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Research Article

Determining the trend of science education topics in gifted education research with R studio program

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Abstract

The aim of the study is to examine the trends and results of studies on giftedness in science education by making bibliometric analyzes through the R program. For this purpose, 443 scientific studies published between 2000 and 2022 were accessed from Web of Science (WoS). The data were analyzed under the headings of numerical distribution by year, keyword, active scientific study, active researcher, active journal, active institution and most collaborating country. Result show that the most published scientific study on giftedness in science education was in 2016 and the highest citation rate was in 2003. The most common and central keywords related to giftedness in science education were "learning", "creativity" and "development". In addition, the most influential scientific study was "Tracking exceptional human capital over two decades", the most prolific author was "VanTassel-Baska, J.", the most influential journal with the highest co-citation network was "Gifted Child Quarterly", the most influential institution was "National Taiwan Normal University", and the most collaborative country was "USA". This study provides a perspective for future studies by revealing the gaps and emerging trends of giftedness in science education.

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Introduction

Human beings have been to influence and make sense of the environment and the world since the day they came into existence. In this endeavor, individuals whose mental potential, problem-solving skills, creativity and leadership qualities are superior to others, i.e. gifted individuals, emerge more prominently (Tarhan & Kılıç, 2014). It is difficult to define a gifted individual because of his/her complex structure. However, in general, gifted individuals have higher levels of intelligence, talents, expertise, creativity and motivation compared to individuals with normal development. A gifted individual is a person who transfers these characteristics to fields such as science, technology, leadership, creativity, art, aesthetics, music and shows high performance in these fields (Feldhussen, 1986; Kaya, 2022). Considering these gifted students need to be educated. Because although gifted individuals have some innate talents, it is difficult for gifted individuals to reveal their true potential without a good education. Therefore, gifted individuals, who make up approximately 2% of every society and are seen as an above-ground treasure for countries, should receive a good education designed for them (Tanık Önal & Büyük, 2020). It is important for a society to recognize and identify gifted individuals from an early age and provide them with appropriate education. This is because it is believed that gifted

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individuals who are well educated from an early age will produce science, technology, aesthetics, art and practical benefits and thus accelerate the development of society (Betts, 1986; Tortop & Kunt, 2013). In this sense, the education that society provides to gifted individuals is of vital importance in every step of the process of developing their talents. Society should strive for a good education for gifted individuals and gifted individuals should take charge of their own development and growth. Finally, the ultimate goal of gifted individuals in education should be prestige and high achievement (Subotnik, Olszewski-Kubilius & Worrell, 2011).

Research on academically giftedness or giftedness in science

The importance of science and technology in understanding and interpreting the world is undeniable. It is a fact that gifted individuals play a key role in the development of fields such as science, technology and arts. Countries care about gifted people and their education in order to raise the living standards of the society, to increase their power in science, technology and industry, and to make economic gains. In this respect, giftedness has been an important area of research in recent years. Gifted individuals have above-average creativity and scientific research skills. They show strong engagement, interest and motivation in science. Therefore, gifted individuals tend to choose science and technology related courses and show high motivation in those courses. One of the most important courses to provide this service to gifted students is science (Han & Shim, 2019; Kaya, 2022). Science lessons support students' scientific development and develop their sense of curiosity. Thanks to science course, gifted students can create new products and take these skills beyond school. For example, gifted students can design experiments, create personal laboratories and actively participate in scientific journals and books. Therefore, science education for gifted students is necessary (Kunt & Tortop, 2017).

In science, students construct new knowledge through research, reading and discussion. Through these lessons, students also learn how to predict the consequences of their actions. Such achievements reveal the importance of science courses (Tekbıyık & Akdeniz, 2008). Science education is the pathway through which individuals develop their creativity, develop scientific understanding and foresight, and apply scientific literacies to daily life. In addition, the intelligence, aptitudes, talents, expertise, motivation and creativity characteristics of gifted individuals are likely to become more evident of science. Therefore, the field of giftedness in science education has become a priority for countries and states due to these characteristics of gifted individuals and their support for the development of their countries (Demir & Çelik, 2020; Feldhusen, 1986; 1994; Sumida, 2013).

Bibliometric studies and importance

Content analysis and bibliometric analysis are used to map scientific studies. Content analysis examines abstracts of full texts and explores thematic organization, the use of methods and paradigms in a particular field. Content analysis is time-consuming and laborious. It is also limited in terms of analyzing many scientific studies. Another limitation of content analysis is that it is performed subjectively by an author or group (Kuzhabekova, Hendel & Chapman, 2015). Bibliometrics is a quantitative and systematic method that allows an objective evaluation of the literature (Garfield, 1979; Mourao & Martinho, 2020). Bibliometric studies examine coded information about the publication such as the name of the author, the institution to which the author is affiliated, the country where the author lives, keywords, etc. without examining the content of scientific studies. The aim here is to identify and evaluate the status of authors, journals, institutions and countries. It also supports the discovery of patterns of ranking and collaboration in terms of productivity related to the publication. This is achieved through special software that can analyze the bibliographic record (Hernández-Torrano & Kuzhabekova, 2019). Although the use of bibliometric methods is not new (Kessler, 1963), its use is increasing thanks to databases such as WOS, SCI and SSCI, which are easily accessible online. The validity of research articles also largely depends on the representation of the scientific topic being researched in the database (Mongeon & Paul-Hus, 2016). One of the databases that can provide this validity is Web of Science (WoS) (Bicakci & Baloglu, 2021).

Bibliometric analysis provides researchers with insight, enabling them to progress in their work, such as citations of research areas, authors' subject areas, methodologies, and values of other authors' work (Ertz & Leblanc-Proulx, 2018; Zupic & Čater, 2015). Bibliometric studies are significant as to determining the current situation in the field in a holistic

manner and guiding researchers (Demir & Çelik, 2020). When the literature is examined, bibliometric studies on giftedness are found (Gürlen, Özdiyar & Şen, 2019; Hernández-Torrano & Kuzhabekova, 2019; Sierra et al., 2015). Although these studies add a lot of value to the field of giftedness, there are no studies that have conducted bibliometric analyses on giftedness in science education. In addition, it is thought that the study will make significant supports the field because it covers a 52-year period between 1970 and 2022, includes 433 articles, and bibliometric analysis and citation network analysis, thematic analysis, etc. are done with a different analysis program than others by using only R Studio program.

Research aim and problem

The aim of this study is to determine the bibliometric characteristics and common citation network structure of the studies on giftedness in science education and to determine the trends in the field and the effective documents, researchers, sources and countries. This study will provide a solid basis for future studies through bibliometric analysis of giftedness in science education. In addition, it is hoped that this study will shed light on the under-studied topics related to giftedness in science education and the basic resources that guide the field. In this context, answers to the following problems were sought in the study:

- What is the numerical distribution of scientific studies published on giftedness in science education and their citations by years?
- What is the keywords network for giftedness in science education?
- Which are the most effective studies published on giftedness in science education?
- Who are the most prolific authors on giftedness in science education and who are the authors with the most common citation network?
- Which is the most influential scientific journal on giftedness in science education and which journal has the most common citation network?
- Which institutions are effective in scientific studies published on giftedness in science education?
- Which countries cooperate the most in scientific studies published on giftedness in science education?

Method

Research Model

In this study, a bibliometric analysis of studies on giftedness in science education was conducted. Bibliometrics is based on statistical and mathematical methods used to identify studies in a particular field according to certain parameters (Pritchard, 1969). The flow chart used for the bibliometric method in this research is shown in Figure 1. In this regard, a 5-step procedure was carried out for mapping in management and organization (Zupic & Čater, 2015).

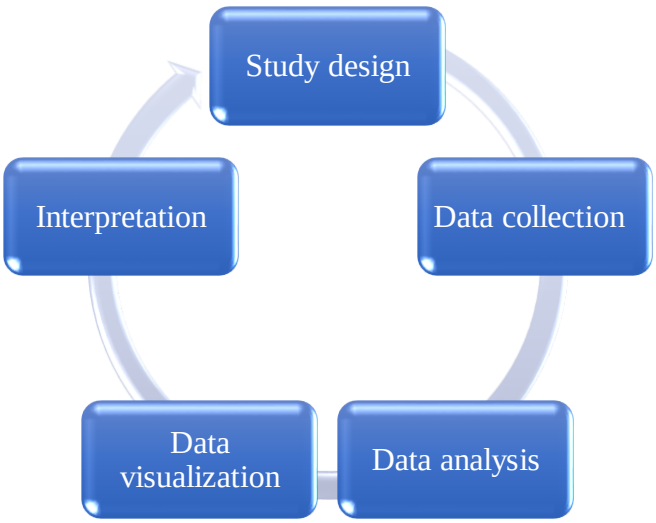

Figure 1. Workflow implementation steps in bibliometric analysis

In the first step of the research, questions are defined and a bibliometric method appropriate to the answer to the questions is selected. In the data collection step, databases such as WoS, Scopus and SSCI are selected and the data are exported by filtering and scanning according to the research questions. In this step, the researcher creates his/her own data. In the data analysis step, the data is analyzed using a bibliometric software. In the data visualization step, programs such as R, Citespace and vosviewer that can be used to visualize the results obtained in the analysis step are decided and appropriate software is used for visualization. Finally, in the data interpretation step, the results are interpreted and explained.

Data Collection Techniques

In order for bibliometric analyses to take place, it is necessary to collect data appropriate to the design of the research. Databases likes WoS, Scopus, and Microsoft Academic are used for data collection in bibliometric analysis. In this study, the Web of Science database was preferred because it has multiple databases, contains citation data, and covers different formats such as abstracts, proceedings, and technical articles (Moral-Muñoz, Herrera-Viedma, Santisteban-Espejo & Cobo, 2020). Web of Science Core Collection Advanced Search database 1970- Between 2022, the "Topic" field was selected and “"gifted education" or "gifted student" or "gifted child" or "gifted" or "giftedness" or "giftedness" or "talented education" or "talented student" or "talented child" or "talent" or "talentless"” and “"science education" or "science teaching" or "science learning" or "science instruction" or "science content" or "science concepts" or "science facts" or "science activities" or "science curriculum" or "science class" or "science classes" or "science teachers" or "science material" or "science achievement" or "science program" or "science vocabulary" or "science laboratory" or "science text" or "science text" or "science textbooks" or "science performance" or "science centre" or "science unit" or "science study" or "science standard" or "science passages" or "science course" or "science inquiry" or "science for students" or "interest in science" or "teaching science" or "learning in science" or "education in science" or "inclusive science"”. As a result of the search, 449 scientific studies were reached (Access Date: 25 Jully 2023). It has been left out as the year 2023 continues. There may be the same and incorrect index documents that may arise from this and the first study published on giftedness in science education was in 1970, the search was limited between 1982-2022 and the number decreased to 433. Regarding the document type of scientific studies, the most common types were articles (n=278, 64.2%), proceedings paper (n=118, 27.3%) and other (review, editorial material, etc.) (n=37, 8.5%).

Data Analysis

The changes in research data such as organization, region, source, research method, number of citations were determined through the Office 2021 program and the data were uploaded to the R Studio program. R studio is a statistical package used for bibliometric and visualization of data obtained from Bibliometrix, WoS and Scopus databases. Bibliometix is a bibliometric analysis package written in R. R program consists of open libraries, open algorithm and open graphical software. This allows for statistical algorithms, mathematical operations and visualization. This makes it a good candidate for bibliometric analysis (Derviş, 2019). Through R studio, the numerical distribution of scientific studies of giftedness in science education, keyword analysis, the most effective scientific studies, the most effective authors, the most effective sources, the most effective institutions and the countries that cooperate were analyzed. Visuals were also included as a result of the analysis.

Results

In this study, the annual number of publications and citations, word analysis, influential researchers, influential journals, influential institutions and influential countries of scientific studies on giftedness in science education were examined and findings were reached.

The distribution of citations and publications of 433 scientific studies on giftedness in science education, which were obtained as a result of the search, is presented in Figure 2.

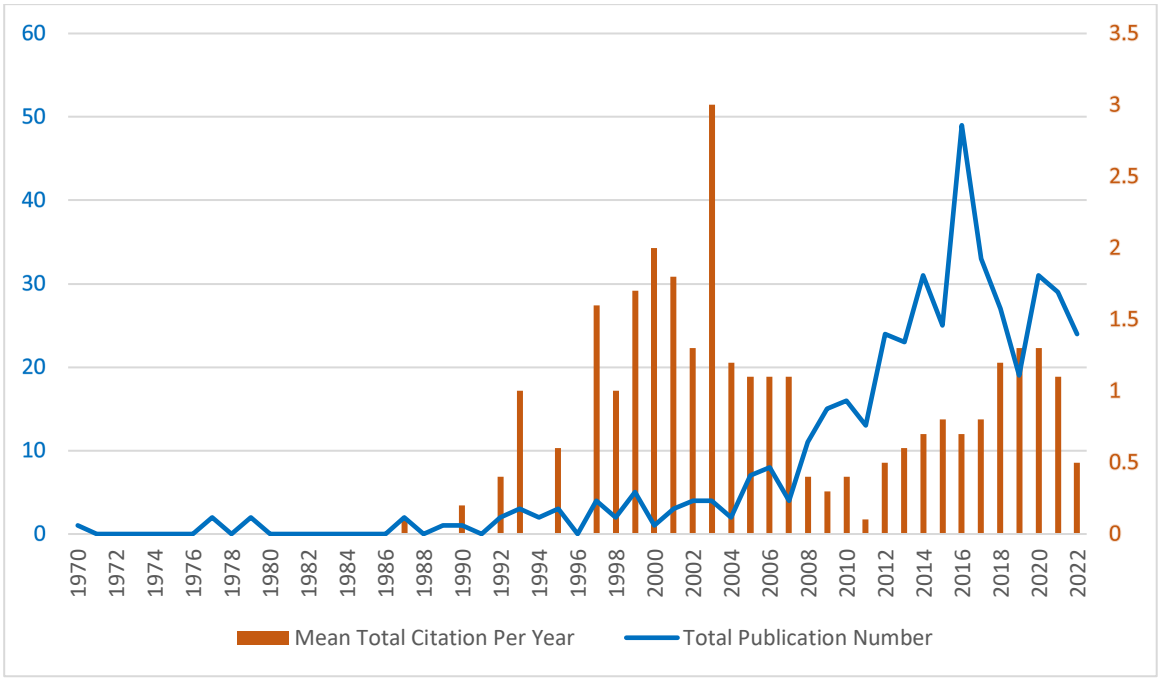

Figure 2. Number of citations and publications of scientific studies on giftedness in science education

Figure 2 shows that the upward trend studies on the field started in 2008 and reached its maximum level in 2016. Looking at the annual total citation averages, it is seen that the upward trend started in 1997 and reached its maximum level in 2003. From 2008 to 2022, the ratio of publications to total publications is 85.5%, and from 1997 to 2022, the ratio of citations to total citations is 90.1%.

The thematic analysis of keywords related to scientific studies on giftedness in science education is presented in Figure 3.

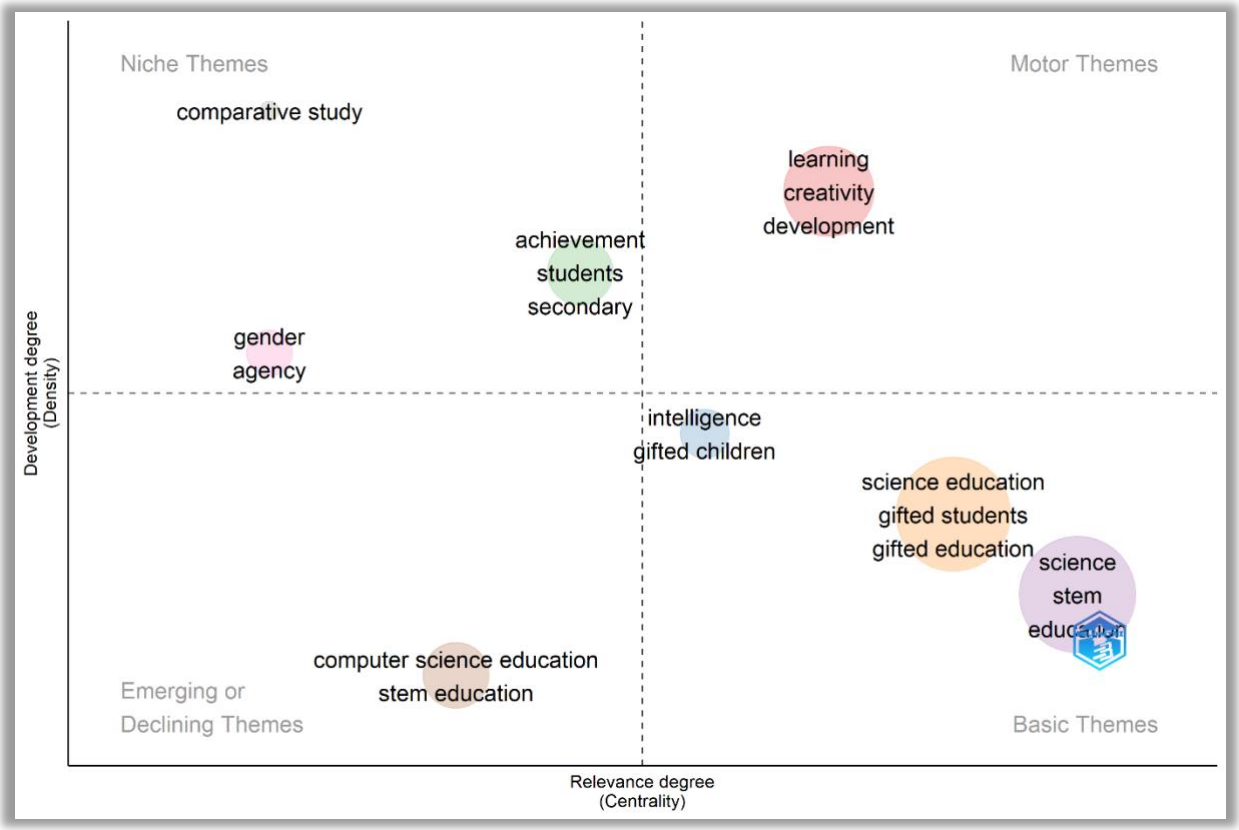

Figure 3. Thematic analysis of keywords related to scientific studies on giftedness in science education

A total of 1563 keywords, including 1176 different types of keywords, were identified for studies on giftedness in science education. When the graph is analyzed, it is seen that the words "science education", "stem", "gifted student" and

"gifted education" are in centrality. The words with both centrality and density in the related field are "learning", "creativity" and "development". In other words, the keywords "learning", "creativity" and "development" were determined as the most robust keywords in the literature. In addition, it is seen that "intelligence" and "gifted children" have a centrality above the medium level and a density slightly below the medium level. In addition, "computer science education" and "stem education" are considered as disappearing or emerging keywords, while "comparative study" is considered to be decentralized but widespread. The top 10 most cited scientific studies on giftedness in science education are presented in Table 1.

Table 1. The top 10 most effective scientific studies on giftedness in science education according to the level of citation

Name of article	Authour(s)	Year	Journal	LC	GC
Tracking exceptional human capital over two decades	Lubinski, D., Benbow, C. P., Webb, R. M., & Bleske-Rechek, A.	2006	Psychological Science	5	118
The effects of a science-focused STEM intervention on gifted elementary students' science knowledge and skills	Robinson, A., Dailey, D., Hughes, G., & Cotabish, A.	2014	Journal of Advanced Academics	5	39
Identifying twice-exceptional children and three gifted styles in the Japanese primary science classroom	Sumida, M"	2010	International Journal of Science Education	4	7
Science enrichment programs for gifted high school girls and boys: Predictors of program impact on science confidence and motivation	Stake, J. E., & Mares, K. R"	2001	Journal of Research in Science Teaching	3	104
Self-regulated science learning with highly gifted students: The role of cognitive, motivational, epistemological, and environmental variables	Neber, H., & Schommer-Aikins, M.	2002	High Ability Studies	3	104
The translation of teachers' understanding of gifted students into instructional strategies for teaching science	Park, S., & Oliver, J. S".	2009	Journal of Science Teacher Education	3	17
Project Clarion: Three years of science instruction in Title I schools among K-third grade students	Kim, K. H., VanTassel-Baska, J., Bracken, B. A., Feng, A., Stambaugh, T., & Bland, L.	2012	Research in Science Education	3	17
Encouraging talented girls in math and science: Effects of a guidance intervention	Kerr, B., & Robinson Kurpius, S. E.	2004	High Ability Studies	2	47
Gendered practices in the education of gifted girls and boys	Kerr, B. A., Vuyk, M. A., & Rea, C.	2012	Psychology in the Schools	2	13
Visual–spatial ability: Important in STEM, ignored in gifted education	Andersen, L.	2014	Roeper Review	2	36

LC: Local Citation **GC**: Global Citation

Table 1 shows that the most cited is "Tracking exceptional human capital over two decades". This study was published in 2006 in the journal "Psychological Science" by the authors "Lubinski, D., Benbow, C. P., Webb, R. M., & Bleske-Rechek, A.". It was found that the study was cited 5 locally and 118 globally. This study is followed by the article titled "The effects of a science-focused STEM intervention on gifted elementary students' science knowledge and skills". It was determined that the study was cited at 5 local and 39 global levels. The third most cited study on giftedness in science education is the article titled "Identifying twice-exceptional children and three gifted styles in the Japanese primary science classroom". This study was cited 5 at local level and 7 at global level.

The productivity of the authors publishing on giftedness in science education by years and the co-citation network of the authors are presented in Figures 4 and 5, respectively.

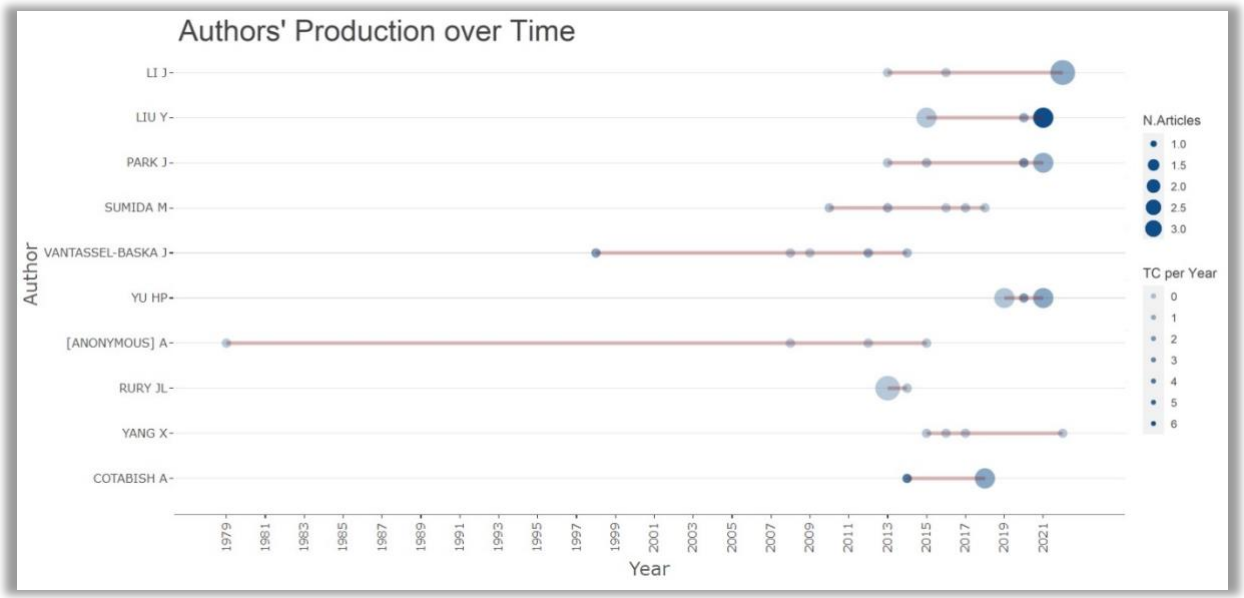

Figure 4. Productivity of authors publishing on giftedness in science education by years

When the productivity of the authors related to giftedness in science education was analyzed, it was determined that VanTassel-Baska, J. had 5 publications and 80 citations between 1198-2014, Liu, Y. had 5 publications and 25 citations between 2015-2021, Sumida, M. had 5 publications and 20 citations between 2010-2018, Park, J. had 5 publications and 19 citations between 2013-2021, and Yu, H. P. had 5 publications and 15 citations between 2019-2021.

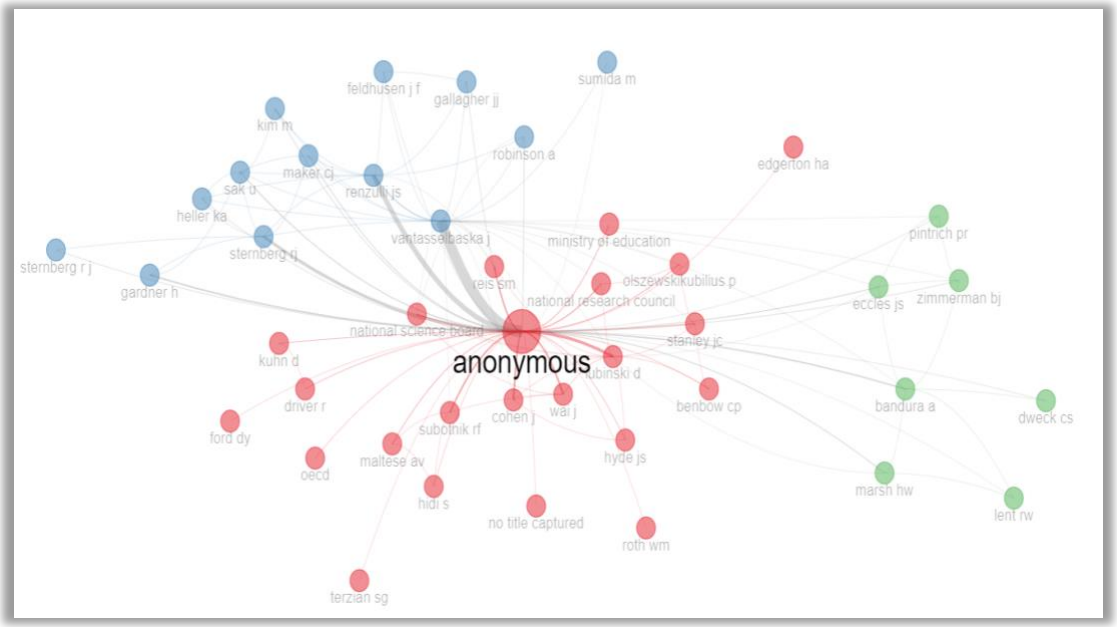

Figure 5. Co-citation network analysis of authors publishing on giftedness in science education

In the analysis of the most common citation network in scientific studies on giftedness in science education, it was determined that the authors were "Anonymous (betweenness; 1377,5)", "Renzulli, J. S. (betweenness; 62,144)", "Robinson, A. (betweenness; 55,6)", "Subotnik, R. F. (betweenness; 53,435)" and "VanTassel-Baska, J. (betweenness; 45,4)" respectively.

The top 10 most effective references on giftedness in science education are presented in Table 2 and the co-citation network of the references is presented in Figure 6.

Table 2. Top 10 most influential references on giftedness in science education

Journals	h-i	g-i	m-i	TC	NP	PYS
Gifted Child Quarterly	9	15	0,167	226	17	1970
Journal for the Education of the Gifted	8	10	0,258	175	10	1993
Journal of Advanced Academics	7	10	0,368	142	10	2005
International Journal of Science Education	6	8	0,24	153	8	1999
Journal of Research in Science Teaching	5	6	0,147	199	6	1990
High Ability Studies	4	5	0,182	195	5	2002
Roeper Review-a Journal on Gifted Education	4	5	0,286	64	5	2010
Science Education	4	5	0,125	324	5	1992
Academic Medicine	3	3	0,12	61	3	1999
Journal of Biological Education	3	4	0,13	16	4	2001

h-i:h-index, g-i:g-index, m-i:m-index, TC:Total citation, NP: Number of publication, PYS: publication year start

When the journals related to giftedness in science education are analyzed, it is seen that "Gifted Child Quarterly", "Journal for the Education of the Gifted" and "Journal of Advanced Academics" are the most effective journals.

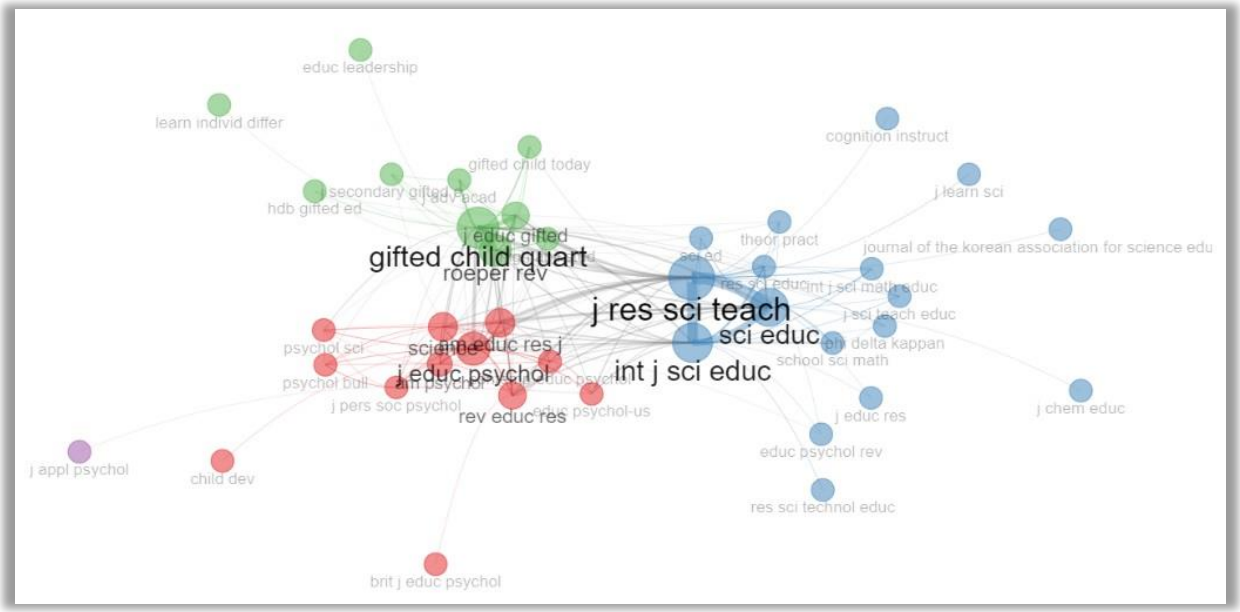

Figure 6. Co citation network analysis of journals published within the scope of giftedness in science education

Among the journals with "co-citation network" related to giftedness in science education, the most active ones are "Gifted Child Quarterly (betweenness; 287,3)", "Journal of Research in Science Teaching (betweenness; 229,6)", "Journal of Educational Psychology (betweenness; 125,7)", "International Journal of Science Education (betweenness; 89,8)", and "Science Education (betweenness; 64,4)".

The institutions that are active in scientific studies on giftedness in science education are presented in Figure 7.

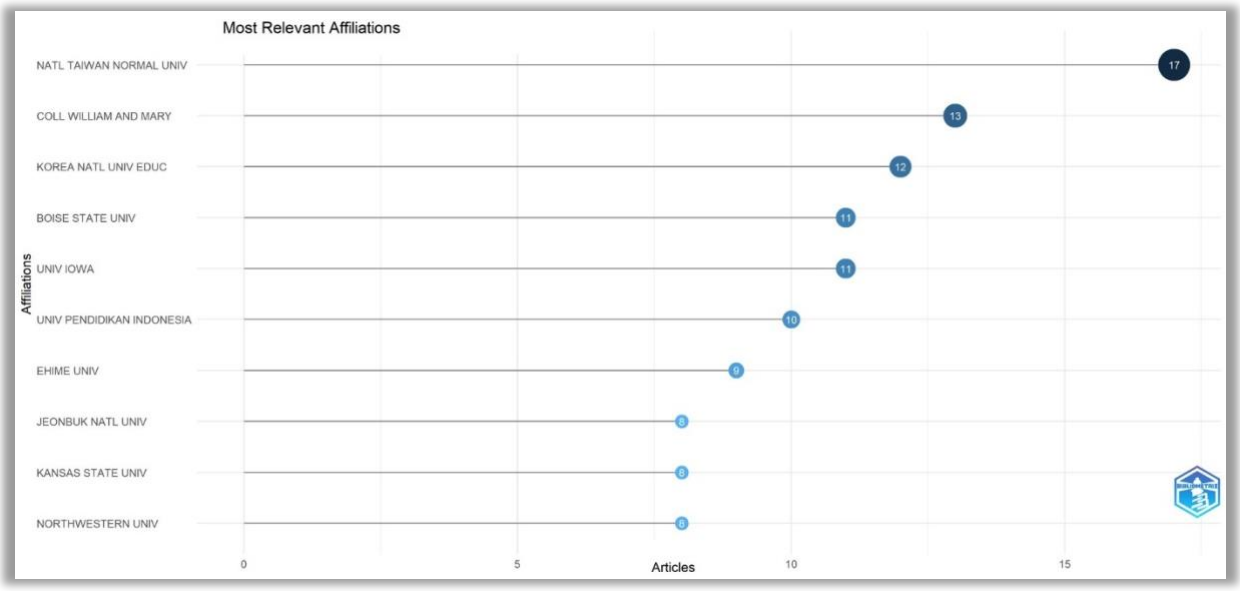

Figure 7. Institutions active in scientific studies on giftedness in science education

Figure 7 shows that the most influential institutions are "National Taiwan Normal University" with 17 scientific studies, "College of William and Mary" with 13 scientific studies and "Korea National University of Education" with 12 scientific studies.

Scientific studies published on giftedness in science education were analyzed and the most collaborative and influential countries and the publication network are presented in Figure 8.

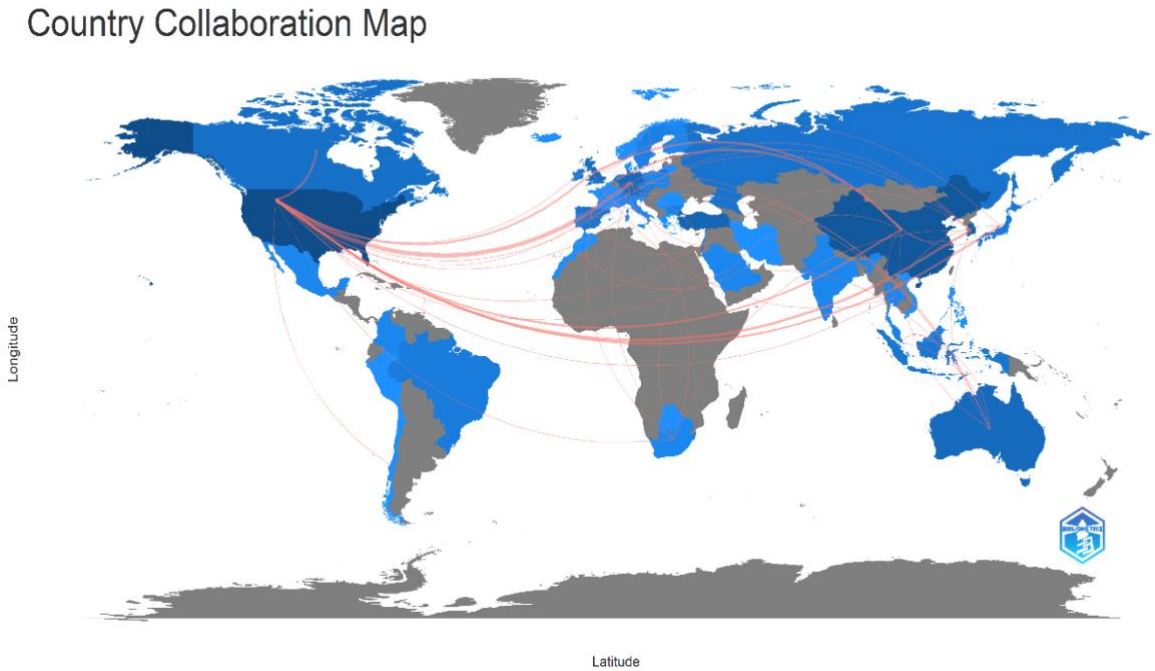

Figure 8. Countries with the highest number of active collaborations on giftedness in science education

Among the countries with the highest number of collaborations in scientific studies on giftedness in science education, it was determined that USA (461 publications, 2285 citations), China (188 publications, 197 citations), Korea (106 publications, 103 citations), Turkey (55 publications, 93 citations), Australia (35 publications, 79 citations), Germany (33 publications, 257 citations), Japan (20 publications, 20 citations), Spain (20 publications, 63), UK (20 publications, 31 citations) and Russia (20 publications, 12 citations), respectively.

Conclusion

In this study, a holistic evaluation of the international literature on giftedness in science education was conducted with bibliometric analysis technique using R software. Bibliometric studies in a certain field provide opportunities for researchers to see the "big picture" (Karagöz & Şeref, 2019). The bibliometric study conducted within the scope of giftedness in science education provides researchers who will work in this field with the opportunity to obtain information about the field, to identify the positive, strong, deficient and weak aspects of scientific publications and to evaluate the performance of publications. The aim of this study is to examine the distribution of scientific studies on giftedness in science education by years, keywords, the most influential scientific studies in this field, the most influential authors, the most influential journals, the most influential institutions and the most collaborating countries.

When the studies conducted in the relevant field are examined in the research, it is determined that the upward trend in the number of studies started in 2008 and reached its maximum level in 2016. There are similar results in the literature. Looking at the bibliometric studies on giftedness, it was determined that the most frequent publications were in 2016 in the study by Gürlen, Özdiyar & Şen (2019) and Baylarova & Baloğlu (2023), 2017 in the study by Bicakci & Baloglu (2021), 2018 in the study by Hernández-Torrano and Ibrayeva (2020), and 2020 in the study by Baccassino & Pinnelli (2023). In addition, in Yurdakul and Bozdoğan's (2022) bibliometric study on science education, it was determined that the most articles were published in 2019 and there was an upward trend after 2005. The ratio of research and citations in the last 10 years to the whole is approximately 85-90%. This shows that studies on giftedness in science education have increased in the last 10 years. Especially after the 2000s, researchers can access libraries in many parts of the world via the internet. The widespread use of online databases may have supported the acceleration of publications related to the field after the 2000s. It was determined that the upward trend of publications has decreased since 2016, albeit partially. This may indicate that the studies on giftedness in science education have reached saturation. In the study, it was determined that the upward trend started in 1997 and reached its maximum level in 2003. In addition, if we divide the studies in the field into beginning, middle and end sections in terms of time, the studies in the first section represent the foundation of the field, the studies in the second section represent the body rising on the foundation, and the last section represents more extreme points. Therefore, more recent studies have been cited less, while earlier studies have been cited more (Bicakci & Baloglu 2021). There are similar results in the literature (Hernández-Torrano & Ibrayeva, 2020). In contrast to this situation, in Baylarova & Baloğlu's (2023) bibliometric analysis study on the social-sensory problems of gifted children, it was determined that citations related to the related field have increased more in recent years.

As a result of the thematic analysis of the keywords, it was determined that "learning", "creativity" and "development" were found in the engine section, that is, in both the common and basic/central sections. These were identified as the most robust and prominent keywords related to gifted students in science education. On the other hand, "science education", "stem", "gifted student" and "gifted education" were identified as core/center words, and "intelligence" and "gifted children" were identified as medium level publications and core words. In addition, "computer science education" and "stem education" are considered as vanishing or emerging keywords, while "comparative study" is in the niche theme, that is, it is located far from the center. It was also determined that "gifted" and "science" were generally used as keywords in studies on giftedness in science education. Similarly, it was determined that the words "gifted", "giftedness", "gifted student", "students", "gifted education", "education" "children" were frequently used in studies on giftedness (Baccassino & Pinnelli, 2023; Baylarova & Baloğlu, 2023; Gürlen, Özdiyar & Şen, 2019). In the studies conducted within the scope of bibliometric analysis in science education, it was determined that the keywords "science education", "science", "science teaching", "education", "student" "professional development", and "science" were used most frequently (Demir & Çelik, 2020; Yurdakul & Bozdoğan, 2022). It is recommended to use the keywords in Figure 3 in future studies on giftedness in science education.

When the studies on giftedness in science education were examined, it was determined that the study titled “Tracking exceptional human capital over two decades” published in the journal “Psychological Science” in 2006 received the highest citation at the local and global level. Perhaps what makes this study special and pioneering in the field is the fact that gifted students were identified before the age of 13, followed for 20 years and compared with other top achievers in

terms of creativity, professional and life achievements. The second study that received the highest citation in the field was “The effects of a science-focused STEM intervention on gifted elementary students' science knowledge and skills” published in the “Journal of Advanced Academics” in 2014. This study is an experimental study conducted with gifted students and the experimental process in the study lasted 2 years. The most prolific authors on giftedness in science education were VanTassel-Baska, J., Liu, Y., Sumida, M., Park, J., and Yu, H.P., respectively. However, when the co-citation network of the authors is taken into consideration, it is determined that the most active authors are "Anonymous", "Renzulli, J. S.", "Robinson, A.", "Subotnik, R. F." and "VanTassel-Baska, J.", respectively. Similarly, in the study conducted by Gürlen, Özdiyar & Şen (2019) with gifted students, "Renzulli J. S." and "VanTassel-Baska, J." come to the forefront in studies on giftedness. Similarly, "VanTassel-Baska, J." stands out in the study conducted by Baccassino & Pinnelli (2023) with gifted students.

When the most effective journals related to giftedness in science education were examined, it was found that the most effective journals were “Gifted Child Quarterly”, “Journal for the Education of the Gifted”, “Journal of Advanced Academics”, “International Journal of Science Education” and “Journal of Research in Science Teaching”, respectively; and the most effective journals among the journals with “co citation network” were “Gifted Child Quarterly”, “Journal of Research in Science Teaching”, “Journal of Educational Psychology”, “International Journal of Science Education” and “Science Education”, respectively. When the most active journals related to giftedness in science education are analyzed, it is seen that journals generally publish studies related to giftedness and/or science education. Similarly, when the studies on giftedness are examined, “Gifted Child Quarterly”, “Journal for the Education of the Gifted”, “Journal of Advanced Academics” and “Roeper Review: A Journal on Gifted Education” are among the most active journals (Baylarova & Baloğlu 2023; Bicakci & Baloglu, 2021; Gürlen, Özdiyar & Şen, 2019). In addition, in bibliometric analysis studies on science education, it was determined that “International Journal of Science Education”, “Science Education” and “Journal of Research in Science Teaching” journals are among the most active (Demir & Çelik, 2020; Yurdakul & Bozdoğan, 2022).

When the institutions that are active in scientific studies on giftedness in science education are examined, it was determined that the most active institutions are “National Taiwan Normal University”, “College of William and Mary” and “Korea National University of Education”, respectively. In Yurdakul and Bozdoğan's (2022) bibliometric study on science education, “National Taiwan Normal University” was among the top three most active institutions. In Baylarova & Baloğlu's (2023) study on gifted education, University of IOWA was among the top 10 most effective institutions. In this study, University of IOWA is the 5th most effective institution.

It has been determined that the countries with the highest number of collaborations in published scientific studies on giftedness in science education are USA, China, Korea, Turkey, Australia, Germany, Japan, UK and Russia, respectively. It was determined that the USA, which ranked first here, published much more (more than twice as much) than China, the country closest to it, in its studies on giftedness in science education. In a sense, it has been determined that the USA acts as a locomotive in the cooperation between countries for the studies on giftedness in science education. In other words, it plays a key role in the development of inter-country cooperation in studies related to the field. It can be concluded that the USA's high budget allocated to science and mathematics fields and gifted students and the federal government's identification and identification of gifted students and the implementation of differentiated education programs for them according to the Marland report have supported its prominence in this field (Freeman, 2005; Jolly, 2009; Marland, 1972; Mcclain & Pfeiffer, 2012). It can also be explained by the fact that countries have a longer history of academic publishing, institutions related to giftedness and more research resources. It is taken into consideration that population is proportional to the studies conducted.Similarly, there are studies in the literature indicating that the USA is the most effective country in terms of giftedness (Baylarova & Baloğlu, 2023; Bicakci & Baloglu 2021; Demir & Çelik, 2020; Gürlen, Özdiyar & Şen, 2019; Yurdakul & Bozdoğan, 2022).

Recommendations

This study provides a bibliometric analysis of the studies on giftedness in science education, reveals research trends in the field and draws a general framework. Looking at this study before starting future studies on giftedness in science education will provide researchers with a foresight and will support the studies to be conducted to be more qualified. It is recommended that researchers who will conduct studies in this field should use keywords in the literature review, search and examine effective documents, resources, journals and authors in the field.

Limitations of Study

This study is limited to a bibliometric analysis of giftedness in science education. The findings provide a more holistic view of more general characteristics. It is recommended that more detailed studies should be conducted to reach in-depth information. Although the WoS used in the research is an accepted database in many fields, it does not show that it contains all the studies on giftedness in science education. This is another limitation of the study. The study is limited to the period between 1970 and 2022 and it is recommended that a similar study be conducted in certain periods in the following years.

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References

Baccassino, F., & Pinnelli, S. (2023). Giftedness and gifted education: A systematic literature review. *Frontiers in Education, 7,* 1073007. DOI:10.3389/feduc.2022.1073007

Baylarova, S., & Baloğlu, M. (2023). Bibliometric analysis of research on social-emotional problems in gifted children. *Journal of Society, Education and Cultural Research, 2*(1), 1-11.

Betts, G. (1986). The autonomous learner for the gifted and talented. In J.S. Renzulli (Ed) *System and models for developing programs for the gifted and talented* (pp 27-56). Mansfield Center, CT: Creative Learning Press.

Bicakci, M., & Baloglu, M. (2021). A bibliometric analysis on personality research of gifted individuals (1957-2020). *Journal of Uludag University Faculty of Education, 34,* 125-157. DOI: 10.19171/uefad.845218

Demir, E., & Çelik, M. (2020). Bibliometric profile of scientific studies in the field of science curriculum. *Journal of Turkish Chemical Society Section C: Chemistry Education (JOTCSC). 5*(2), 131-182. https://orcid.org/0000-0002-6313-1644

Derviş, H. (2019). Bibliometric analysis using bibliometrix an R package. *Journal of Scientometric Research*, *8*(3), 156-160.

Ertz, M., & Leblanc-Proulx, S. (2018). Sustainability in the collaborative economy: a bibliometricanalysis reveals emerging interest. *J. Clean. Prod. 196,* 1073e1085. DOI: 10.1016/j.jclepro.2018.06.095.

Feldhussen, J. F. (1986). A conception of giftedness: conception of giftedness. In R. J. Steinberg, J. E. Davidson (Eds), *Conception of Giftedness.* New York: Cambridge University press.

Feldhusen, J. F. (1994). Talent Identification and Development in Education (TIDE). *Gifted Education International*, *10*(1), 10–15. DOI: 10.1177/026142949401000103

Freeman J. (2005). Permission to be gifted. In Sternberg R. J., Davidson J. E. (Eds.), *Conceptions of giftedness, second edition* (pp. 80–97). New York, NY: Cambridge University Press.

Garfield, E. (1979). Is citation analysis a legitimate evaluation tool? *Scientometrics, 1(*4), 359-375.

Gürlen, E., Özdiyar, Ö., & Şen, Z. (2019). Social network analysis of academic studies on gifted people. Education and Science, *44*(197), 185-208. http://dx.doi.org/10.15390/EB.2018.7735

Han, H. J., & Shim, K. C. (2019). Development of an engineering design process-based teaching and learning model for scientifically gifted students at the Science Education Institute for the Gifted in South Korea. *Asia-Pacific Science Education*, *5*(1), 1-18.

Hernández-Torrano, D., & Ibrayeva, L. (2020). Creativity and education: A bibliometric mapping of the research literature (1975–2019). *Thinking Skills and Creativity, 35,* 100625. DOI: 10.1016/j.tsc.2019.100625

Hernández-Torrano, D., & Kuzhabekova, A. (2019). The state and development of research in the field of gifted education over 60 years: A bibliometric study of four gifted education journals (1957–2017). *High Ability Studies,* 1-23. http://dx.doi.org/10.1080/13598139.2019.1601071

Jolly, J. L. (2009). Historical perspectives: The national defense education act, current STEM Initiative, and the gifted. *Gifted Child Today, 32*(2), 50-53.

Karagöz, B. & Şeref, İ. (2019). Bibliometric analysis of researches on Yunus Emre. *Mediterranean Journal of Educational Research, 13*(27), 123-141. DOI: 10.29329/mjer.2019.185.6

Kaya, N. G. (2022). Effective classroom management qualifications for teachers of gifted students. *Electronic Journal of Social Sciences*, *21*(82), 572-583.

Kessler, M. M. (1963). Bibliographic coupling between scientific papers. *American documentation*, *14*(1), 10-25.

Kunt, K., & Tortop, H.S. (2017). Examination of science and technology teachers' attitude and opinions related giftedness and gifted education in Turkey. *Journal for the Education of Gifted Young Scientists, 5*(1), 37-54. DOI: 10.17478/JEGYS.2017.53

Kuzhabekova, A., Hendel, D. D., & Chapman, D. W. (2015). Mapping global research oninternational higher education. *Research in Higher Education,56*(8), 861–882.

Marland, S. P., Jr. (1972). *Education of the gifted and talented: Report to the Congress of the United States by the U.S. Commissioner of Education and background papers submitted to the U.S. Office of Education* (Y4.L 11/2: G36). Committee on Labor and Public Welfare United States Senate. Washington, DC: U.S. Government Printing Office.

Mcclain, M. C. & Pfeiffer, S. (2012). Identification of gifted students in the United States today: A look at state definitions, policies, and practices. *Journal of Applied School Psychology, 28*(1), 59-88. DOI: 10.1080/15377903.2012.643757

Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: A comparative analysis. *Scientometrics, 106*(1), 213-228. doi:10.1007/s11192-015-1765- 5. DOI: 10.1007/s11192-015-1765-5

Moral-Muñoz, J.A., Herrera-Viedma, E., Santisteban-Espejo, A., & Cobo, M.J., (2020). Software tools for conducting bibliometric analysis in science: An up-to-date review. *El profesional de la información, 29*(1), 1-20. DOI: 10.3145/epi.2020.ene.03

Mourao, P.R., & Martinho, V.D. (2020). Forest entrepreneurship: a bibliometric analysis and a discussion about the co-authorship networks of an emerging scientific field. *J. Clean. Prod. 256,* 14. DOI: 10.1016/j.jclepro.2020.120413.

Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of Documentation, 25,* 348– 349.

Sierra, V. D., Valdés Cuervo, A., Leyte, M., Aymes, G., Amezaga, T., & Rodríguez, A. (2015). Analysis of the scientific productivity of Mexican researchers on the topic of gifted students. *Journal of Education, Society and Behavioural Science, 8*(4), 216-226. DOI: 10.9734/BJESBS/2015/16947

Sumida, M. (2013). Emerging trends in Japan in education of the gifted: A focus on science education. *Journal for the Education of the Gifted*, *36*(3), 277-289.

Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2011). Rethinking Giftedness and Gifted Education: A Proposed Direction Forward Based on Psychological Science. *Psychological Science in the Public Interest, 12*(1), 3–54. DOI: 10.1177/1529100611418056

Tanık Önal, N., & Büyük, U. (2020). To be a gifted child. *Journal of National Education*, *49*(228), 153-174.

Tarhan, S., & Kılıç, Ş. (2014). Identification of gifted and talented student and models in Turkey. *Journal of gifted education research*, *2*(2), 27-43.

Tekbıyık, A. & Akdeniz, A., R. (2008). Teachers' views about adoption and application of primary science and technology curriculum. *Necatibey Faculty of Education, Electronic Journal of Science and Mathematics Education (NFE-EJSME), 2*(2), 23-37.

Tortop, H. S., & Kunt, K. (2013). Investigation of primary school teachers' attitudes towards gifted education. *International Online Journal of Educational Sciences, 5*(2), 441-451.

Yurdakul, M., & Bozdoğan, A. E. (2022). Bibliometric evaluation based on web of science database: articles on science education. *Turkish Scientific Researches Journal, 7*(1), 72-92.

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429-472.