to be determined in the content analysis conducted in this study are as follows: subject types of special education studies in the field of science education, change of preferred studies according to years, main objectives, research methods, sample sizes, data collection tools, research method, data analysis method, the types of disabilities of the individuals in my samples, the level of education of the participants, the types of techniques used in the analyses. The articles to be reviewed in the study were searched in ERIC databases. Articles covering the years 2010-2020 were based on the keywords "science", "special education", "chemistry" "physics" and "biology". As a result of the search, 87 articles were examined within the scope of science and special education at nineteen journals. Tables and graphics were used to make the findings more understandable. According to study results: It has been concluded that both researchers working in the field of special education and researchers working in the field of science education do not want to conduct science education studies with individuals with special needs; the special education studies were mostly conducted in the field of science and technology; the studies were mostly focused to STEM; it was determined that the most studies were done in the field of science education and the least in the field of physics, chemistry and astronomy; "Quasi-experimental" and "Multiple design" methods were preferred the most among the quantitative research methods.

Keywords: Special Education, Science Education, Meta-synthesis, ERIC database

Introduction

Individual differences are at the forefront of the factors affecting the academic success of students (Pirgon & Babacan, 2013). For this reason, students who differ significantly from their peers in terms of their individual characteristics and educational needs for various reasons are expressed as individuals in need of special education. Individuals with special needs may differ significantly from their peers, especially physically, mentally, emotionally, socially and developmentally (Soykan, Gemikonakli & Kanbul, 2019). According to the (World Health Organization [WHO], 2020) there are more than one billion disabled people in the world, and this amount is increasing every year. Therefore, while making im-

28
37 improvements in education policies, the fact that the number of individuals with disabilities is increasing
38 year by year should be taken into consideration. 14

39 Individuals with special needs should have a basic literacy level in order to continue their lives
40 without being dependent on other people. This can only be achieved by taking into account the needs of
41 individuals. One of the courses that facilitate the daily life of individuals in need of special education is
42 science education. Science literacy provides important contributions to students in discovering, under-
43 standing and explaining basic natural phenomena and gaining sustainability awareness. When the
44 studies in the field of special education in the literature are examined according to the subject areas, it
45 has been determined that the studies are mostly about certain subject areas. It has been determined
46 that studies on the subject areas curriculum (Gebbers, Evans & Murphy, 2010; Lee, 2020; Miller,
47 2012), teaching (Breit-Smith, Busch, Dinnesen & Guo, 2017; Cozendey & Costa, 2016; Knight,
48 Creech-Galloway, Karl, & Collins, 2018; Soykan, Gemikonakli, & Kanbul, 2019), teaching materials
49 (Carnahan, Williamson, Birri, Swoboda & Snyder, 2016; Marino, & Beecher, 2010), teacher education
50 (Kennedy, Rodgers, Romig, Mathews & Peebles, 2018) and students' general problems (Dukes &
51 Lamar, 2009; Wilson, Kim & Michaels, 2013) are more common. 21

52 In addition to these studies, there are studies in the literature that subject publications for stu-
53 dents with special education needs to content analysis. Some of the content analysis studies carried out
54 are as follows: Content analysis of Australian special education research conducted between 2005 and
55 2015 (Ralston, Dally & Dempsey, 2019); Content analysis of studies conducted in the field of special
56 education between 2009-2014 (Sakallı Demirok, Baglama & Besgul, 2015) Content analysis of master's
57 theses made in the field of special education between 2009-2014 (Sakallı Demirok, Besgul & Baglama,
58 2016); Content analysis of doctoral dissertations in special education between 1997-2010 (Walker &
59 Haley-Mize, 2012); Content analysis of experimental studies in the special education journal between
60 2004-2017 (Fisher, Spooner, Algozzine, Anderson, Brosh & Robertson, 2019); analysis of the papers in
61 the special education congress held between 2007-2017 (Aslan & Özkubat, 2019) Content analysis of
62 the journals published in the special education journal between 2004-2013 (Tiryakioğlu, 2014); Content
63 analysis of theses made in the field of special education between 2008-2013 (Coşkun, Dünder & Parlak,
64 2014) In addition to these studies, there are studies conducted in only one subject area in special edu-
65 cation: Content analysis on science studies for students with visual impairment 1972-2014 (Sözbilir, Gül,
66 Okçu, Yazıcı, Kızılaslan, Zorluoğlu, & Atilla, 2015); Content analysis of theses about gifted students be-
67 tween 2010-2015 (Schreglmann, 2016) Content analysis of studies on teaching science concepts to
68 students with multiple disabilities between 1985 and 2009 (Spooner, Knight, Browder, Jimenez &
69 DiBiase, 2011); Content analysis of studies on teaching science to students with special learning difficul-
70 ties between 2008 and 2017 (Karaer & Melekoğlu, 2020). 36

71 Content analysis is a method used to convey the studies done in a subject area in a certain time
72 period to the reader in a certain order. Content analysis should be original and capable of leading new
73 research. Unlike the existing studies, this study is about examining the special education studies on
74 science education in the ERIC database. For this reason, the main factors tried to be determined in the
75 content analysis conducted in this study are as follows: subject types of special education studies in the
76 field of science education, change of preferred studies according to years, main objectives, research
77 methods, sample sizes, data collection tools, research method, data analysis method, the types of disa-
78 bilities of the individuals in my samples, the level of education of the participants, the types of tech-
79 niques used in the analyses. It is thought that examining the trends of the studies in the ERIC database
80 between 2009-2020 in the mentioned directions will give an idea to the conduct of future special educa-

tion-science education studies and can create new criteria for new studies. Considering this aim of the study, answers to the following questions were sought:

1. What is the change in science education researches in special education journals by years?
2. What are the main targets of science education research in special education journals?
3. Which research methods were used in science education research in special education journals?
4. What are the sample sizes in science education studies in special education journals?
5. For which disability group were the science education researches in special education journals conducted?
6. What is the education level of the participants participating in science education research in special education journals?
7. What kind of data collection tools were used in science education research in special education journals?
8. What kind of data analysis method was used in science education research in special education journals?

*Corresponding author:



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Materials and methods

The study has been conducted using the method of document analysis. The meta-synthesis method was used to study the science education studies about to special education. Meta-synthesis is a sub-study of content analysis. Meta synthesis is the interpretation of these themes created by creating themes from studies done on a subject (Çalık & Sözbilir, 2014). The purpose of using the meta-synthesis method in the study is to reveal the orientation of science education studies in the field of special education.

The articles to be reviewed in the study were searched in ERIC databases. Articles covering the years 2010-2020 were based on the keywords "science", "special education", "chemistry" "physics" and "biology". As a result of the search, 87 articles were found within the scope of science and special education at nineteen journals. Studies were examined in detail in terms of year, purpose, method, sample size, sample education level, type of disability, data collection and analysis. The descriptive analysis method was used to present the data in tables and graphics. During the analysis, all studies were examined in detail in line with the questions determined in the study, and findings were obtained. Tables and graphics were used to make the findings more understandable.

Results

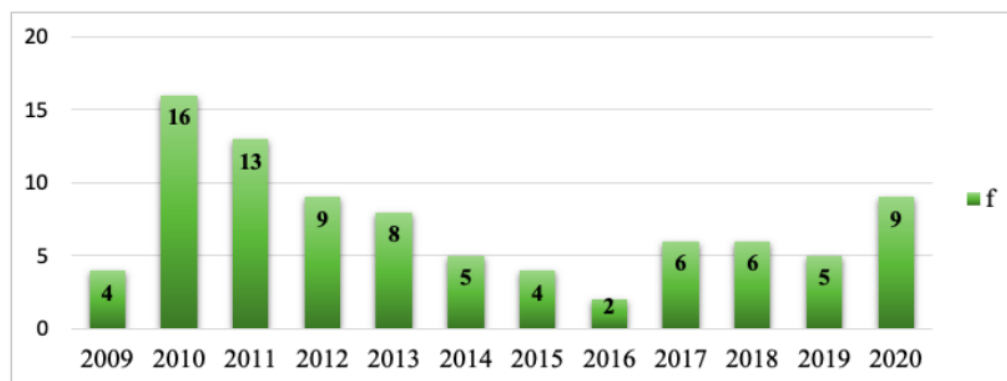
Table 1

Distribution of Articles According to Journals

Journal Name	Frequency (f)
Journal of Postsecondary Education and Disability	12

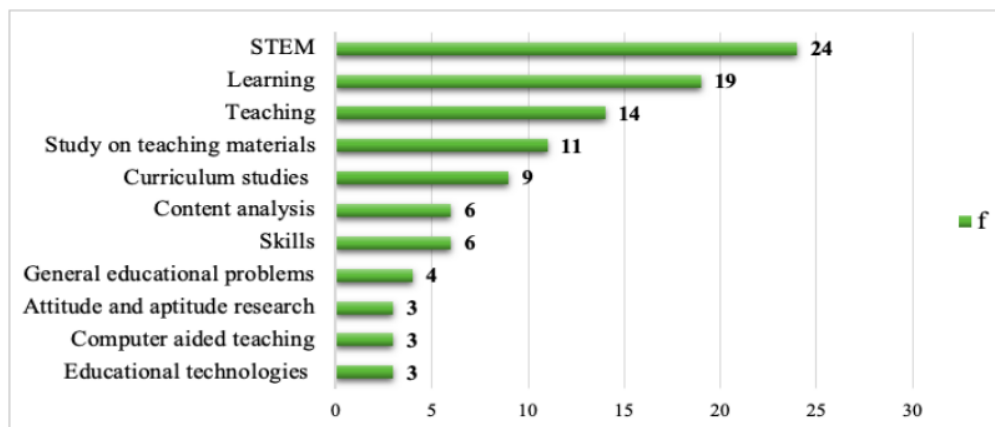
Teaching Exceptional Children	10
Learning Disabilities Research & Practice	9
Journal of Special Education Technology	8
Focus on Autism and Other Developmental Disabilities	7
Journal of Special Education	6
Remedial and Special Education	6
Learning Disability Quarterly	5
British Journal of Special Education	4
International Journal of Disability, Development and Education	4
International Journal of Special Education	3
Research and Practice for Persons with Severe Disabilities	3
Journal of the American Academy of Special Education Professionals	2
Journal of Special Education Technology	2
Journal of Learning Disabilities	2
Young Exceptional Children	1
Journal of Research in Special Educational Needs	1
Teacher Education and Special Education	1
Rural Special Education Quarterly	1
Total	87

In Table 1, it is seen that the science education studies published in special education journals are mostly published in the Journal of Postsecondary Education and Disability (13) and Teaching Exceptional Children (10); at least, in the journals Young Exceptional Children (1), Journal of Research in Special Educational Needs (1), Teacher Education and Special Education (1) and Rural Special Education Quarterly (1) (Graphic 1).



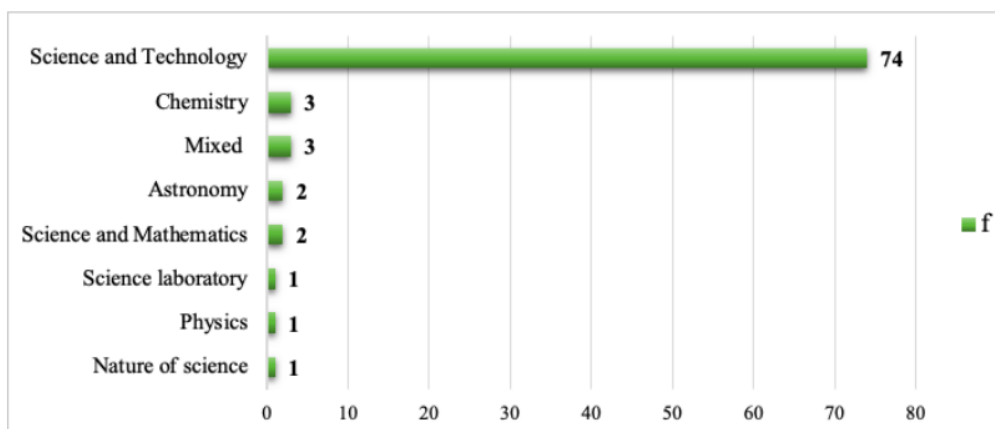
Graphic 1. Distribution of articles According to years

In Graphic 1, it is seen that 87 science education articles in special education journals were carried out mostly in 2010 (16) and 2011 (13); at least in 2009 (4), 2015 (4) and 2016 (2). In addition, it was determined that while the number of studies decreased regularly between 2010 and 2016; there was no definite decrease or increase between 2017 and 2020.



Graphic 2. Distribution of articles according to study objectives

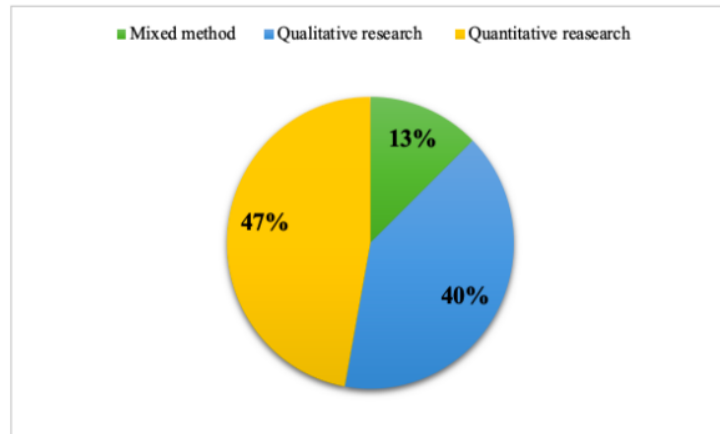
In Graphic 2, the target subject areas of science education studies in special education journals are mostly STEM (23), learning (19) and teaching (16); at least general educational problems (4), attitude and aptitude research (3), computer aided teaching (3) and educational technologies (3) study objectives.



Graphic 3. Distribution of articles according to main discipline

In Graphic 3, it is seen that the subjects of science and technology (74) are mostly preferred; astronomy (2) and science laboratory (1) subjects are the least preferred, according to their main disciplines.

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Graphic 4. Distribution of articles according to research method

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The frequency distributions of the research methods preferred in 87 science education articles are given in Graphic 4. Respectively, quantitative research methods (47%), qualitative research methods (40%) and mixed method (13%) were used in the articles (Graphic 4).

Table 2

Distribution of articles according to research method

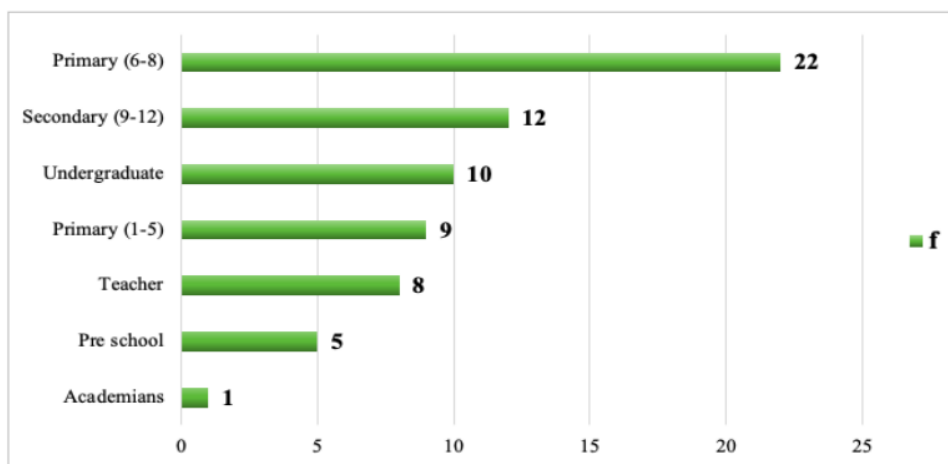
Research design	Research design type	Frequency	%
Quantitative Research	Quasi-experimental	10	14
	Multiple probe design	10	14
	Longitudinal	6	8
	Other	4	6
	Survey	3	4
	Meta-analysis	2	3
	Multiple baseline design	1	1
	Single subject design	1	1
	Ex-post facto	1	1
Total		38	52%
Qualitative research	Review	21	27
	Case study	4	6
	Other	2	3
	Cross design	2	3
	Phenomenography	2	3
	Single case design	2	3
	Action research	1	1
	Not reported	1	1
Total		35	48%

In Table 2, it is seen that quantitative research methods (52%) are preferred more than qualitative research methods (48%) in science education articles of special education journals. According to Table 2, quasi-experimental (10) multiple probe design (10), meta-analysis (2), single subject design (1) from the quantitative research methods are the least used. Review (21) from the quantitative research methods is the least preferred; single case design (2) and action research (1) are preferred. Among the qualitative research methods, review (21) is mostly preferred, while single case design (2) and action research (1) are the least preferred.

Table 3
Distribution of articles according to data collection tools

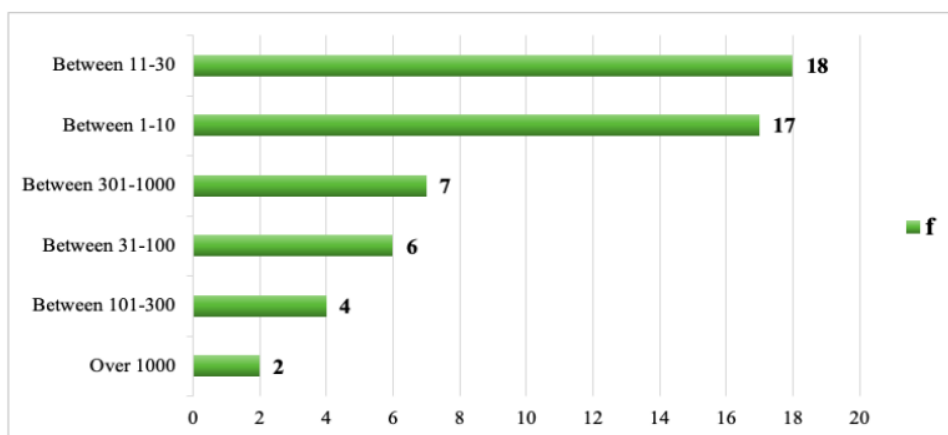
Data collection tools	Data collection tool	Frequency	%
Quantitative data collection tools	Questionnaire	14	18
	Likert	7	9
	Tests	6	8
	Open-end	6	8
	Achievement test	5	7
	Multiple choice	5	7
	Multiple resource	4	5
	Task	3	4
	Perception test	1	1
	Attitude test	1	1
	Intelligence test	1	1
Total		53	69%
Qualitative data collection tools	Observation	12	16
	Interview	8	11
	Focus group interviews	2	2
	Portfolio	1	1
Total		23	31%

In science education studies, quantitative data collection tools (69%) were preferred more than qualitative data collection tools (31%) (Table 3). According to Table 3, as quantitative data collection tools the mostly questionnaire (14) and likert (7) type; at least perception test (1), attitude test (1) and intelligence test (1) type data collection tools are preferred. While observation (12) and interview (8) are mostly preferred among qualitative data collection tools, focus group interviews (2) and portfolio (1) are the least preferred.



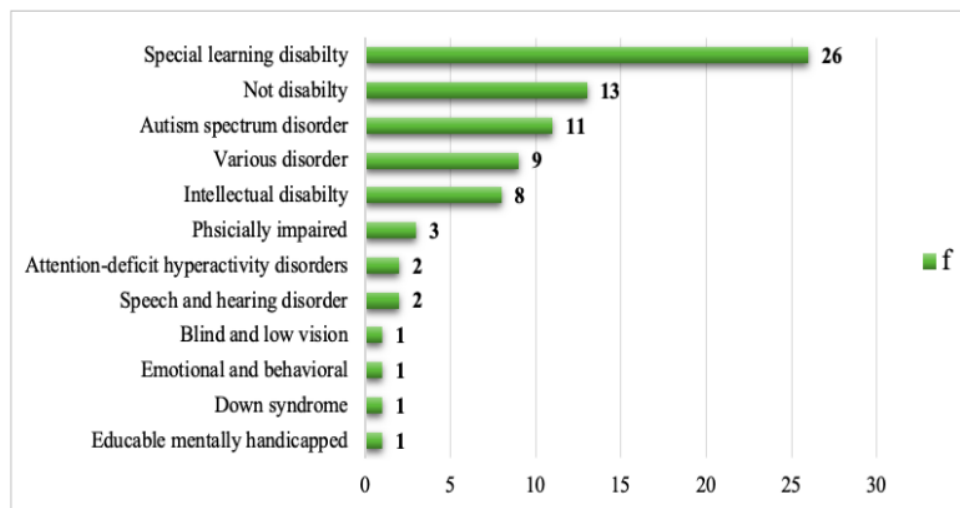
Graphic 5. Distribution of articles according to education level of the sample group

In science education studies, primary 6-8 (22) and secondary 9-12 (12) sample groups were mostly preferred; pre-school (5) and academians (1) sample groups were the least preferred (Graphic 5).



Graphic 6. Distribution of articles according to the sample group size

According to Graphic 6, It is seen that the sample sizes of science education studies in special education journals are mostly between 11 to 30 (33%) and between 1 to 10 (32%), at least between 101-300 and over 1000.



Graphic 7. Distribution of participants according to special needs types

In Graphic 7, It is seen that at the science education studies published in special education journals is carried out with mostly special learning disability (26), not disability (13) and autism spectrum disorder (11), at least physically impaired (3) attention-deficit hyperactivity disorders (2) and blind-low vision (1) individuals.

Table 4

Distribution of articles according to data analysis

Data analysis		Frequency (f)	%
Quantitative Analysis	ANOVA	13	16
	Frequency and percentage tables	14	20
	Logistic regression	6	7
	Descriptive statistics	4	5
	MANOVA	3	4
	Central tendency	3	4
	Meta-analysis	2	2
	t-test	2	2
	Task analysis	2	2
	Regression	2	2
	ANCOVA	2	2
	Correlation	1	1
	Factor analysis	1	1
	Constant comparative analysis	1	1
	Ordinary least squares model	1	1
Total		57	70%
Qualitative Analysis	Visual analysis	7	9

Other	6	8
Content analysis	4	5
Descriptive analysis	3	4
Cross case analysis	1	1
meta-synthesis	1	1
Constant comparison method	1	1
Thematic analysis	1	1
Total	24	30%

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204 According to Table 4, it is seen that quantitative data analysis methods (70%) are preferred more than
 205 qualitative data analysis (30%) methods in studies. ANOVA (13) and frequency and percentage tables
 206 (14) were the most preferred quantitative data analysis methods, while t-test (2) and factor analysis (1)
 207 were the least preferred. Among the qualitative research methods, visual analysis (7) was the most pre-
 208 ferred, while thematic analysis (1) and meta-synthesis (1) were the least preferred.

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Discussions

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213 When the special education journals are evaluated according to the number of science educa-
 214 tion publications in the last 11 years, the most publications are in "Journal of Postsecondary Education
 215 and Disability" and "Teaching Exceptional Children", and the least publications in "Young Exceptional
 216 Children" and "Journal of Research in Special Educational Needs". According to this finding, the high
 217 number of publications of science education studies in some journals may be due to the fact that the
 218 journal may be well-known in terms of publishing science education publications. When this result is
 219 evaluated from a general point of view, the number of science education studies of all journals that have
 220 published for 11 years has been found to be quite low. From this point of view, it has been concluded
 221 that both researchers working in the field of special education and researchers working in the field of
 222 science education do not want to conduct science education studies with individuals with special needs.

223 When the 87 special education journal science education studies in the ERIC database were
 224 evaluated according to the number of articles, the most studies were in 2010 and 2011; at least studies
 225 were published in 2009, 2015, and 2016. Although there was not much increase or decrease in the
 226 number of studies from 2017 to 2019, there was a significant increase in the number of studies in 2020.
 227 According to this finding, it can be said that the number of science education article studies has been in
 an unbalanced distribution since 2009. The highest number of science education studies in special ed-

228 ucation journals in 2010 and 2011 may be due to the popularity of science subjects studied in these
229 years. Finally, the sharp increase in 2020 compared to previous years can be interpreted as progress in
230 science education studies in special education.

231 When the science education studies in special education journals were evaluated according to
232 their fields of study, it was determined that most of the studies were conducted in the field of STEM.
233 With the recognition of 21st century skills by people, many multifaceted skills such as the individual's
234 productive, leader, self-directed and critical skills have come to the fore (Kurudayıoğlu & Soysal, 2019)
235 For this reason, researchers may have turned to subject areas such as STEM in order to determine the
236 changes in individuals with special needs. In addition, individuals with special needs in the 21st century.
237 The implementation of STEM applications in gaining skills improves these individuals from psychomotor,
238 affective and cognitive dimensions (Balçın & Yıldırım, 2021).

239 When the science studies in special education journals were evaluated according to their main
240 disciplines, it was determined that the most studies were done in the field of science education and the
241 least in the field of physics, chemistry and astronomy. Science education is given to individuals from an
242 early age (Ünişen & Kaya, 2015). For this reason, it is quite natural that science education is the most
243 studied subject. However, it is noteworthy that sub-disciplines such as physics, chemistry and astrono-
244 my were studied less in this study. Because science education is divided into sub-disciplines such as
245 physics, chemistry, biology and astronomy at high school level. In another finding of this study, the fact
246 that high school level sample groups were preferred most suggests that sub-disciplines should have
247 been studied more. It is thought that the sub-disciplines are not studied much at the high school level or
248 the situation examined in the studies is not clearly expressed, causing the studies to remain superficial.

249 When studies in the field of special education are examined, quantitative research types are
250 generally preferred with individuals with special needs (Çaka, 2020; Çelik, Sarı & Yıldırım Doğru, 2015;
251 McKissick, Davis, Spooner, Fisher & Graves, 2018; Sancar, Tozkoparan & Odabasi, 2017; Soykan,
252 Gemikonakli & Kanbul, 2019). In the study, when science education studies in special education jour-
253 nals were evaluated in terms of research methods, it was determined that "Quasi-experimental" and
254 "Multiple design" methods were preferred the most among the quantitative research methods. The main
255 reason for using these methods may be to reach the conclusion by making controlled changes between
256 the samples and to determine the correctness of the hypothesis from this point of view. Therefore, it is a

257 very correct practice to use these techniques in studies. Unlike the result of this study, Yıldız,
258 Melekoglu & Paftalı (2016) pointed out that there are few experimental studies in the field of special ed-
259 ucation and more should be done. However, since individuals with special needs have different charac-
260 teristics from normal individuals, the researcher may experience problems in collecting data (Cevahir &
261 Özdemir, 2015). When this finding of the study is evaluated in terms of qualitative research methods, it
262 is noteworthy that a general evaluation is mostly made in the form of "review". Yılmaz (2019) evaluated
263 the content analyzes on inclusive education and found that qualitative research is more than quantitative
264 research. Finally, the least mixed model is preferred in special education journals. This result may be
265 due to the thought that multidimensional examination of individuals with special needs may be difficult.

266 When science education studies in special education journals were evaluated in terms of data
267 collection tools, questionnaire, likert type scale, observation and interview techniques were preferred
268 most (Boyle, 2010; Carnahan, Williamson, Birri, Swoboda & Snyder, 2016; King-Sears & Johnson,
269 2020). Questionnaire and Likert-type scales are quantitative data collection tools (Creswell, 2012, p. 14)
270 Therefore, this finding is consistent with the result of focusing on quantitative research methods in the
271 study. As a result, this finding is consistent with the most preferred data collection tools in similar studies
272 carried out within the scope of special education(Sözbilir, et. al., 2015; Yılmaz, 2019).

273 When science education studies in special education journals are evaluated in terms of sample
274 group characteristics, "Special Learning Disability", "Autism Spectrum Disorder" are the most common;
275 it has been determined that it has been studied at least with Emotional and Blind and Visual impaired
276 individuals. The preference of individuals who do not have any needs as the sample group in the studies
277 examined may be due to the fact that they are both control and experimental groups in the studies. It
278 may be that in the studies examined, working hard with individuals with autism and learning disabilities
279 may be able to receive education under the name of inclusive education in schools. However, individu-
280 als with disabilities such as visually impaired and autism receive education with their peers at school
281 according to the level of their needs. From this point of view, it can be said that these individuals are in
282 the sample group that cannot be easily reached. As a result, there is information that these sample
283 groups are preferred in similar studies (Cevahir & Özdemir, 2015; Sancar, Tozkoparan & Odabasi,
284 2017).

285 When science education studies in special education journals were evaluated in terms of sam-

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286 ple size, it was determined that the preferred sample size was between 11-30 people and 1-10 students
287 (Mason & Hedin, 2011; VanBuskirk & Simpson, 2013; Wu, Chen, Lo & Chiang, 2020). This result of the
288 study shows parallelism with the literature (Cevahir & Özdemir, 2015; Sakallı Demirok, Besgul &
289 Baglama, 2016; Sözbilir, et al., 2015). The least preferred sample size in the examined studies is be-
290 tween 101 and 300 people. The reason for this situation is that it can be difficult to work with individuals
291 with special needs. Qualitative studies are studies that do not have generalization concerns. However,
292 studies with a quantitative point of view tend to generalize to the universe. For this reason, the prefer-
293 ence of large sample groups in studies is very important for the validity and reliability of the study. How-
294 ever, the fact that the sample groups are composed of individuals with special needs may create prob-
295 lems in the conduct of the study. When the sample groups are evaluated in terms of grade levels, max-
296 imum 6th-8th grades. It was determined that grade level and high school grade levels were preferred
297 (Cozendey & Costa, 2016; Gebbels, Evans & Murphy, 2010; Wilson, Kim & Michaels, 2013). This find-
298 ing is supported by a similar special education study (Sözbilir, et al., 2015).

299 When the data analysis methods preferred in science education studies in special education
300 journals were evaluated, quantitative data analysis methods were used the most. The most preferred
301 data analysis methods among quantitative data analyzes are "ANOVA" and "frequency and percentage
302 tables" (Hedrick, Dizen, Collins, Evans & Grayson, 2010; Therrien, Taylor, Hosp, Kaldenberg, & Gorsh,
303 2011) In addition, this result coincides with the use of quantitative data analysis techniques, among the
304 data analysis techniques, in studies conducted for similar purposes.(Aslan & Özkubat, 2019; Walker &
305 Haley-Mize, 2012). Another analysis technique used in the studies examined is qualitative data analysis
306 techniques. Among the qualitative data analysis, visual analysis, other and content analysis are pre-
307 ferred the most. When this finding was examined in terms of the methods used in the studies examined,
308 it was found to be partially consistent. Because, among the qualitative research methods in the studies
309 examined, there are research methods based on document analysis such as review and content analy-
310 sis.

311 Conclusions

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313 Based on the results stated above, the following suggestions may be recommended:

- The findings indicated that the special education studies were mostly conducted in the field of science and technology. Therefore, researchers should be directed to do more studies in astronomy, science laboratory, biology, physics and chemistry education
- The findings obtained from analysis indicated that the studies were mostly focused to STEM. Therefore, in the framework of the needs identified, more studies are needed in facilitate learning objectives.
- The scope of science education studies in special education journals should be expanded by including different samples with a specific target group. Also, it should be worked with larger samples to reliability and validity.
- Researchers should be encouraged about usage of different data analysis such as qualitative and mix data analysis in addition to quantitative data analysis.
- Taking into account the criteria of inclusion and exclusion from the research, such as the fact that this study was conducted in the field of only science education, special education, chemistry education, physics education and biology education; the articles in other databases were not included from the research due to examining the journals indexed in ERIC database. This situation are thought as limitation of this study. Therefore, it is suggested that thus the scope of study should be more expanded.

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Conflict of interests

The authors declare no conflict of interest.

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