International Online Journal of Educational Sciences, 2017, 9 (1), 101 - 117

iojes
www.iojes.net

International Online Journal of Educational Sciences

ISSN: 1309-2707

Investigating Educational Research Articles (1980-2014) in terms of Bibliometric Indicators

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ARTICLE INFO

Article History:
Received 06.11.2016
Received in revised form 30.11.2016
Accepted 25.12.2016
Available online 07.01.2017

ABSTRACT

Research in the field of education is growing more rapidly than ever before. However, the educational research literature still lacks an actual comprehensive view for current status of educational research. The aim of this survey study, in which data mining has been used, is to find out bibliometric analysis results related to educational research covering WOS articles between 1980 and 2014 (156.689 articles) in order to gain a comprehensive point of view about the current status of educational research in the world. Results of the study point out which subjects come into prominence, which countries have the most contribution to educational research, which publications have the most impact, which journals are the top in educational research.

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Keywords:
Educational research, data mining, bibliometrics

Introduction

Research in the field of education is growing day by day in accordance with the rapid developments and innovations in science, technology and requirements of educational institutions, researchers, universities and etc. Findings, recommendations and other deliverables of this growing research are expected to set light to existing needs of today's educational policies in order to both contribute to and adapt to current developments related to education in the world. Many universities and various funder institutions have been encouraging and funding research in education (Hicks, 2012; Milesi, Brown, Hawkley, Dropkin & Schneider, 2014). In addition, researchers in the field of education have been conducting research and producing articles for the same purposes.

Despite the fact that educational research is growing at a fast rate, we still need to produce meaningful implications based on this huge amount of data regarding current educational research for future policies and research plans. There is a need to see the big picture about the cumulative educational research because the literature still lacks above mentioned related findings. There are various methods that produce meaningful results from big data. One of them is bibliometrics. Bibliometrics is a statistical analysis of written publications, such as books or articles (Pritchard, 1969). Bibliometric methods are frequently used in the field of library and information science, including scientometrics. For instance, bibliometrics is used to provide quantitative analysis of academic literature (Mishra, 2015). There is various research related to investigation of research performance on the basis of bibliometrics (Diem & Wolter, 2013). It is possible to observe recently conducted studies on the bibliometric measurement of research performance in the literature (For example: Abramo, Cicero & D'Angelo, 2012; Anninos, 2014; Budd & Magnuson, 2010; Davarpanah, 2009; Dees, 2008; Earp, 2010;

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DOI: http://dx.doi.org/10.15345/iojes.2017.01.008

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Milesi, Brown, Hawkley, Dropkin & Schneider, 2014; Pendlebury, 2012; van Aalst, 2010). Number of publications and citation count are the two main bibliometric indicators that are used to measure research performance in the literature (Diem & Wolter, 2013). Bibliometrics, as a method, can be used in order to define contribution levels of journals into literature and also to measure the up-to-dateness of literature of a discipline (Al, Soydal & Yalçın, 2010). There are some pioneer studies that used bibliometrics for author productivity (Lotka, 1926), and publication dynamics of journals (Bradford, 1934). There are various studies that make use of bibliometrics for similar purposes with this research. Some of them are summarized below:

In their study, Abramo et al. (2012) studied the research performances of Italian universities. They made bibliometric analysis on publications indexed in the Web of Science (WOS) between 2004 and 2008. They also investigated the level of correlation between research performance and its dispersion in universities. The findings of the study were argued to be beneficial for similar studies, policy indications and university funding.

Jacob and Lamari (2012) studied on factors related to research productivity. They conducted a case study. They analyzed data of 194 researchers for the period of 2001–2008. Number of publications, fractioned publications, citations and impacts were taken into consideration for research productivity. They concluded that not only number of publications but also citations and outcomes generated as well as individual and organizational attributes should be taken into consideration when studying research productivity (Jacob & Lamari, 2012).

Phelan (2000) conducted bibliometric analysis in order to find out the contribution of Australia to international educational research. He studied on publications and citations in the journals which were indexed by the Institute for Scientific Information (ISI). He compared Australian universities in terms of educational research performance. One of his significant results is that education is the second largest contributor, in terms of publication, to the international literature as a major field of research. He also mentioned that educational research had grown in recent years at a faster rate than before (Bates, 2003).

Today, there is an international effort in order to find out educational research performances of the countries and universities in terms of a variety of indicators and also to explore new research assessment methods and techniques. EERQI (European Educational Research Quality Indicators) project can be given as an example for this effort. The aim of the three-year project was to reinforce and enhance the worldwide visibility and competitiveness of European research by developing new indicators and methodologies to determine the quality of educational research publications. The project was funded under the 7th framework programme of the European Commission (Gogolin, Åström & Hansen, 2014).

An article of Diem and Wolter (2013) aimed to investigate the research performance of Swiss researchers in educational sciences using bibliometrics. WOS and Google Scholar were covered as the source of data for this research. Various indicators, such as number of publications and citations, were used to measure research performance. In addition they pointed out some difficulties encountered when gathering detailed data related to research papers from WOS and Google Scholar (Diem & Wolter, 2013).

Gülgöz, Yedekçioğlu and Yurtsever (2002) studied on Turkey originated publications which were indexed in SSCI between 1970 and 1999. According to the results of this study, there was a high rate of increase in the number of publications, most of which are articles, in recent years. On the other hand, a decline was observed in impact factors and citations across years. In addition, many of the articles having high impact were observed as co-authored with authors from other countries.

Another worldwide research related to productivity of authors was conducted on 2.727 authors and 1.407 publications. Articles regarding a specific subject area in ISI and WOS were covered in this research. According to the results, 86% of the authors produced one publication. Authors from the USA, the UK and Germany were found to be the most three productive ones respectively. Number of citations and journal impact factors were found to be statistically positively correlated variables in this research (Gu, 2004).

Liu, Hu, Tang and Wang (2015) studied on China's social science research using bibliometric analyses. Their dataset included SSCI publication data between 1978 and 2013. They found an increase in the rate of China's publications in terms of volume, world share, and global ranking. In addition, they pointed out that

China was not yet a major player in social sciences according to the findings of the study. National orientation of social science research and the linguistic obstacles were specified as the barriers.

As mentioned above, there are various studies that make use of bibliometrics in order to obtain statistical results regarding research performance, country contributions to international research and journals' status etc. On the other hand, especially in educational research context, almost all of the previous studies deal with only a few variables and small sizes of datasets. For this reason, it is not possible to access broad findings and to draw a big picture of current status of educational research. It must be taken into consideration that we must deal with big data and various related variables to come up with broad empirical research findings and to see the big picture of current status of educational research.

In this regard, a comprehensive investigation related to educational research is needed in order to find out which subjects come into prominence, which countries have the most contribution to educational research, if the funds spent make the grade or not, which publications have the most impact on developments in educational research etc. Such an investigation will probably give feedback to policy makers, researchers, universities, funders and other stakeholders in terms of their responsibilities, studies and policies.

The aim of this research is to find out bibliometric analysis results related to educational research covering 156.689 WOS articles in the period of 1980-2014, which are indexed in "Education & Educational Research" subject area in order to gain a comprehensive point of view about the current status of educational research in terms of various critical variables. In addition, this study specifically aims to find out the contribution of Turkey addressed researchers in educational research. In this context, research questions are listed below:

1. What are the general descriptive statistics related to the data set of the study?
2. What are the statistical results related to collaboration of authors in published articles?
3. What are the statistical results related to distribution of published articles according to subject areas?
4. Which journals are the most effective ones in the field of educational research?

Method

This research was designed as a descriptive research because it mainly tended to discover current status of educational research covering WOS articles. According to Fraenkel, Wallen and Hyun (2014) descriptive research describes a given state of affairs as fully and carefully as possible.

The Dataset of the Study

The dataset of the study is composed of information of articles which are indexed under "Education & Educational Researches" subject category (SC) in Social Sciences Citation Index (SSCI), Science Citation Index (SCI) and Arts and Humanities Citation Index (A&HCI) of WOS (Web of Science) between 1980 and 2014. In this context, detailed data such as author name, title, journal name, number of authors, date of publication, keywords and number of citations were collected for each article. 95% (N= 149.620) of the articles are in English.

The dataset of the study was downloaded from WOS database on 01.20.2015. In order to reach this dataset, the web site of WOS was visited and the following query was executed:

(su=(education and educational research)) AND DOCUMENT TYPES: (Article) Timespan: 1980-2014. Indexes: SCI-EXPANDED, SSCI, A&HCI).

After executing this query, it was possible to download all article information in the dataset as "full record and cited references" in plain text format. It was not possible to download the complete dataset at once because of the WOS policy. For this reason, information of articles was downloaded as groups of 500 articles. Totally 157.690 articles were reached. Authors of this study were not able to reach all related data of 2014 on this date. This is one of the limitations of the study.

In order to cope with data duplication, all the data were scanned and controlled carefully using various verification techniques. For example, an article can be indexed in two different indexes at the same time. In this case, an article can be found to have two different WOS ids. Title (TI) of article and journal name (SO) were taken into consideration and data duplications were detected in these cases. As a result of this

verification, 1001 records were found to be duplicate data. After data cleaning and eliminating duplication, totally 156.689 articles were ready for analysis. All the data were transferred to Microsoft SQL Server database management system. Because the study dealt with big data, relational database and advanced queries were needed for data analysis.

Data Analysis

Because of the size and complexity of the dataset of the study, data mining was used. Larose (2014) defines data mining as "*the process of discovering useful patterns and trends in large datasets*". In order to see these patterns and trends, bibliometric analysis was conducted in this study. Pritchard (1969) explained the term bibliometrics as "*the application of mathematical and statistical methods to books and other media of communication*". According to Glanzel (2003) the most important information used in bibliometrics for scientific publications are journal title, names of authors, corporate addresses, references, document type, title, keywords, abstract, subject headings and acknowledgements. Glanzel (2003) also mentions that bibliometrics has become a standard tool of science policy and research management in the last decades.

Co-occurency analysis (co-word, co-authorship etc.), author productivity and journal productivity were used as bibliometric indicators by VOSviewer software in order to answer the research questions. VOSviewer is *"a software tool for constructing and visualizing bibliometric networks. These networks may for instance include journals, researchers, or individual publications, and they can be constructed based on co-citation, bibliographic coupling, or co-authorship relations"* (van Eck & Waltman, 2016).

In addition, a heat map was used to illustrate distribution of articles by country. Heat map can be defined as "*a graphical representation of data where the individual values contained in a matrix are represented as colors*" (https://en.wikipedia.org/wiki/Heat_map).

Microsoft SQL Server database management system software was used to produce query results which were needed for frequencies, figures, heat maps and other deliverables in the study.

Findings

This study has four research questions. Findings were presented considering these questions respectively under separate titles.

General Descriptive Statistics Related to the Dataset of the Study

It is important to gain knowledge about the data size, handled in the study, in order to put forth meaningful bibliometric results. The data set of the study included 156.689 educational research articles derived from WOS between 1980 and 2014. Distribution of articles by year is summarized in Figure 1.

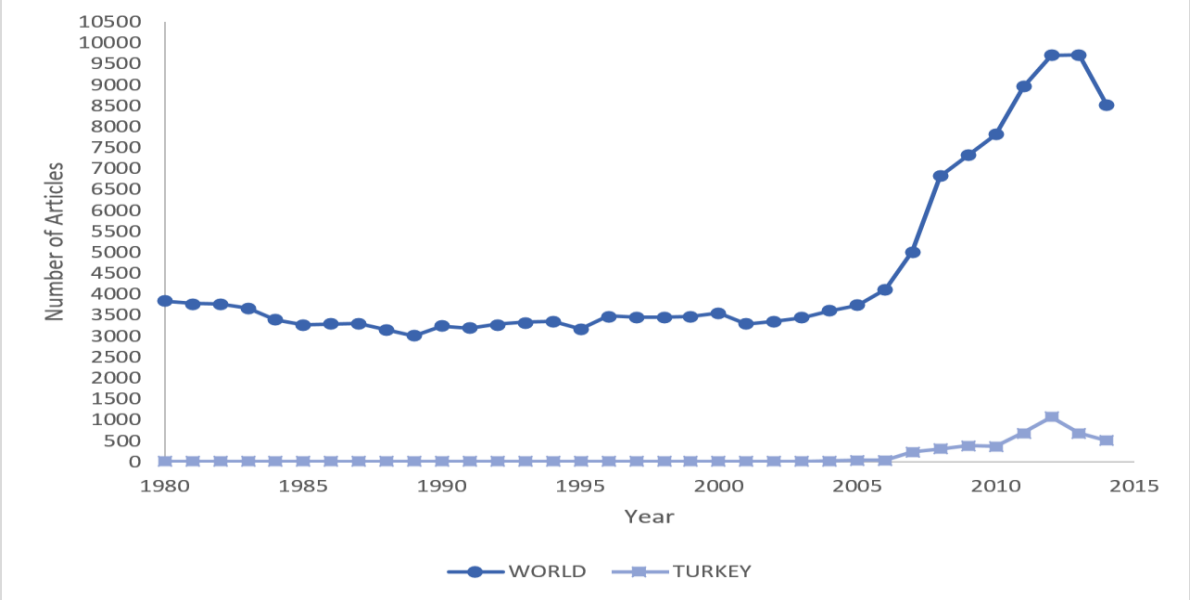


Figure 1. Distribution of articles by year

The label "TURKEY" in Figure 1 refers to articles written by at least one Turkish addressed author. There may be a confusion when reading Figure 1 because some few numbers might be seen as zero. This is because of the scale of the "Number of Articles" axis. For example the number is 1 for 1980. According to Figure 1, 4.429 (2,82 %) of the articles were written by at least one Turkey addressed author. It is obvious that there is a significant increase in the number of educational research articles especially in recent years. Totally there are 3.827 educational research articles, indexed in WOS, in 1980. On the other hand there are 8.512 articles in 2014. For Turkey, this number is 1 in 1980 and 504 in 2014. The average number of educational research articles per year in the world between 1980 and 2006 is 3.439,33. Moreover this average between 2007 and 2010 was calculated as 6.738,25 and as 9.218,50 between 2011 and 2014. The average number of articles, written by at least one Turkish addressed author, per year between 1980 and 2006 is 6,77. As an additional information; there was no article in 1987 for Turkey. Moreover, this average between 2007-2010 was calculated as 322,75 and as 738,75 between 2011 and 2014.

Especially by the year 2006, the increase in the number of articles written by Turkish authors is higher than before. The result is almost the same for the educational research articles in the world. This rapid increase may be due to the expansionism of WOS in 2006 as there has been an increase in the number of journals indexed in WOS in the subject category of "Education & Educational Researches" as a result of this expansionism. Of course this may not be the only reason, but it can be said that the increase in the number of these journals may have probably been the main factor. However, 2014 shows a contradiction as given number of articles published in 2014 is less than the number of the articles published in 2013 both for Turkey and the world. This contradiction can be explained by the obstacle that it was not possible to reach a part of the data of 2014 because of the delay in data entrance into WOS database (See "Limitations"). Another significant point to be considered is the descriptive statistical results related to number of authors. Number of authors contributed to educational research by year is summarized in Figure 2.

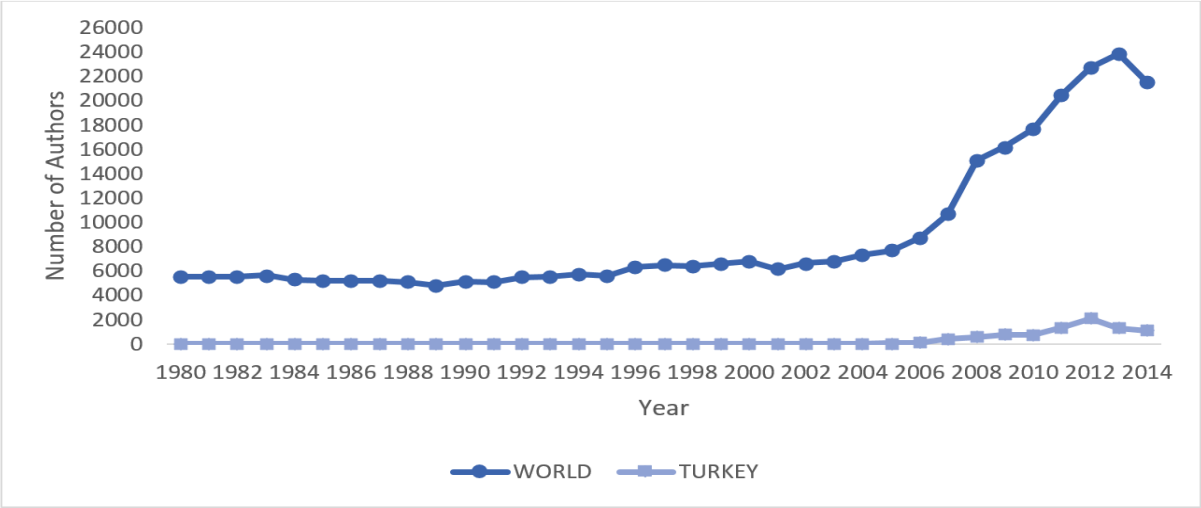


Figure 2. Number of authors contributed to educational research by year

"Number of authors" in Figure 2 refers to authors that were defined as an "author" in articles in the dataset context. It can be easily seen that there is a coherence between Figure 1 and Figure 2. In other words, number of authors goes parallel with the number of articles. For this reason, it must be taken into consideration that an author can be defined in many articles and also some articles are written by only one author and some more than one.

According to the dataset of the study, the total number of authors defined in the articles is 309.341. Turkey addressed author numbers defined in the articles is 8.679 (2,80 %). In addition, 178.441 single authors contributed to educational research between 1980 and 2014. The number of single Turkey addressed authors is 5.223 (2,93 %).

2006 is the critical year in which there is a shift in the number of authors that produced educational research articles both in the world and Turkey, in particular. The average number of authors per year between

1980 and 2006 is 5.974,96. This average between 2007 and 2014 is 18.502,12. The average number of Turkey addressed authors per year between 1980 and 2006 is 13,11. This average between 2007 and 2014 is 1.040,62.

In the dataset of the research, addresses of authors were also included. Analysis containing this specific data enabled us to produce results that will uncover the contribution levels of countries to educational research relative to each other.

Number of articles by country is summarized in Figure 3. In this study, authors' defined affiliations were used as the indicator in order to determine the "country" as the source of articles. For example, if an article was written by a collaboration of a Turkey addressed author with a USA one, this kind of an article was counted for both Turkey and USA. In addition, only the top 25 countries were presented in terms of contribution level to educational research. It must be taken into consideration that there are 47.555 articles (30,35 % of all articles) of which author addresses could not be reached in WOS database. For this reason, articles without author addresses were not included as records for the analysis related to country contribution.

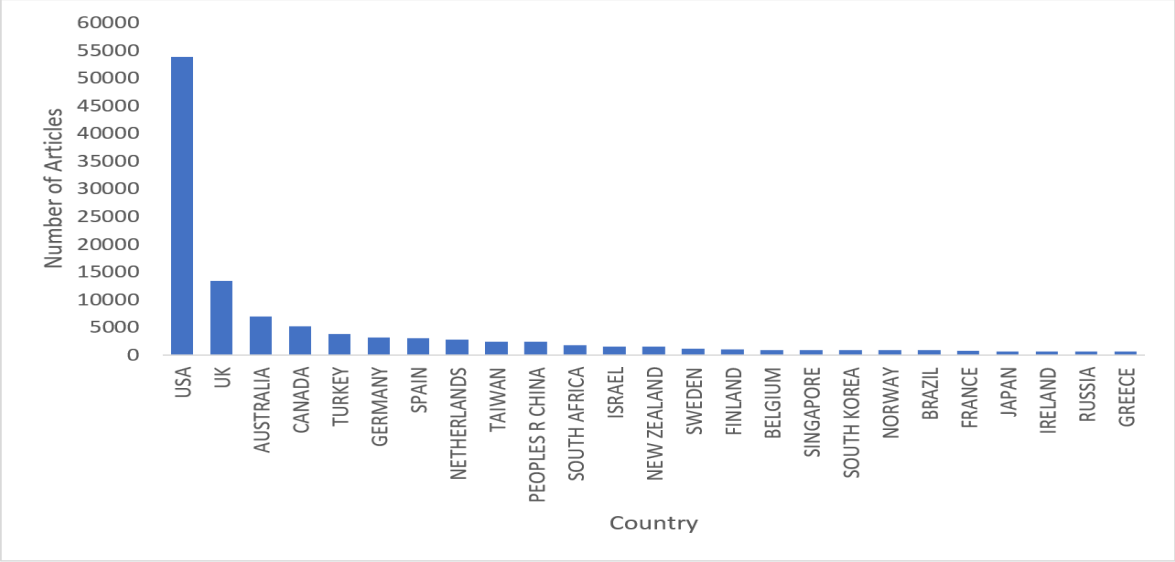


Figure 3. Number of articles by country

A heat map related to the distribution of articles by country is given in Figure 4 in order to support the intelligibility of Figure 3.

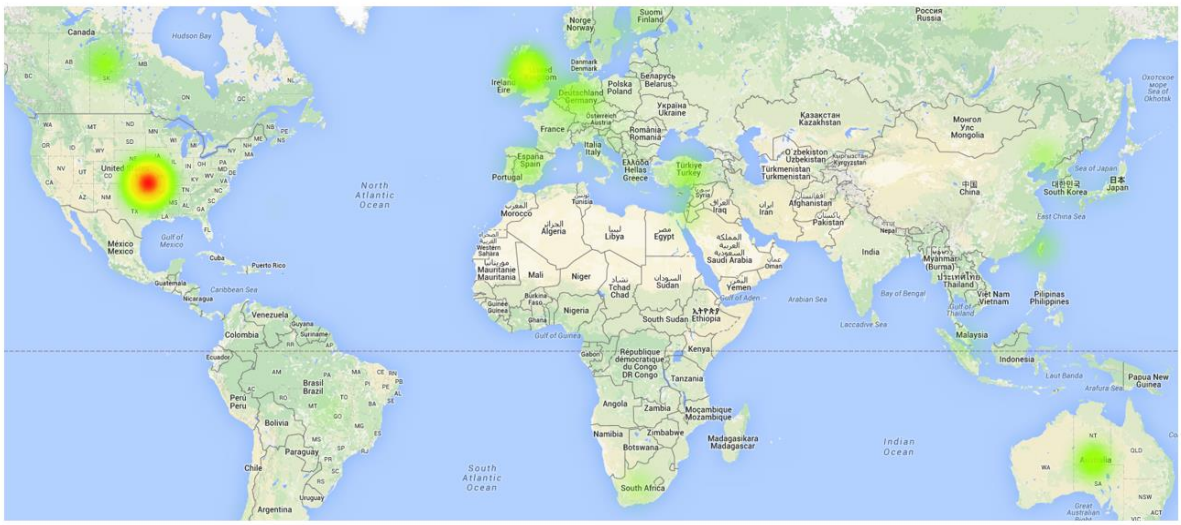


Figure 4. A heat map related to distribution of articles by country

Countries are emphasized relatively according to their level of contribution to international educational research literature in Figure 4. When Figure 3 and Figure 4 are considered together in the context of the dataset, the following results can be listed:

- The top 4 countries which most contributed to educational research are the USA, the UK, Australia and Canada, respectively.
- Turkey is the fifth one in this ranking.
- The dominance of USA addressed authors in terms of contribution can easily be seen.

Findings Related to Collaboration of Authors

The calculated total number of author names mentioned in 156.689 articles is 309.341. Number of authors is higher than the number of articles because of co-authorship. Number of articles with respect to number of authors is summarized in Figure 5.

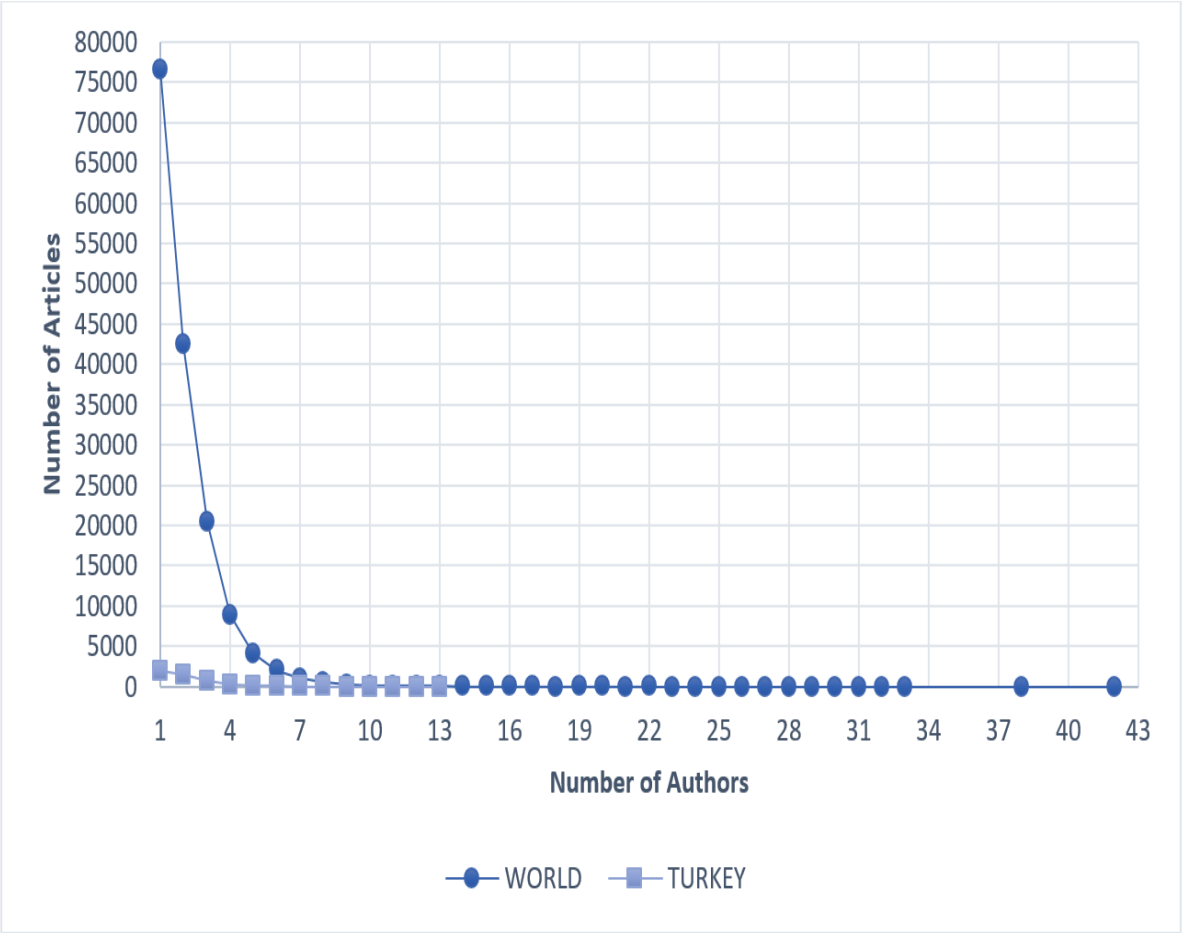


Figure 5. Number of Articles with respect to Number of Authors

According to Figure 5, it is a remarkable result that almost half of the articles (49 %) are single-authored. In addition, approximately 89% of the articles have less than 4 authors. The figure of Turkey, in particular, seems similar with the world in this perspective. As an additional information; the article titled "Learning by creating and exchanging objects: The SCY experience" has 42 authors (maximum number in the dataset).

These results show us that co-authorship is not usually preferred by researchers in the field of education. This study does not include deep analysis related to co-authorship in terms of specific subject areas, disciplines, countries or other possible related variables. Future research should set light to collaboration of authors in international educational research in a cause-effect perspective.

Social network analysis was performed in order to visualize co-authorship (collaboration of authors). Co-authorship map is given in Figure 6. It would be very difficult to understand such a map if we included all of the authors because of the big size of the data and the complexity of the map. For this reason, only the data of authors who had at least 20 articles (threshold = 20) were used. There are 765 authors who fulfill these criteria.

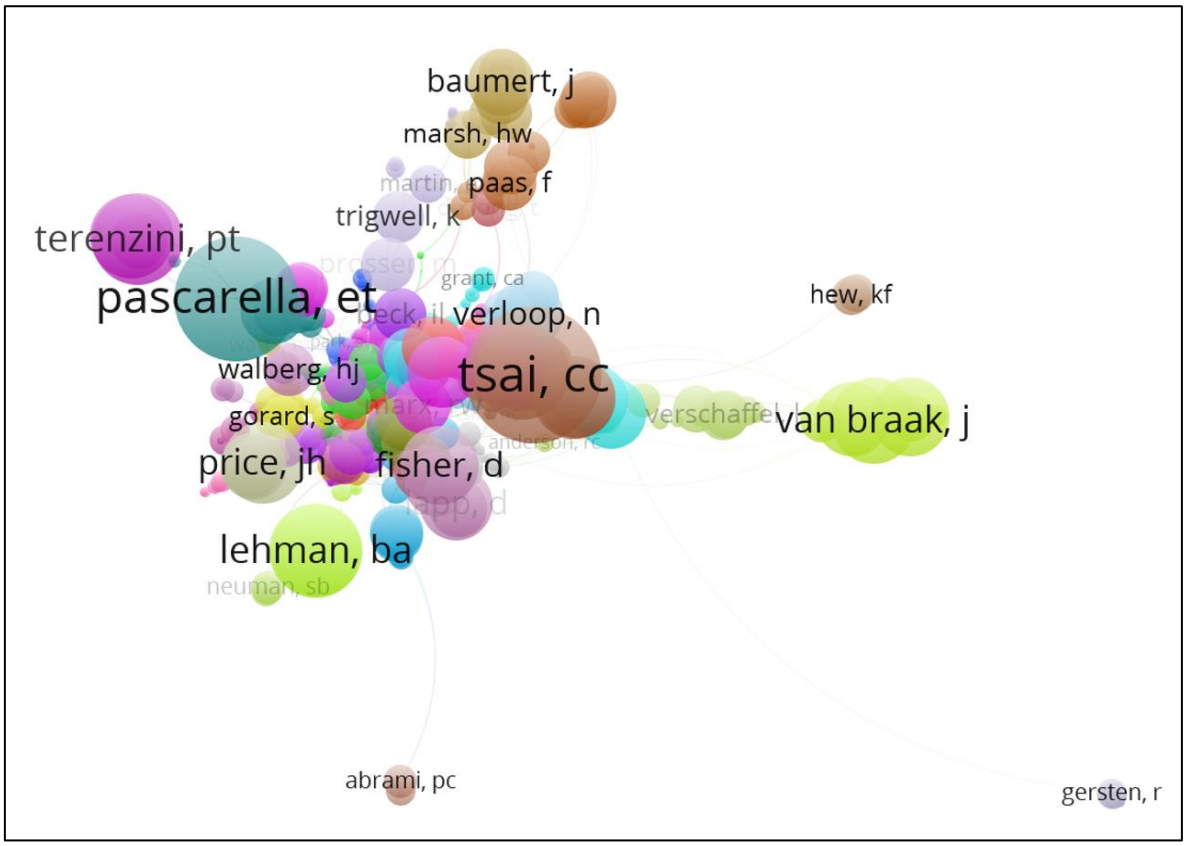


Figure 6. Co-authorship map

In Figure 6, the most prominent authors in educational research in terms of co-authorship can be easily seen. In other words, the most upfront names in the figure have the highest number of articles written by at least two authors. For example, Tsai, who has been mentioned as an author in 183 articles, has written 118 of them (64,5 %) in collaboration with other authors. For this reason, this name seems to be one of the dominants in the figure.

It can also be concluded that the most productive authors, in terms of number of articles published, generally find themselves a place in the co-authorship map. Of course there are some exceptions. In other words, there are some productive authors who have much more single-authored articles than co-authored articles. For this reason, we cannot talk about an exact correlation between number of articles and number of co-authorships. Number of authors per article by year is presented in Figure 7. In order to draw this figure, the average number of authors per article for each year has been calculated.

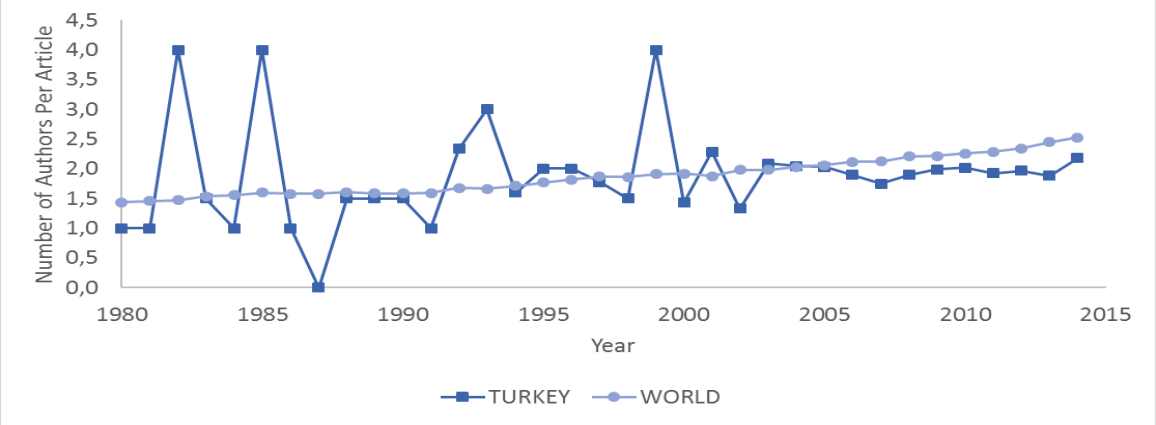


Figure 7. Number of Authors per Article by Year

According to Figure 7, average number of authors per article shows a growing trend especially since 2000 in the world. This trend is different for Turkey as this growing trend can be seen since 2008 for Turkey. It can be concluded that there is an increase in the collaboration rate of authors over the years in international

educational research. In other words, researchers seem to prefer collaboration much more than ever before. In Figure 7, the average number of authors per article was intently shown as zero in 1987, just because there was no article written by Turkey addressed authors in that year.

Findings Related to Distribution of Articles with respect to Subject Areas

For this analysis of the study, keywords of the articles were taken into consideration. Using cluster analysis, occurrence and co-occurrence frequencies of the terms in keywords were calculated. Occurrence refers to how many times a term is used as a keyword in the articles. Co-occurrence refers to how many times a term is used conjoined with another term as a keyword. For example; if "distance education" is a keyword, this is an example for co-occurrence of both the terms "distance" and "education".

According to cluster analysis results; the terms "education" (occurrence= 7.532, co-occurrence= 1.437), "teacher" (occurrence= 2.793, co-occurrence= 279) and "teaching" (occurrence= 2.360, co-occurrence= 882) are the top three keywords in terms of occurrence frequency. Figure 8 represents cluster analysis map regarding co-occurrence frequencies of keywords in the articles.

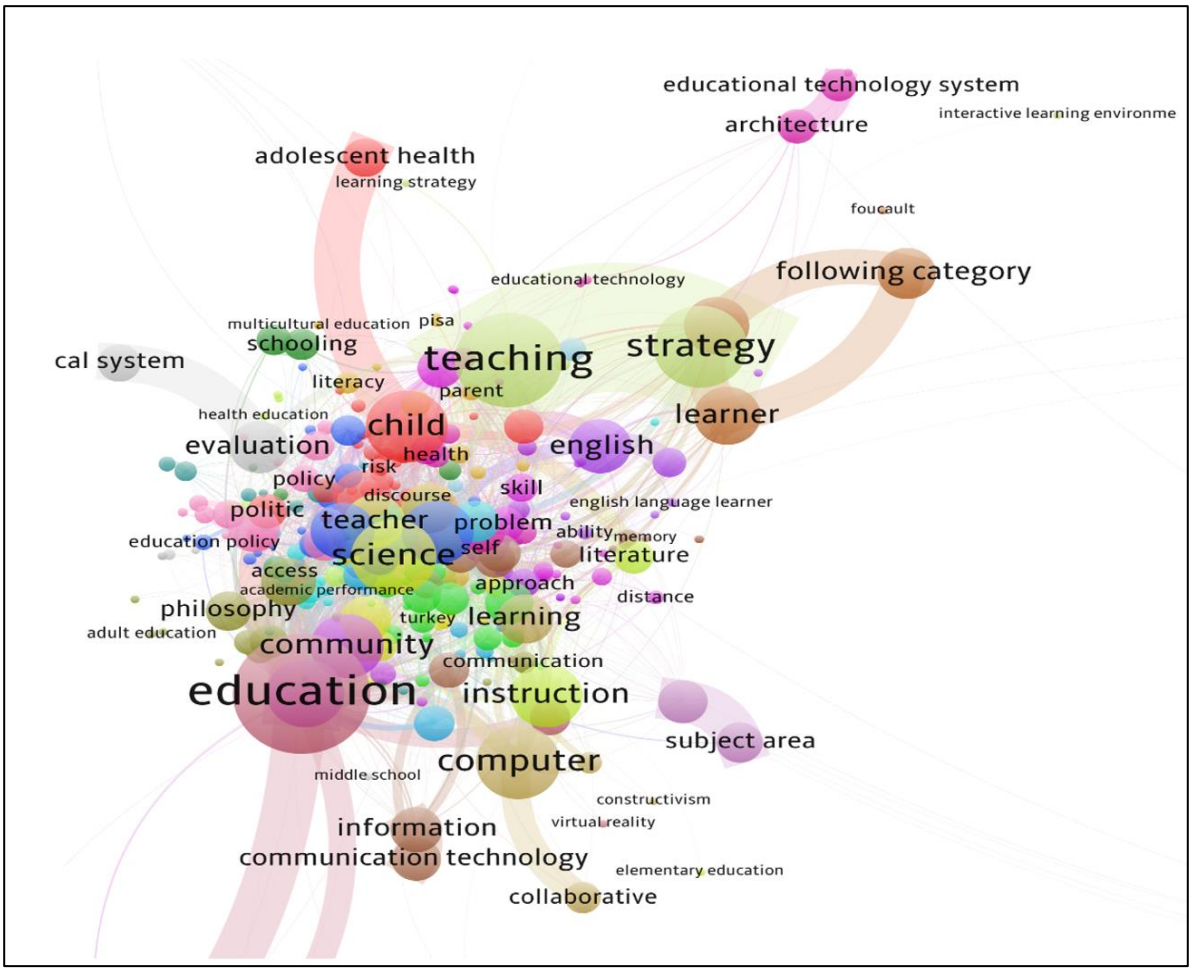


Figure 8. Cluster Analysis Map Regarding Co-Occurrence Frequencies of Keywords in the Articles (WORLD)

Only the keywords with high co-occurrence frequencies can clearly be seen in Figure 8. It should be noted that it is not possible to present all keywords in the dataset of the study in one figure. It is because there is a limit of page width and intelligibility of the figure is concerned. The most upfront keywords in Figure 8 are the ones with the highest co-occurrence frequencies. Also relations between these keywords are emphasized by lines in the figure.

Using cluster analysis, occurrence and co-occurrence frequencies of the terms in keywords for articles, written by at least one Turkey addressed author, were calculated. According to these cluster analysis results; the terms "education" (occurrence= 741, co-occurrence= 76), "teacher" (occurrence= 389, co-occurrence= 33) and "attitude" (occurrence= 247, co-occurrence= 57) are the top three keywords in terms of occurrence

frequency. The first two keywords are the same with the first two keywords mentioned above. On the other hand, it is a remarkable finding that "attitude" is the third one for Turkey unlike the rest of the "world".

Figure 9 represents cluster analysis map regarding co-occurrence frequencies of keywords in articles, written by at least one Turkey addressed author.

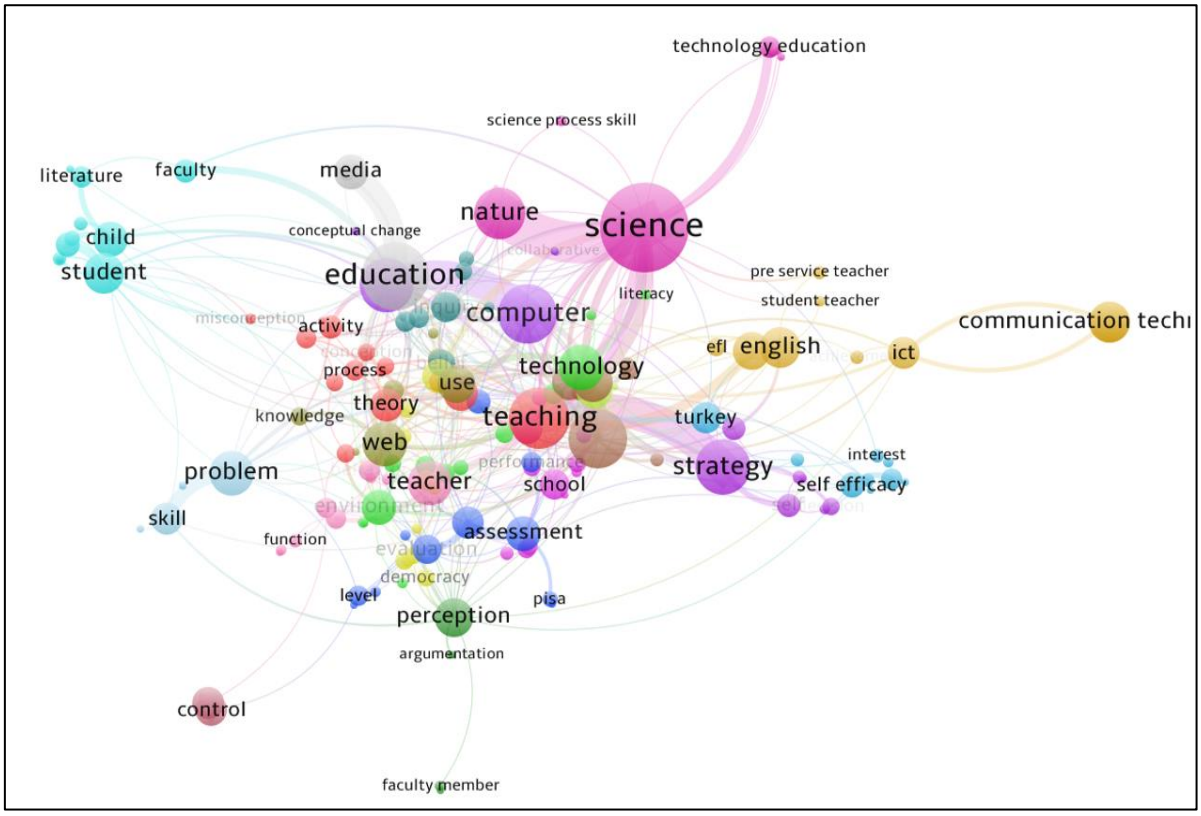


Figure 9. Cluster Analysis Map Regarding Co-Occurrence Frequencies of Keywords in the Articles (TURKEY)

Figure 9 was produced using the same method with Figure 8. Keywords in articles, written by at least one Turkey addressed author, were used as the data for Figure 9. The most featured keywords and relations of them for co-occurrences can easily be seen in Figure 8. Further analysis focusing on comparison of the above-mentioned two figures could be done in order to come up with more detailed findings. However, this is not included as a research question in this study. Deep understanding of keyword usage is recommended to be studied on in detail for future research.

Findings Related to Journals in the Field of Educational Research

In order to find out the most effective journals in the field of educational research, top 50 journals in terms of number of published articles were taken into consideration. In addition, 5 years impact factors of these journals were derived from Journal Citation Reports (JCR) database. According to the dataset of the study, 41.782 (26,67 %) articles were published in journals with a 5 years impact factor higher than 1,00. In addition, 21.822 (10,65 %) articles were published in journals with a 5 years impact factor between 0,50 and 1,00. Number of articles published in journals with a 5 years impact factor lower than 0,50 is 14.080 (8,99 %).

The total number of articles published in the top 50 journals is 72.543 (46,30 % of all articles in the dataset). In the dataset of the study, total number of journals indexed in WOS (education & educational research) is 231. We can say that almost half (46,30 %) of the educational research articles were published in the top 50 journals.

Journals with respect to number of articles is given in Figure 10. It includes names of the top 50 journals in terms of number of published articles.

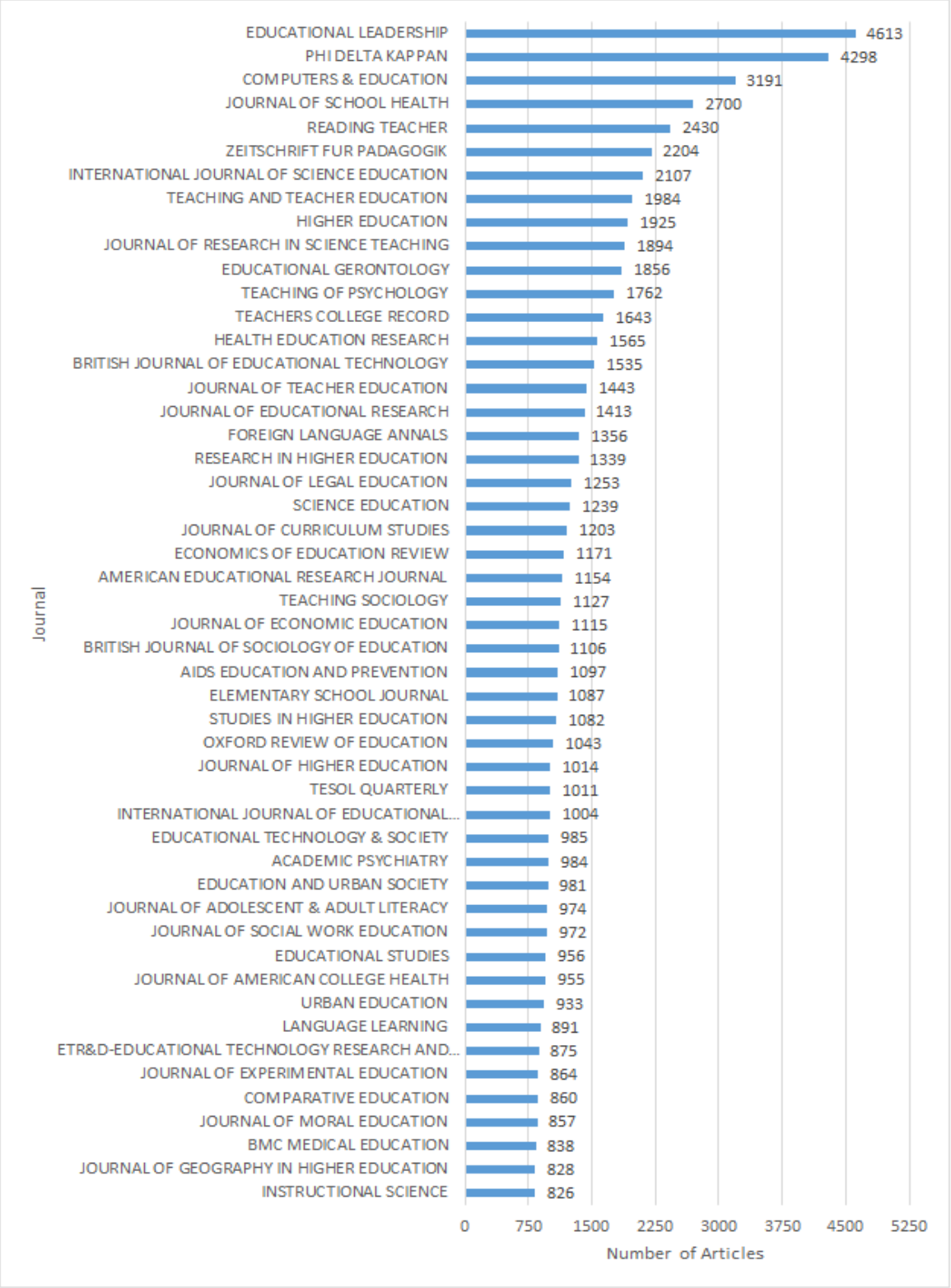


Figure 10. Journals with respect to Number of Articles (WORLD)

According to Figure 10, "Educational Leadership", "PHI Delta Kappan" and "Computers & Education" are the top 3 journals in terms of number of published articles. In this finding, number of articles published is assumed as the indicator for effectiveness of journals in educational research. Certainly there are many reasons affecting the above mentioned distribution of articles to journals some of which may be the impact factor, language, publication frequency and scope of the journals. However, this study does not deal with investigating these reasons. Figure 10 clearly shows which journals are mostly preferred by authors studying

on educational research. This finding and the subsequent one will serve as a guide for researchers, especially the unexperienced ones, when determining the journal to submit article and scanning literature related to their studies.

Of course only the number of articles cannot be taken as the indicator for journal effectiveness. Many bibliometric studies point out impact factor to be considered (Cvetanovich et. all, 2015; Xu, Liu & Rousseau, 2015). Especially five years impact factor (impact factor for the last five years) is important in this context. For this reason, subsequent figure and finding represent five years' impact factors of these top 50 journals. Figure 11 gives journals with respect to five years' impact factor. The ranking in Figure 10 was not modified for Figure 11 in order to allow easy comparison of these two figures.

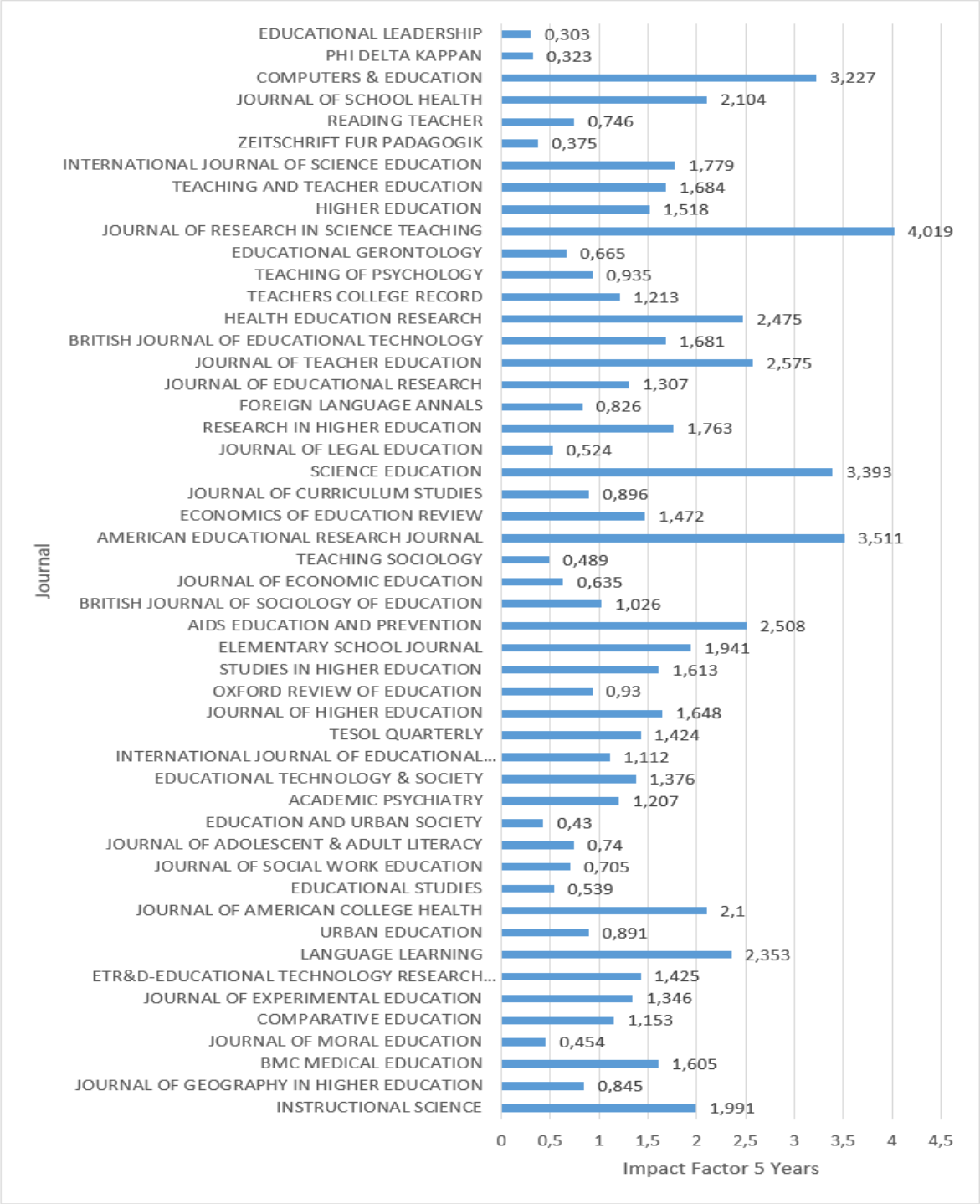


Figure 11. Journals with respect to 5 Years Impact Factor (WORLD)

It can be concluded that there is not a direct positive relationship between number of articles published and five years impact factor. Five years impact factors of top 50 journals were illustrated on Figure 11. According to Figure 11, "Journal of Research in Science Teaching", "American Educational Research Journal" and "Science Education" come into prominence as the top three in terms of five years impact factor.

When articles of Turkey addressed authors are concerned, the big picture completely changes. According to the dataset of the study, 543 (12,26 %) articles of Turkey addressed authors were published in journals with a 5 years impact factor higher than 1,00. In addition, 271 (6,12 %) articles were published in journals with a 5 years impact factor between 0,50 and 1,00. Number of articles published in journals with a 5 years impact factor lower than 0,50 is 2156 (48,68 %). Considering that totally 4.429 articles were written by at least one Turkey addressed author, it can be concluded that 67,06 % of articles written by Turkey addressed authors were published in the mentioned top 50 journals. Figure 12 represents journals with respect to number of articles, written by at least one Turkey addressed author.

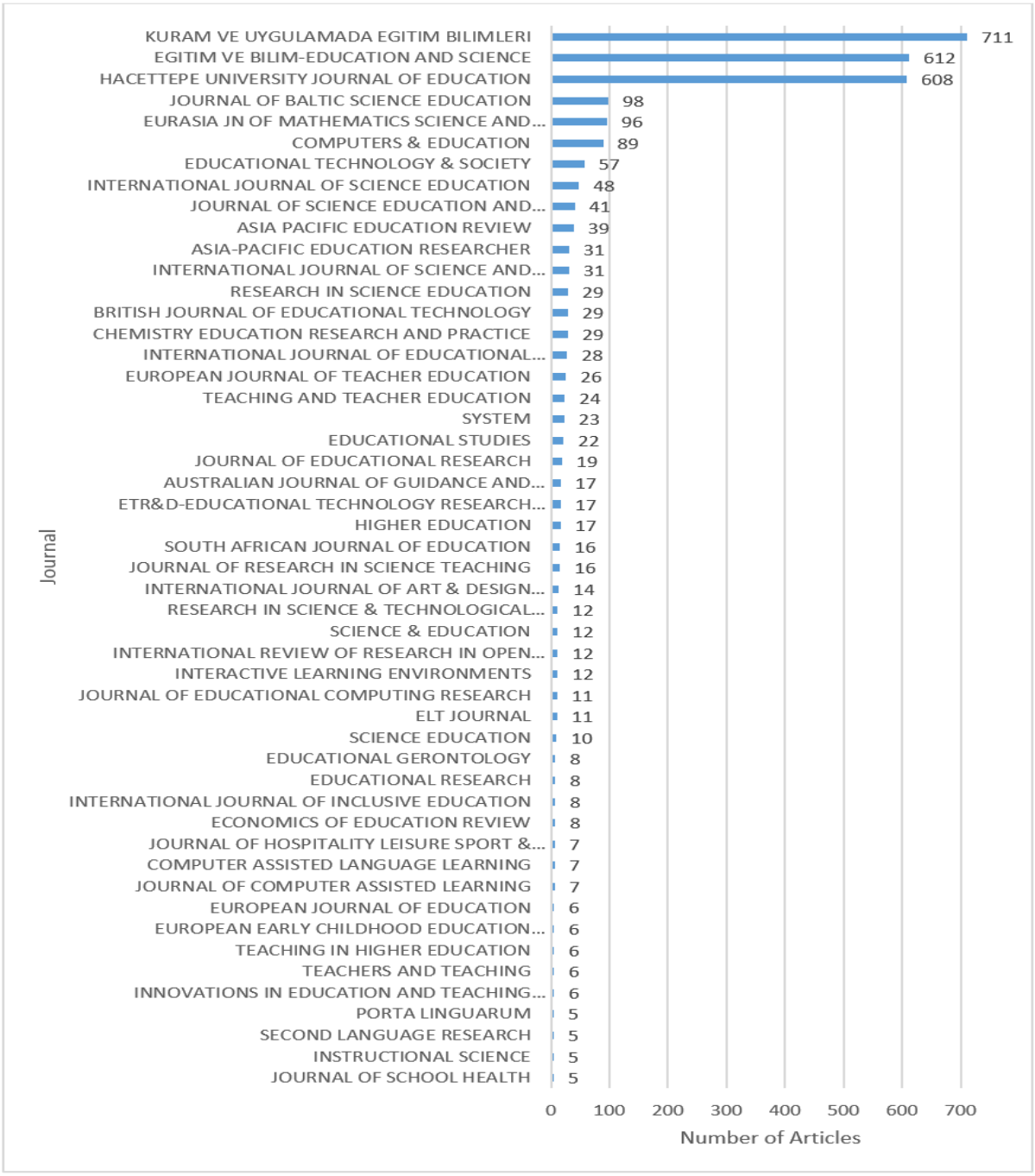


Figure 12. Journals with respect to Number of Articles (TURKEY)

In this finding, number of articles, written by at least one Turkey addressed author, is used to come up with a ranking. According to Figure 12, "Kuram ve Uygulamada Eğitim Bilimleri (Educational Sciences: Theory & Practice)", "Eğitim ve Bilim (Education and Science)" and "Hacettepe Üniversitesi Eğitim Fakültesi Dergisi (Hacettepe University Journal of Education)" are the top three journals in terms of number of published articles of Turkey addressed authors. This finding calls attention to journal preferences of Turkey addressed authors. It is a remarkable and interesting finding that Turkey addressed authors generally seem to prefer the above mentioned three journals which are already Turkey originated.

Limitations of the Study

The dataset of the study is limited with accessible articles which are indexed under "Education & Educational Researches" subject category in SSCI, SCI and A&HCI between 1980 and 2014. Articles without author addresses were not included for some of the analysis.

The dataset of the study was downloaded from WOS database on 01.20.2015. However, authors were not able to reach all related data of 2014 on this date. This may be due to the delay in data entrance to WOS database. Moreover, it takes much time and some part of the data of 2014 were not ready to be downloaded on that date. The heat map, the co-authorship map and the cluster analysis maps were simplified for a better understanding.

Conclusion and Discussion

This study aimed to exhibit a holistic approach to current status of educational research in the context of articles. For this purpose, many variables some of which are number of articles, number of authors, countries, journals, keywords and years were taken into consideration separately and sometimes together. By this way, we were able to find answers to research questions. On the other hand, more meaningful and valuable results might only be reached if you think about all related findings together. When interrelated findings are considered as a whole, the following conclusions can be listed:

There is a rapid increase in the number of educational research articles and authors, studying in the field of educational research, especially in the last decade. This increment can be assumed as ordinary and usual because of the rapid developments in science, education, technology and communication. On the other hand, this result should be additionally discussed. Because the main problem is if this improvement is adequate or not. There are various factors affecting this improvement. For this reason, future research should find answers to this question. Number of articles per author in the world, funding opportunities for educational research, policies and visions of journals publishing educational research articles, university resources and some other related issues can be investigated together in the light of current requirements of education for this purpose. Similar research findings will serve to improve educational research literature by proposing applicable and sustainable recommendations about how to increase the number and quality of educational research articles.

Almost half of the articles in the dataset of the study were found to be single-authored. However co-authored articles were found to be more successful in terms of citations. In addition, especially authors who prefer collaborative research studies seem to come into prominence in the field of education in terms of author productivity. Multidisciplinary studies encourage co-authorship. For this reason, number of co-authored articles would increase if number of multidisciplinary studies increase. The literature clearly points to the importance of multidisciplinary studies and these studies should be encouraged (Al, Soydal & Yalçın, 2010; Yalçın, 2010). For this reason, we can predict that number of multidisciplinary studies and co-authored articles will probably increase at a faster rate. There may be many reasons of why authors usually tend to write single-authored articles. For example, in Turkey, academicians in the field of education are required to have at least one single-authored article to become associate professor.

The USA has the biggest impact on international educational research. This conclusion might have various reasons. There are similar findings in the literature (Bornmann, Wagner & Leydesdorff, 2015; Bauer, Leydesdorff & Bornmann, 2015). In addition, the USA has more journals, which accept educational research articles, than other countries. We can conclude that almost half of the articles in the dataset of the study were produced by USA addressed authors. This result clearly points out the leadership of the USA in the world in terms of contribution to international educational research. Our study also showed that researchers from

almost all other countries tend to study in collaboration with USA addressed researchers. This may be interpreted as a conclusion and also as a reason of the above mentioned leadership. Of course we still need new deeper researches in order to find out the real reasons of this result.

Turkey, on the other hand, is the fifth country in terms of high contribution to international educational research. We can say that Turkey addressed authors usually tend to study in collaboration with researchers from European countries. It is also a strange conclusion that Turkey addressed authors usually prefer journals which are Turkey originated although there are a few journals indexed in WOS. Of course these journals have contribution to international educational research. However, these journals were not found to be listed in the first 50 journals in the world in terms of contribution to international educational research. For this reason, it is obvious that Turkey addressed researchers should increase tendency to other journals with high impact factors. By this way their contribution level to educational literature might increase. Research related policies and funding opportunities of Turkey should be revised in order to encourage Turkey addressed authors in this context.

According to the dataset of the study, number of Turkey addressed authors is 2,8 % of number of authors in the world. This ratio cannot be an indicator itself. However, it is clear that this ratio is low although Turkey is the fifth country in terms of high contribution to international educational research. Turkish policy makers should think about how to increase this ratio. Researchers should be encouraged and supported in this sense. They should not only deal with increasing the number of researchers in the field of education but also increase the potential ability of them to produce educational research articles to be indexed in WOS. Supporting and funding more educational research projects, in-service trainings and international relations will probably help them in this respect.

The average number of citations for an article (Times Cited / N) is 7,57 in the world. This average is 2,74 for Turkey. This average means how many times an article is cited in other articles in average. In this study WOS articles were taken as the dataset. For this reason, this ratio is expected to be high. The meaning of number of citations to articles is important for authors and journals in the world. This study tried to find out prominent journals and countries. For this reason, these are not detailed results. Future research should question the reasons of high and low number of citations to articles. Such an investigation also needs big data related to articles. Because findings derived from limited datasets will not be able to present realistic and comprehensive results.

Findings related to analysis of keywords generally give clue about which subjects are studied more often. Thus, there are many research papers inferring from keywords used in articles (Sedighi, 2016; Hong et. all, 2016). Cluster analysis maps in this study presented mostly used keywords in WOS articles. In this study, the terms “education”, “teacher” and “teaching” were found to be the top three keywords, used in articles in the world, in terms of occurrence frequency. These general terms have the potential to be used with other terms as keywords. When it comes to articles of Turkey addressed authors, the first two are the same but the third term is “attitude”. This result is not enough to argue that Turkey addressed authors studied “attitude” related subjects much more. However, this is an important result and can be used with other possible future research findings in order to show subject preferences of researchers in the field of education for their articles as subject preferences are important in terms of direction of educational research development.

It is obvious that there is not a direct relationship between five years’ impact factors of journals and number of published articles.

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