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Bibliometric Analysis of Scientific Research on Misconception Conducted in The Field of Education

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Abstract

The purpose of this study is to perform a bibliometric analysis of articles on misconception in the education research category of the Web of Science (WoS) database. Bibliometric analyses are carried out to identify conceptual developments in a subject area, trends of researchers over time, themes researched, changes in the boundaries of disciplines, and the most productive academics, institutions, or countries and to present the "big picture". This study used the descriptive survey model. In line with the purpose of the study, the keywords "misconception" and "misconceptions" were searched in "topic" in the WoS database using the "OR" option. As a result of the survey carried out on 12.01.2023, 3,545 articles were accessed. The obtained data were analyzed using the "bibliometrix" package in the RStudio programming language, included in the open-source R program. Journal of Chemical Education (f=310) was found to be the journal publishing the most articles on misconception in the WoS database, and the academics with the most studies were determined to be Bretz S. L., Treagust D. F., and Geban, O. The authors whose studies on misconception have the highest h-index values are Bretz S. L., Treagust D. F., and Sanger M. J. The first three countries producing the most articles on misconception are the USA, Turkey, and the United Kingdom, and the researchers who have the most international collaborations with researchers from different countries are also from the USA (83 articles). The most used keywords are "misconception/misconceptions", "conceptual change", and "science education". This study is anticipated to present a comprehensive and detailed projection for academics who plan to conduct research in the subject area of misconception. In addition to different studies may be designed focusing on other dimensions of concept teaching.

Keywords: bibliometric analysis, concept, education, misconception

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Introduction

Concepts are related to each other. Therefore, how concepts are classified in the education process is very important. A concept that is learned incorrectly will also affect whether the subsequent related concepts are understood correctly or not, and sometimes it will even appear as an important obstacle to proper understanding of them. Thus, it is extremely important to plan the education process by taking into account what concepts mean to students and what meanings they carry for them and to ensure that concepts are structured correctly (Laçin Şimşek, 2019).

Concepts help individuals make sense of and interpret the world they live in, thus making it easier for them to cope with it. If there were no concepts, in other words, if objects, events, ideas, or objects could not be grouped based on their similar characteristics, people would have to learn each element in nature separately and would not be able to create an order in the complex world (Çaycı, 2007).

One may see different definitions of “concept” in the literature. While Ülgen (2004) defines “concept” as a knowledge construct that gains meaning in the human mind and represents the changing common characteristics of different objects and phenomena, Senemoğlu (2005) sees it as a category used to group similar objects, people, events, ideas, and processes. Cüceloğlu (2013) , on the other hand, describes “concept” not as a concrete object, entity, or situation, but as a thinking unit that we create in our minds when we group them and defines it as a symbol assigned to a group of events or objects that share certain characteristics. Based on these definitions, it can be said that concepts refer to the most basic features that distinguish the objects grouped based on their common characteristics from other groups.

According to Senemoğlu (2005), concepts are expressed with words, and the main features of concepts are strength, generality, usability, and learnability.

Concepts are very important in the learning process as well as in the daily lives of individuals. Concepts have an important place in the structuring of knowledge in the mind in the learning process and form the basis for subsequent learning. Students come to learning environments with a lot of information in their minds that they have acquired from the environment and previous learning (Kılıçoğlu, 2011), and such information may not always be correct and may involve inaccuracies and deficiencies. This, in turn, affects their subsequent learning negatively and, moreover, prevents new learning. This situation, which makes it difficult for students to acquire new knowledge, is referred to as misconception. Therefore, prior knowledge, which is one of the biggest obstacles to students’ new learning, should not be ignored but evaluated (Ashlock, 2006).

Misconceptions are ideas that emerge as a result of students’ false beliefs and personal experiences, that are consistent and logical and do not need to be changed from students’ points of view, and that are incompatible with scientific facts; they are are non-scientific definitions developed as an alternative to scientifically accepted concepts (Çakır & Yürük, 1999; Tekkaya, Çapa & Yılmaz, 2000).

Research suggests that many factors cause misconception, which makes it difficult for students to gain new knowledge and for teachers to teach in accordance with the desired objectives:

- Students unable to make connections between concepts because of concepts taught to them by rote (Doğar & Başıbüyük, 2005; Çaycı, 2007),

- The information and experiences gained by students in their daily lives (Yazıcı & Samancı, 2003; Başıbüyük etc., 2004),

- Teachers unable to teach concepts to students correctly as a result of the former's misconceptions (Sanders, 1993, p.30; Yazıcı & Samancı, 2003),

- Textbooks used in the teaching process (Yazıcı & Samancı, 2003),

- The development of alternative conceptions through the media (Doğar & Başıbüyük, 2005),

- Students' inability to use their prior knowledge in learning new subjects or concepts (Çaycı, 2007),

- Non-scientific information acquired by students through their environment before the education process (Sanders, 1993, p.930),

A general consideration of these reasons suggests that misconceptions may arise from the teaching activities carried out in school environments, as well as from the past lives of students. Accordingly, it is important to reveal the thoughts of students about the concepts in their minds before or during the teaching process and to make an effort to eliminate these misconceptions. Misconception is a subject emphasized in many areas. Many studies on the subject have been conducted in the fields of sciences, social sciences, and educational sciences, and it is clear that such research will continue due to the importance of the subject. Some of the studies on misconception are as follows: Kızılcık & Güneş (2011) developed a three-stage test to determine the misconceptions of pre-service teachers studying at the education faculty of a state university about regular circular motion. As a result of the study, it was determined that the students had misconceptions about speed and strength. Another study on the subject was carried out by Wilhelm (2014). In his study, examined how children build their knowledge about natural events in the early period and identified the misconceptions that exist in children about the phases of the moon and the formation of shadows from natural events. Karpudevan, Roth & Chandrakesan (2015) reached the conclusion that the activities designed according to the constructivist understanding were effective in eliminating the misconceptions of students in their research, which aimed to eliminate the misconceptions of secondary school students in Malaysia regarding the concept of climate change. Öçal (2018), investigated the effects of mathematics teachers' practices in detecting and eliminating 11th grade students' misconceptions about the concept of probability. As a result of the study, it was concluded that the activities carried out by the teachers were effective in identifying and eliminating the misconceptions of the students. Suryadi, Kusairi & Husna (2020) comparatively examined the misconceptions of middle school and high school students and physics teacher candidates about simple electrical circuits. Consequently the study, it was determined that both middle school and high school students and teacher candidates have common misconceptions about the subject. In addition to the studies on the subject, it is obvious that studies will continue in the future due to the importance of the subject. Hence, determining the trends of researchers studying on misconception in a specific period and in specific regions, the ways they address the subject, the journals in which such studies are published, etc. is important to see and evaluate the studies as a whole. One of the most basic ways to make evaluations in many aspects is to perform bibliometric analysis. In recent years, interest in bibliometric

analysis research has increased (Kurtuluş & Tatar, 2021; Madani & Weber, 2016; Ninkov, Frank & Maggio, 2021; Palaz, 2021; Palaz, 2022; Delgado Vázquez, etc., 2021).

Problem Situation

Bibliometric research reveals many features such as the general trend of research on a subject, the articles produced on it, the number of citations, the journals on the subject, and the trends in research (Aria & Cuccurullo, 2017). Based on this idea, this study aimed to make a bibliometric analysis of journal articles from among scientific studies on misconception in the education research category in the Web of Science (WoS) database. To this end, answers to the following questions were sought:

- What is the annual production distribution of journal articles on misconception?
- What is the distribution of the most published journals on misconception?
- Which authors publish the most on the subject of misconception?
- What is the production graph of the authors most interested in publishing on misconception like?
- What is the global citation ranking in journal articles on misconception?
- What is the productivity and collaboration of countries in journal articles on misconception like?
- What is the author collaboration network on the subject of misconception like?
- What are the most frequently used keywords and title words in the journal articles on misconception?

Method

Research Design

This study used the descriptive survey model. The purpose of descriptive survey research is to examine a past or present situation as it is/was. The important point of such studies is the possibility of examining what exists without changing them. The survey researcher can examine the object or individual directly, as well as pre-recorded written documents, pictures, audio and video recordings, ancient remains, or source persons (Karasar, 2016). In this research model, the data are presented in percentage and frequency, allowing the presentation of information involving large samples to readers (Büyüköztürk etc, 2016). The present study was conducted as a bibliometric analysis on the journal articles on misconception through a survey in the education research category in the WoS database. WoS and Scopus are two common databases that offer scientific publications to readers. There are some differences between the two databases (Chadegani., etc., 2013). This study adopted the WoS database because it presents the education research category as a separate category from social sciences.

Bibliometric analysis involves different qualitative and quantitative literature review approaches to understand and organize previous findings. This analysis is based on a systematic, transparent, and repeatable survey process grounded on the statistical measurement of science, scientists, or scientific activities. Bibliometric analyses are carried

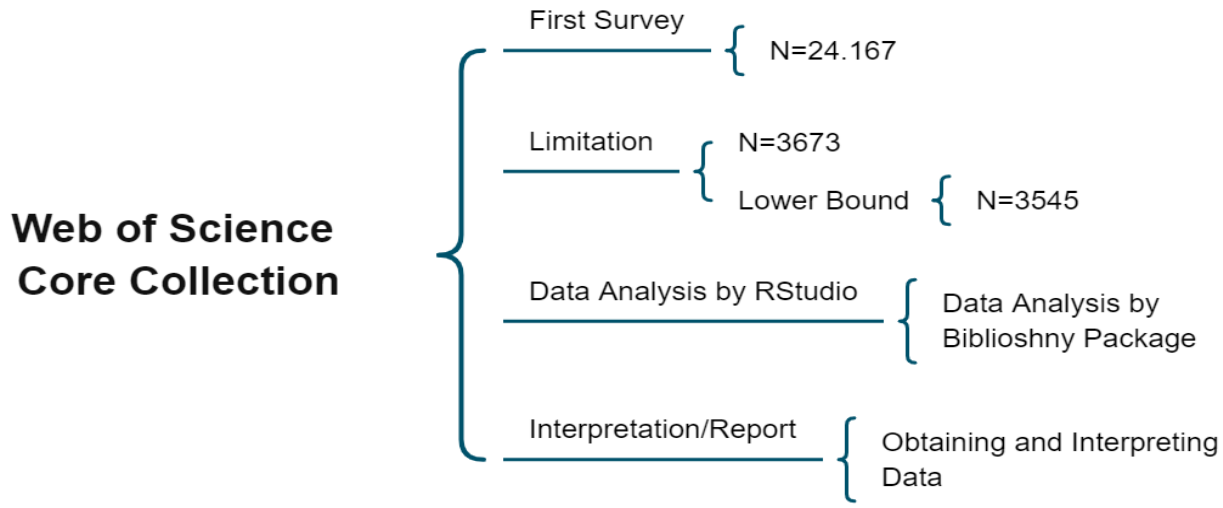
out to identify conceptual developments in a subject area, trends of researchers over time, themes researched, changes in the boundaries of disciplines, and the most productive academics, institutions, or countries and to present the “big picture” (Aria & Cuccurullo, 2017).

Data Collection and Analysis

The workflow diagram for the process of collecting and analyzing the research data is given in Figure 1.

Figure 1

Workflow Diagram



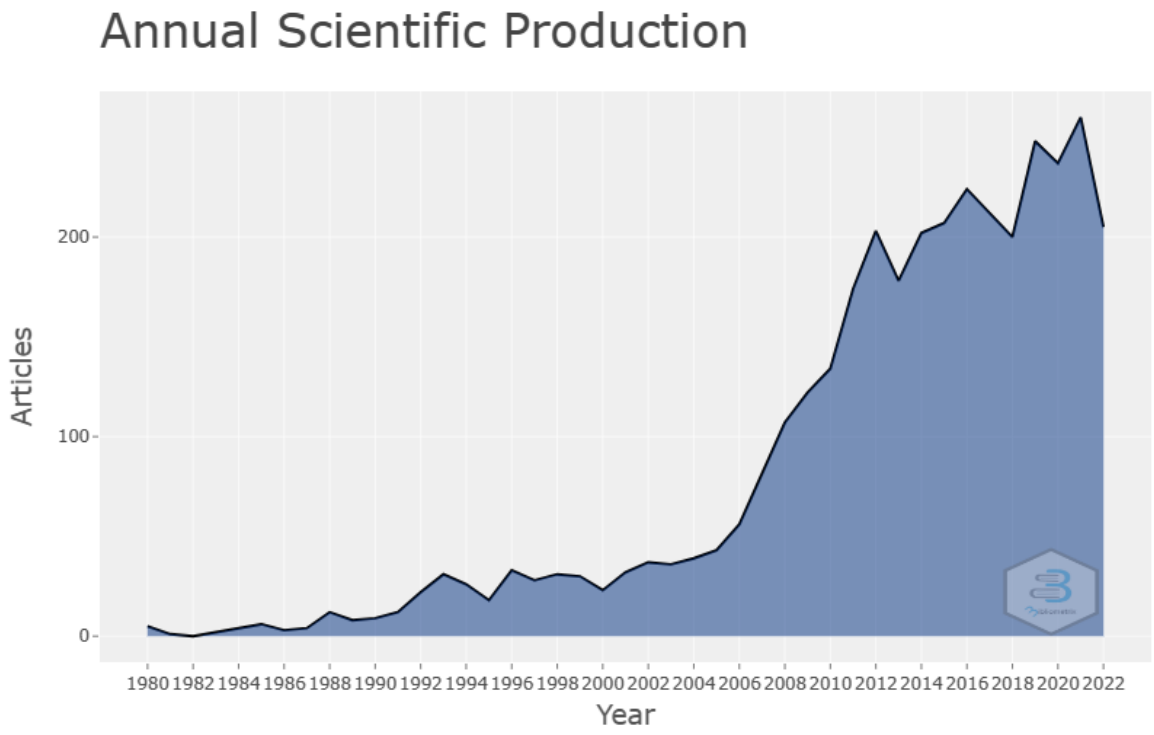
In line with the purpose of the study, the keywords “misconception” and “misconceptions” were searched in “topic” in the WoS database using the “OR” option. As a result of the first search carried out on 12.01.2023, a total of 24,167 articles were accessed. When the category was limited to “Education Scientific Disciplines” and “Education Educational Research”, the document type to “article”, and the index to SSCI, ESCI, AHCI, and SCI-Expanded, a total of 3,673 articles were accessed. Since the access to the articles published as early access and the articles in the conference proceedings was limited, a sub-limitation was also made. As a result of that limitation, 3,545 journal articles were accessed. As the study material, those 3,545 journal articles were taken from the WoS database in the form of a “plain text” file, and the analyses were made on that material using the “bibliometrix” package after downloading that package to the RStudio program through the open-source site of the R program https://cran.r-project.org/.

Findings and Their Interpretation

The graph of the annual numbers of the articles based on limitations for the purpose of the study is presented in Figure 2.

Figure 2

Annual Scientific Production Graph



The annual numbers of the articles on misconception are given in Table 1.

Table 1

Annual Numbers and Percentages of Articles

Years	Article Count (n)	Percent (%)
1980-1984	12	0,34
1985-1989	33	0,93
1990-1994	100	2,82
1995-1999	140	3,96
2000-2004	167	4,71
2005-2009	409	11,53
2010-2014	891	25,13
2015-2019	1091	30,78
2020-2022	702	19,80
Total	**3545**	**100**

Table 1 shows that the oldest article on misconception included in the WoS database was published in 1980 and that the highest count of the articles on the subject were published between 2015-2019 (n=1,091). The articles published after 2005 constitute 87.24% of all publications. This finding indicates that articles on misconceptions have increased rapidly in recent years. The list of journals with the most publications on misconception in the education research category in the WoS database is given in Table 2.

Table 2

Journals Most Interested in The Subject

Journal Name	Article Count (n)
"Journal of Chemical Education"	310
"International Journal of Science Education"	183
"Chemistry Education Research and Practice"	141
"Journal of Research in Science Teaching"	119
"Journal of Baltic Science Education"	76
"Cbe-Life Sciences Education"	69
"American Biology Teacher"	68
"Journal of Biologıcal Education"	61
"Research in Science Education"	61
"International Journal of Science and Mathematics Education"	55

The articles found by searching the keyword "misconception" were published in 483 different journals. The most published journal on this subject articles is Journal of Chemical Education (n=310), which is followed by International Journal of Science Education (n=183) and Chemistry Education Research and Practice (n=141), respectively. These data represent the count of articles on misconception published in the journals. Looking at these findings, researchers who are doing or planning to do research in the field of misconception can follow the journals that have an impact in this field. The findings on the authors who published the most articles in the education research category in the WoS database and their h-indexes are given in Table 3.

Table 3

Findings on The Number of Articles by The Authors and Their H-Indexes

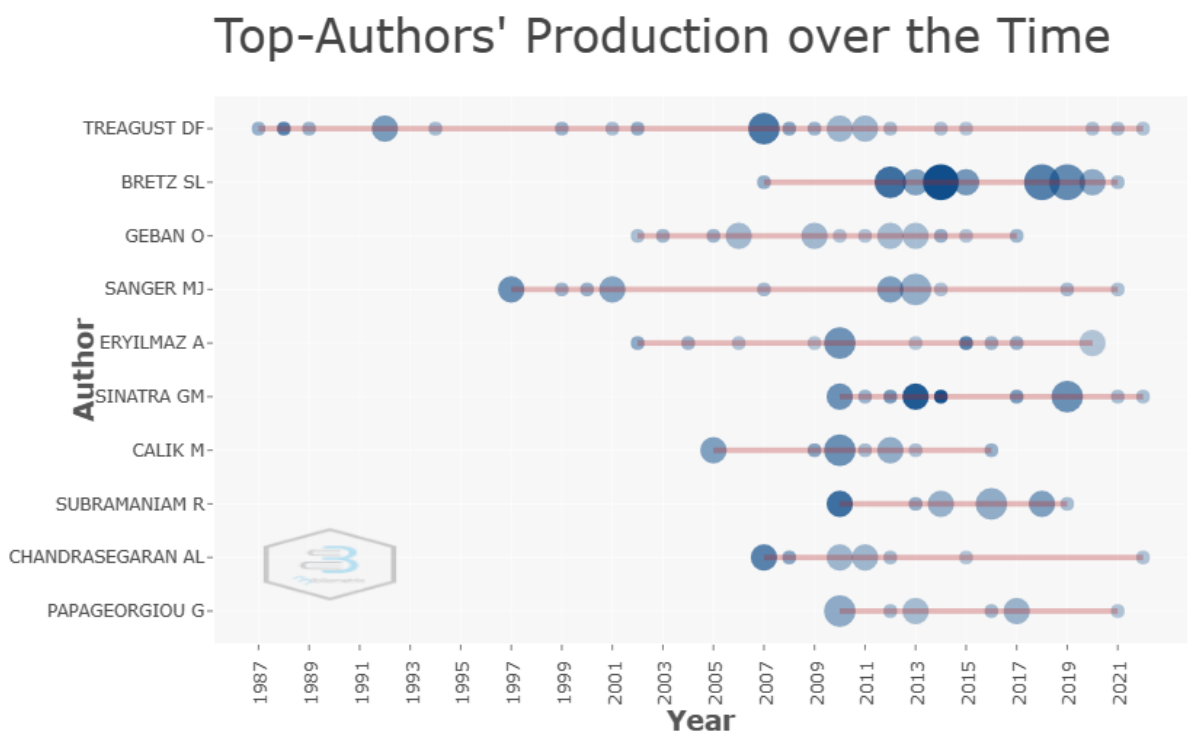
Author	Total Articles (n)	Author	h index
Bretz S.L.	23	Treagust D.F.	17
Treagust D.F.	23	Bretz S.L.	13
Geban O.	16	Sanger M.J.	11
Sanger M.J.	15	Calık M.	10
Eryılmaz A.	13	Greenbowe T.J.	9
Sinatra G.M.	13	Sınatra G.M.	9
Calık M.	11	Subramanıam R.	9
Subramaniam R.	11	Taber K.S.	9
Papageorgiou G.	10	Talanquer V.	9
Taber K.S.	10	Ayas A.	8
Talanquer V.	10	Brown D.E.	8
Tarhan L.	10	Geban O.	8
		Tarhan L.	8

In the WoS database, a total of 7,040 authors published articles on misconception, individually or collaboratively. The number of articles per author is 0.48, and the number of authors per article is 2.08. Table 3 indicates that the first three authors who have the most articles on misconception are Stacey Lowery Bretz (n=23) from Miami University (USA), David F. Treagust (n=23) from Curtin University (Australia), and Ömer Geban (n=16) from Middle East Technical University (Turkey), respectively.

The right part of Table 3 contains information about the h-indexes of the authors conducting research in the subject area. H-index allows evaluating the quality of the scientific studies conducted by researchers (Nakhleh, 2005). The data in Table 4 are limited to statistics from the WoS database only. While researchers named Greenbowe T. J. and Ayas A. are not included in the list of the top 10 most published authors in the left part of Table 4, they are in the top 10 in the h-index ranking. It can be stated that these authors conducted studies that are less in number but more in impact, positive or negative, compared to the authors in both lists. Table 4 shows only the first 10 authors, and those who come after the 10th rank though they have the same number of publications or the same h-index are also included in the list. The citation burst values of the authors publishing articles on misconception are given in Figure 3.

Figure 3

Top-Authors' Production over the Time



The lines in Figure 3 show the productions of the authors publishing on misconception over time. The dots indicate the citation burst value for the article by the author in the year shown. The darkness of dots in Figure 3 refers to high citation burst values.

The author with the highest citation burst value is Gale M. Sinatra (17.77 in 2014 and 15.9 in 2013). Sinatra is not the most cited author, but the most cited author in a year. Other authors with high citation burst values are Stacey Lowery Bretz, with 16.44 in 2014 and 12.54 in 2012, and Rathivarman Subramaniam, with 12.84. It can be said that there has been an interest in the work of these three authors in recent years.

The most cited articles on misconception in education research are given in Table 4.

Table 4

Most Cited Articles Worldwide

Article Name	Author	Citation Count (n)
“Differing perceptions in the feedback process”	David Carless	436
“Revisiting the Conceptualisation of Pedagogical Content Knowledge (PCK): PCK as a Conceptual Tool to Understand Teachers as Professionals”	Soonhye Park & J. Steve Oliver	428
“Why Some Students Don't Learn Chemistry”	Mary B. Nakhleh	365
“Development and Use of Diagnostic Tests to Evaluate Students’ Misconceptions in Science”	David F. Treagust	347
“Making Sense of Focus Groups”	Rosaline S Barbour	307
“Using Bridging Analogies and Anchoring Intuitions to Deal with Students’ Preconceptions in Physics”	John Clement	289
“Second Language Accent and Pronunciation Teaching: A Research-Based Approach”	Tracey M. Derwıng & Murray J. Munro	269
“Development and Evaluation of the Conceptual Inventory of Natural Selection”	Dianne L. Anderson, Kathleen M. Fisher & Gregory J. Norman	244
“Misconceptions About the Learning Approaches, Motivation and Study Practices of Asian Students”	David Kember	231
“Conceptual and Epistemic Aspects of Students' Scientific Explanations”	William A. Sandoval	230

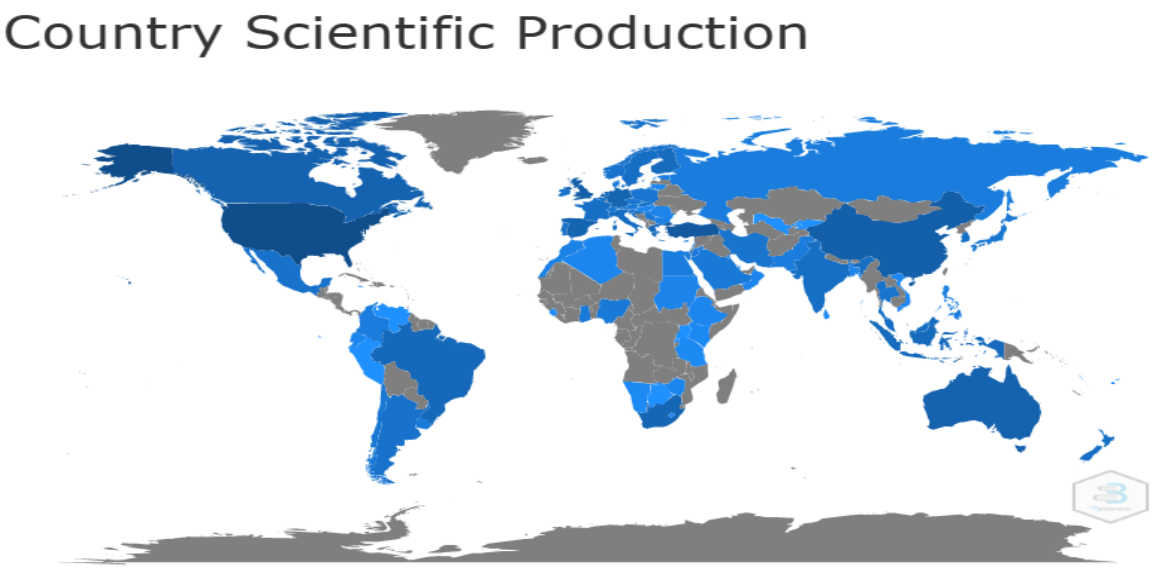
Table 4 shows that the most cited article is the article by Carless (2006) (n=436). That study was carried out to examine the effect of feedback given to homework on eliminating misconceptions (Carless, 2006). The second most cited article is the one by Park & Oliver (2008) (n=428). Their study revealed that misconceptions have an important role in shaping students’ pedagogical content knowledge (Park & Oliver, 2008). The third most cited article is the one by Nakhleh (1992) (n=365). In that study, Nakhleh showed how basic level misconceptions in chemistry teaching affect learning advanced chemistry concepts and tried to offer solutions to this.

The most cited articles on misconception are mostly about eliminating misconceptions and in the fields of science education, physics education, and chemistry education. This implies that scientists from many disciplines are working on misconceptions.

Figure 4 shows the map of the countries with the most production on misconception in the education research category among the countries that allow the indexing of scientific publications in the WoS database.

Figure 4

Scientific Productivity of Countries on Misconception in Education Research



The numerical data part of the map indicates that the first 3 countries with the most published articles on misconception are the USA with 2,688 articles, Turkey with 661 articles, and the United Kingdom with 310 articles. The inner parts of the African continent and some of the Eurasian and Middle Eastern countries are shown in gray on the map. These findings may mean that there are no studies on misconception in these countries indexed in the WoS database.

Figure 5

Countries of Corresponding Authors and Their Numbers of Articles

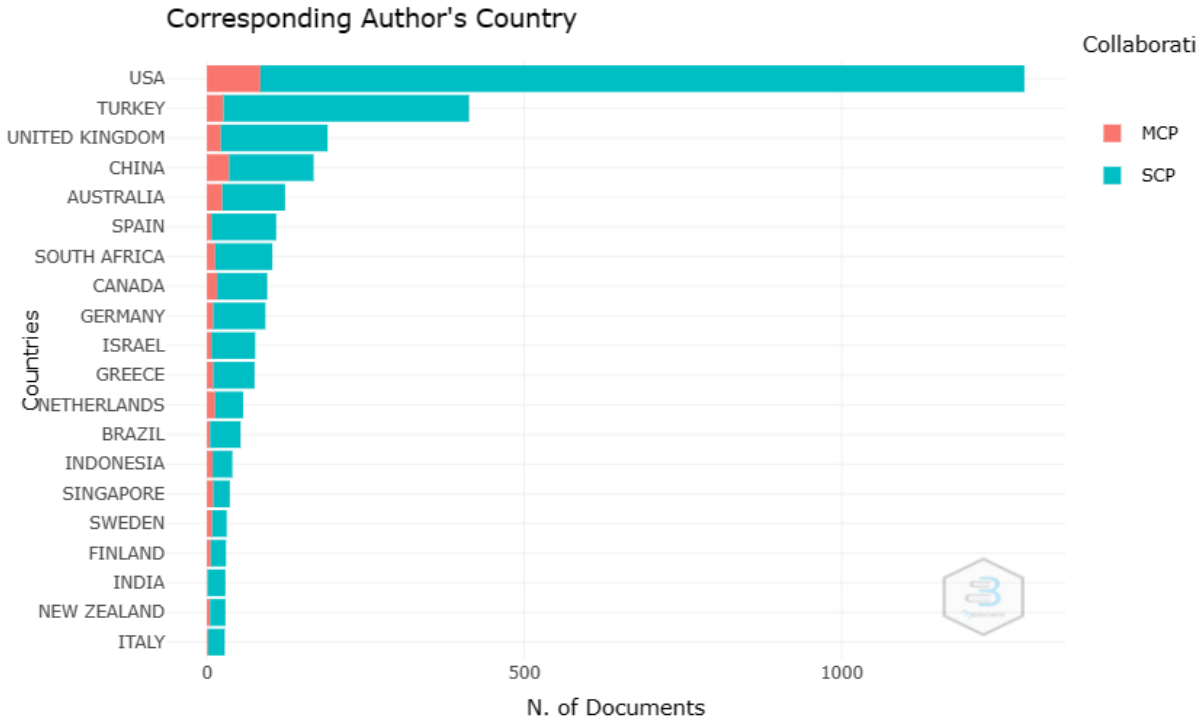


Figure 5 presents the number of articles produced in the mentioned countries, as well as the SCP (Single Country Publications) and the MCP (Multiple Country Publications) ratios. The SCP ratio indicates the number of publications made by researchers in the same country within the total number of publications, while the MCP ratio shows the number of publications made by collaboration of researchers in different countries within the total number of publications. Detailed information on these data is given in Table 5.

Table 5

Number of Articles, SCP, MCP, and MCP Ratio Values by Countries

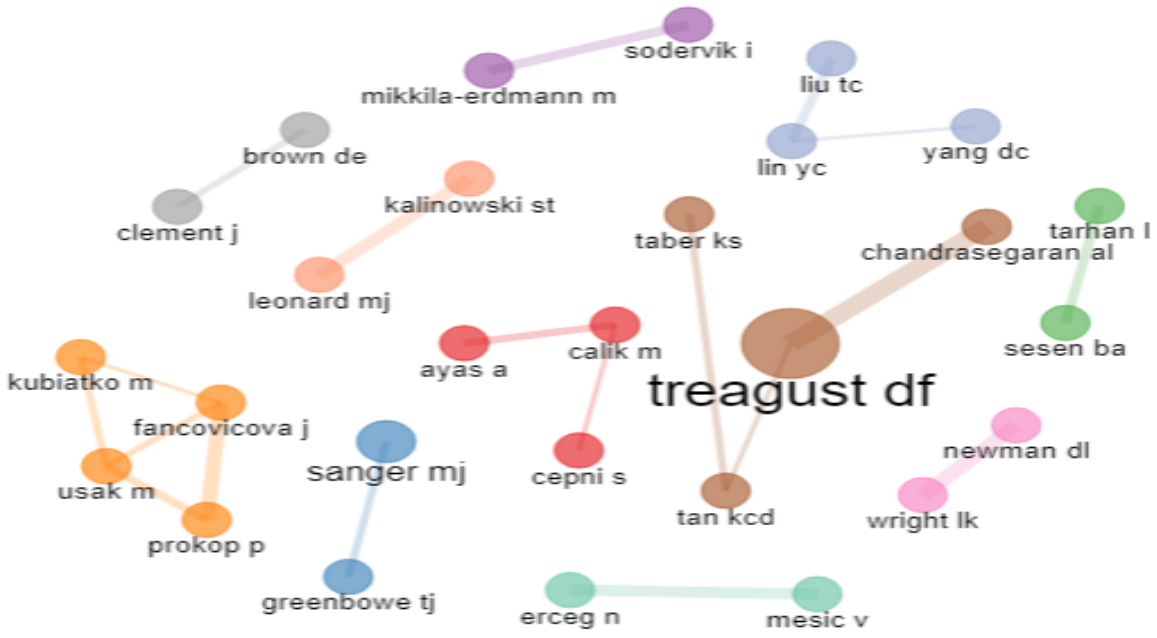
Country	Article Number	SCP	MCP	MCP Ratio
USA	1288	1204	84	0,0652
Turkey	413	387	26	0,0630
United Kingdom	190	168	22	0,1158
Chinese	168	133	35	0,2083
Australia	123	99	24	0,1951
Spain	109	102	7	0,0642
SouthAfrica	103	90	13	0,1262
Canada	95	79	16	0,1684
Germany	92	82	10	0,1087
Israel	76	69	7	0,0921

As shown in Table, the USA with 1,288 articles (SCP: 1,204, MCP: 84), Turkey with 413 articles (SCP: 387, MCP: 26), and the United Kingdom with 190 articles (SCP: 168, MCP: 22) are in the first three places. Considering the MCP ratios, though the USA, Turkey, and Spain are among the 10 countries that publish the most in number, they are among the countries with the lowest MCP rates. This implies that researchers in these countries mostly conduct research in collaboration with their colleagues in the same country. It is seen that researchers in the USA have the highest number of collaborations with researchers from different countries. However, the highness of the number of articles produced in the USA seems to reduce the MCP rate there. It can be stated that researchers in China and Australia, whose MCP rates are higher than other countries in the top 10 countries, are more open to collaboration with researchers from different countries.

Collaboration network of the most collaborating authors is given in Figure 6.

Figure 6

Collaboration Network



The network in Figure 7 includes the most collaborating authors and their clusters. The figure shows that Treagust is the most collaborating author. Table 6 shows the 4 clusters that make up the most collaborative networks and their authors.

Table 6

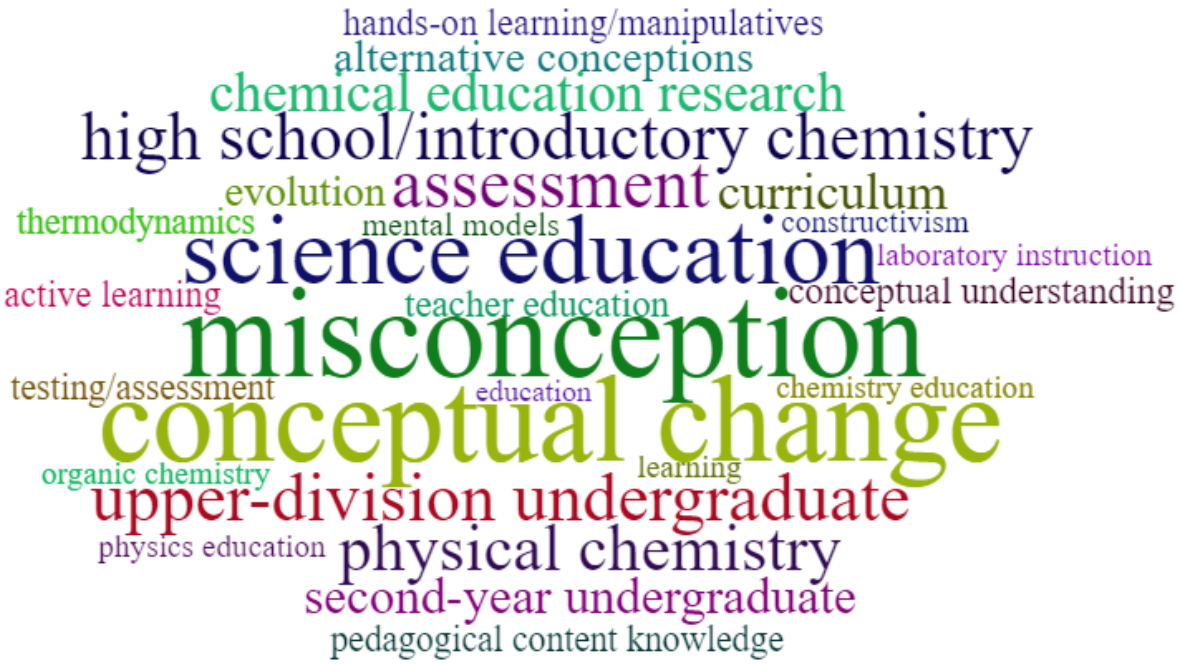
Co-Citation Network Author-Cluster Findings

Author	Cluster	Author	Cluster
Treagust D.F.	1	Calik M.	3
Taber K.S.	1	Ayas A.	3
Chandrasegaran A.L.	1	Çepni S.	3
Tan K.C.D.	1	Sanger M.J.	4
Kubiatko M.	2	Greenbowe T.J.	4
Fancovicova J.	2	Tarhan L.	5
Usak M.	2	Sesen B.A.	5
Prokop P.	2		

Table 6 indicates that researchers from different countries formed common networks under different sub-headings of misconception and produced articles on these subjects collaboratively. In the 1st and 2nd clusters, the authors from different countries conducted research by international collaboration, while in the 3rd, 4th, and 5th clusters, the authors from the same country conducted research through national collaboration.

Figure 7

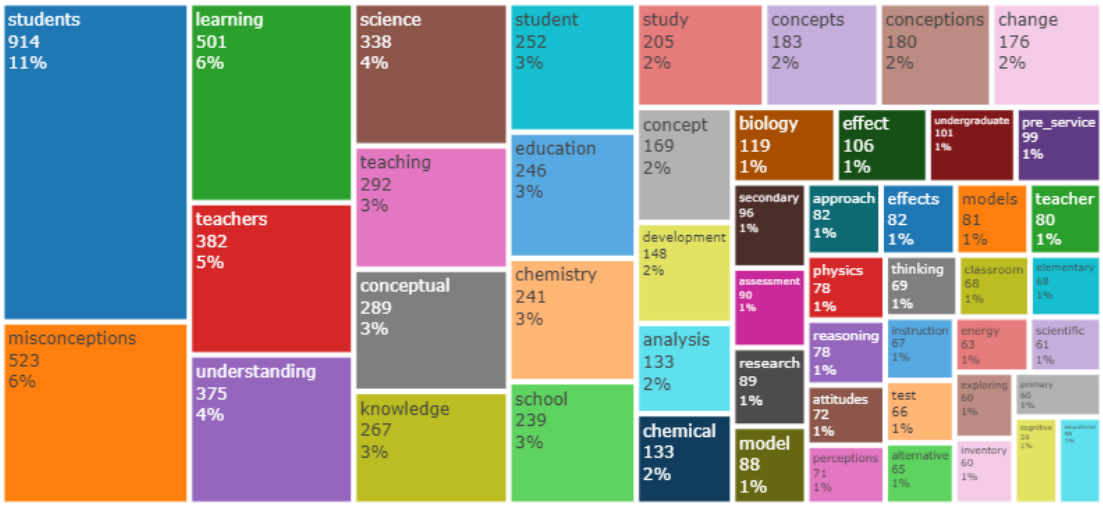
Word Cloud for Most Used Keywords by Authors



Word cloud, one of the text mining methods, shows the most used words in a text. The word cloud analysis for the most used keywords by the authors is given in Figure 7. The word in the center shows the most used word specific to the subject area. The size of the words and their proximity to the center show how frequently words specific to the subject area are used. The smaller the size of the words and the further they get from the center, the less they are used. The quantitative data shows that the most used keywords are “misconception/misconceptions” (f=680), “conceptual change” (f=126), and “science education” (f=102). This finding implies that the number of studies on conceptual change, science education, and student perceptions related to the subject area of misconception included in the WoS database is high in number.

Figure 9

Word Tree Map



Another text mining method is word tree map. This word tree map shows the most used words in the abstracts of the articles on misconception included in the WoS database. The words in the figure show the most used words in the abstract sections of the articles on misconception. As shown in Figure 9, the most used words are “students” (f=914), “misconceptions” (f=523), “learning” (f=501), “teachers” (f=382), “understanding” (f=375), “science” (f=338), “teaching” (f=292), “conceptual” (f=289), “knowledge” (f=267), and “education” (f=246). The data on the right part of the figure give clues about the subject handled in the studies. These data overlap with the keywords in Figure 8.

Conclusion, Discussion and Implications

In this study, the key concepts “misconception” and “misconceptions” were searched in “topic” in the WoS database, which provides access to international publications and citation indexes, using the “OR” option. The search yielded a total of 24,167 documents. As the search was limited in terms of period, subject area, and document type in line with the purpose of the study, a total of 3,673 articles were reached. As the early view articles were also removed from that figure, the accessed number of journal articles turned out to be 3,545.

For those articles, bibliometric analysis was performed using the RStudio program. Such analysis revealed the distribution of the articles by years, the most published journals and the number of citations, the most published authors, the h-index of the authors on the subject area, their numbers of articles, the most frequently used keywords by the authors, their citation burst values, the scientific productivity of the countries, the collaboration networks, the most cited articles on a global scale, word cloud and word tree structures, and the thematic map of the research titles.

The study determined that the oldest article on misconception included in the WoS database was published in 1980. That article titled “Misconceptions about Einstein: His Work

and His Views" was published by Robert Resnick (1980). The literature contains a study that analyzes the studies on misconception, in addition to the keywords reflecting the main subject area of misconception. That study was carried out by Kurtuluş and Tatar (2021), and it was limited to misconception studies in the fields of physics, chemistry, and biology education.

The bibliometric analysis study conducted by Kurtuluş and Tatar (2021) on misconception research in science education determined that the first article was published in 1986. Such difference about years may be due to the limitation of Kurtuluş and Tatar's (2021) study to a more specific field. Another result obtained in the study is that the number of articles started to increase as of 2005, and 87.24% of all articles were published after 2005. Studies on the subject area between the years 2020-2022 are likely to continue the rising trend observed in recent years.

The total number of authors publishing on misconception individually or collaboratively was found to be 7,040. Bretzsel and Treagust were determined both to be the most published authors (both n=23) on the subject area and to have the highest h-indexes (Treagust (n=17) and Bretzsel (n=13)). These index values indicate the index measurement of the authors' studies on misconception only. Bretzsel's studies were seen to be mostly on chemistry education and concept education, while Treagust's studies were detected to be mostly on science education, misconception, and conceptual change. This result is consistent with the study of Kurtuluş and Tatar (2021).

As to the citation burst values, the author with the highest citation burst value is Gale M. Sinatra (17.77 in 2014 and 15.9 in 2013). Sinatra is not the most cited author, but the most cited author in a year. Additionally, research in other fields has been referenced in Sinatra's work, including the politicization of science and digital literacy (Howell & Brossard, 2021; Bolsen & Druckman, 2015). Other authors with high citation burst values are Stacey Lowery Bretz, with 16.44 in 2014 and 12.54 in 2012, and Rathivarman Subramaniam, with 12.84. It can be said that there has been an interest in the work of these three authors in recent years. The study, whose principal author is Bertz, is focused on chemistry instruction. It has made reference to several studies on chemistry education carried out in the years (Burrows & Mooring, 2015; Hunter, Rodriguez & Becker, 2022; Tsapralis, 2018)."Science education" is one of the most commonly used terms in publications concerning misconceptions in research. This finding demonstrates the demand for idea research in the area of scientific education.

The first 3 countries with the most published articles on misconception included in the WoS database were found to be the USA with 2,576 articles, Turkey with 636 articles, and the United Kingdom with 296 articles. Researchers from the USA were observed to have the most international collaboration in research articles on misconception. In terms of international collaboration, the US researchers are followed by China, Turkey, Australia, and the United Kingdom, respectively. This result may point to the impact of the USA in the scientific world.

This result shows parallelism with other bibliometric analysis studies in the field of education. Mathematics education, (Çelik, 2022), digital competence, (Delgado Vázquez, et al., 2021); Educational research (Huang, et al., 2020), media literacy (Yeşiltaş & Yılmazer, 2021), museum education (Bozdoğan, 2019), social studies education (Sönmez, 2020), citizenship education (Karaca & Akbaba, 2021).

Using word tree map and word cloud, the study determined which keywords the studies on misconception gathered around and which concepts were used in the abstracts. Keywords such as "misconception", "conceptual change", and "science education" were most used in the

journal articles on misconception in the education research category in the WoS database. The word tree map showed the most common words in the titles. “Students”, “misconceptions”, “conceptual change”, “science education”, “learning”, “teachers”, “understanding”, “science”, “teaching”, “conceptual”, “knowledge”, and “education” were detected to be used extensively.

Recommendations

This study took WoS as the database. Research may also be conducted on other databases that are actively used in the scientific world.

Information on the journals with the most publications on misconception, the authors most interested in the subject, and the countries most interested in the subject may guide those who are to do research on this subject.

Different studies may be designed focusing on other dimensions of concept teaching.

In this study, journal articles were examined as document type. Studies involving different types of documents may also be designed.

Contribution Rate of the Researchers

The contributions of the authors in this article are equal.

Statement of Conflict of Interest

There is no conflict of interest between the authors.

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