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Research Article

Map of Scientific Publication in the field of Educational Sciences and Teacher Education in Turkey: A Bibliometric Study*

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Abstract

This study aims to create a map for the scientific publications in the field of educational sciences and teacher education in Turkey. A bibliometric analysis was carried out with 7681 articles published in 32 different peer reviewed journals between 2005 and 2014. The findings show that one third of all articles were published in core journals determined by Bradford's Law (Hacettepe University Journal of Education, Educational Sciences: Theory & Practice, National Education, Education and Science). The distribution of articles across journals do not conform to Bradford's and Pareto's Law yet it conforms to Price's Law. It is found that 80 percent of articles are single or multiple–authored; the mean score of author per article is 1.81; and 97 authors have more than 10 articles. When the frequency of words in the titles are analyzed, the first most frequently used five words are: "teacher," "student," "education," "primary education," and "teaching."

Keywords

Educational sciences • Teacher education • Scientific publication • Bibliometric • Bradford • Lotka • Zipf • Price • Pareto

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Many countries make policies to achieve and support sustainable economic growth. The existence of countries on international platforms depends whether they can transform the scientific knowledge into technological developments. In addition, as the developed countries and economies become the source knowledge export, less developed countries depend more on them. It is necessary for both less developed and developing countries to systematically analyses their science policies, and guided by these policies they should make future plans, set goal and attain their goals. Bibliometric indicators first took place in *Science Indicator Report* of National Science Foundation in 1973 and since then they are being used in countries' science policies reports. These reports form the starting point of analyzing structure of science policies quantitatively (Karasozen, 2009). Quantitative analysis of science policies by bibliometric methods makes it possible to compare developments in areas of expertise in accordance with the world standards or to compare national institutions with each other (Zan, 2013).

Turkey, as a slowly progressing country in terms of science and technology, needs bibliometric research in order to direct her main goals such as following changes in the knowledge, setting aims in accordance with the economy of developed countries and improving the quality of lab our force. The use of bibliometric in reviewing scientific articles in Turkey is at its early stage. *Bibliometric* is a method that uses mathematical and statistical methods to assess and analyses scientific publications and plays an important role in guiding science and technology policies (Zan, 2013).

Bibliometric

The qualitative and quantitative analysis of scientific publications, particularly articles, is important for revealing the change in scientific fields. Bibliometric can be defined as the 'mathematical and statistical methods employed in the analysis of scientific communication tools such as journals and books'. It aims to reveal the change, development and characteristic features of a field (Diodato, 1994). The first studies in the bibliometric started before 1920s and but the term was first employed by Pritchard (1969) who defined it as application of statistical and mathematical methods to publications. Thus the term is replaced with *statistical bibliography* (Forsman, 2008).

The statistical analysis of different aspects of scientific publications (*for instance*; such as author, theme, and citations) forms the basis of bibliometric studies. Bibliometric analysis can be in the form of citation analysis in order to describe and define the number of publications in a given year or to find out how a publication affected the subsequent studies (McBurney & Novak, 2002).

Reports prepared by institutes or scientific institutions are frequently seen in the literatures and these reports are based on bibliometric research with the aim of determining the scientific development of countries. The first report using the

bibliometric is the US National Scientific Council report (Aksnes, 2006). Such reports show the status of science in a country, its existing scientific systems, research approaches, and the scientific performances of researchers (Van der Meulen, 1997). These findings play an important role in determining the scientific development of the country/field and in academic promotions. For instance, today's universities place importance not only on publications in academic promotion but also pay particular attention to the bibliometric data such as citations. Bibliometric studies basically include statistical analysis of publications and make it possible to present the general structure of a field (Egghe & Rousseau, 1990; Wallace, 1989).

As the importance scientific studies, which form the basis of economic development and competition in the global world, increases, and the area of use of bibliometric studies are also expanding rapidly. Moed (2012) sorts the reasons of development as follows:

- The Possibility of change of indicators used in evaluation of studies and bibliometric data.
- Classification of articles according to their themes and aims
- Mapping the articles according to their key words
- The importance of impact factor in assessment of journals
- Identifying the main fields of scientific research stakeholders

First studies of bibliometric in Turkey dates back to 1970s. Özinönü (1970) used bibliometric to reveal the scientific efficiency of astronomy, biology, physics, chemistry, mathematics and earth sciences in Turkey. İnönü (1971) looked into the articles published by Turkish scientists in international journals and tried to determine the impact factor of these publications. It could be seen that until 1990, there were only a few bibliometric studies and the number of such studies increased only after 1990 (Al, 2008).

The number of bibliometric studies is increasing in Turkey. These studies aim to:

- Evaluate the scientific performances of countries (Al & Coştur, 2007; Birinci, 2008; Haiqi & Yuhua 1997; İnönü & Kurnaz, 2002; Jacobs & Ingwersen 2000; Liang 2003; Moed 2002; Osareh & Wilson 2000; Tonta & İlhan 1997; Uzun 1998; Wilson & Osareh 2003; Yalçın, 2010; Yurtsever, Gülgöz, Yedekçioğlu, & Tonta, 2001, 2002),
- Compare the countries with each other (Braun, Glanzel, & Grupp 1995a, 1995b; Garfield 1991; İnönü, 2003) and
- Look into the contribution and productivity of a particular person or an institution (Jeevan & Gupta 2002; Tonta & İlhan 2002; Uzun 2002).

Such studies not only evaluate the contributions of countries, institutions or researchers to the field but also offer a detailed assessment of the bibliometric features regarding the themes of publications.

Bibliometric Laws

The meaningful combination of values, which are formed by counting the different features of publication, with various statistical formulas makes up the basis of bibliometric studies. Quantitative analysis of scientific publication dates back to the mathematical models developed by Lotka, Bradford and Zipf between 1920 and 1940. These models are today known as *bibliometric laws*, *law of scattering* or *power law* (Subramanyam, 1979). Although these laws are accepted as bibliometric laws in the literature, they are also known as informatics laws as the term *informetry* covers bibliometric (Ikpaahindi, 1985).

Five main laws can be listed in bibliometric studies; *Bradford's Law*; *Lotka's Law*; *Zipf's Law*, *Price's Law* and *Pareto's Law*. Since these laws determine the productivity of the publications and the field, they are significant for 2 reasons:

- Quantitative indicators allow researchers to better analyze or interpret the work and publications.
- A law can help researchers develop a theory to explain why a certain pattern exists.

Bradford's Law. Bradford's Law is also known as Bradford's Law of Scattering. It is defined as 'distribution or scattering of literature in a particular filed/topic across journals' (Garfield, 1980). Bradford's law was first described by mathematician Samule Clement Bradford in 1934 and it is based on observation and research conducted on Bradford's publications on geophysics. The law argues that when articles of a specific topic/field in a journal are sorted by exponentially diminishing returns, journals can be divided into core journals publishing in a particular field or topic or multiple groups and region that involve approximately equal numbers of articles with the core group (Hertzel, 1987).

Bradford divides articles into three groups in the bibliography he has formed at the end of his research. If articles in the journals are sorted by diminishing returns, they are divided into a core group that forms publication directly related with the topics and regions with diminishing returns that involve equal amount of publications with core group (Egghe & Rousseau, 1990; Olsgaard, 1989)

Lotka's Law. Lotka's law was formulated by statistician Aflred J. Lotka (1926). This law argues that some authors in a field are more productive than other authors and have more publications in the related field (Diodato, 1994). Thus, Lotka's Law

estimates that a significant majority of publication in a field is made (written by) a small number of authors.

Zipf's Law. Zipf's Law ranks the frequency of the words from most frequent words to the least one by using statistical methods and estimates that the values produced by multiplying frequencies (*f*) and rank numbers (*r*) are approximately constant (Zipf, 1949).

Zipf's Law is a complicated bibliometric law and reveals the relation between the value of current index and frequency. Zipf's this research show that common degrees (*r')* are better than the expected lowest values and the highest ones (Hertzel, 1987). In summary, determining the use of frequency of words by using Zipf Law can be beneficial to indexing in a field.

Price's Law. Derek de Solla Price made several analysis to estimate enabled scientists by comparing scientists. Price's square root law has its basis in Lotka's Law. Price's Law states that half of the publications on a subject are contributed by the square root of the total number of authors publishing in that area (Sengupta, 1992). For instance, if we take the number of authors in education management as 225 and the number of articles as 1500, 750 of these articles are written only by 15 people. It is argued that Price's law is a different form of Lotka's Law (Klamer & Dalen, 2002).

Pareto's Law. Pareto's law is also known as the 80/20 law. It estimates that 80% of publication parts (for instance, number of articles and citation) produce 20% of the sources (*for instance*, journal and author). For instance, Pareto's law argues that 20% of the most productive educational sciences journals publish the 80% of articles in educational sciences field. It, at the same time, suggests that 80% of the all articles are written by 20% of the authors in the field (Ravichandra Rao & Neelanghan, 1992).

Academic Publications in the field of Educational Sciences and Teacher Education in Turkey

With the developments in the field of educational sciences and teacher education, many articles were published both during the last years of Ottoman Empire and early Republican era of Turkey. Several copyrighted work on education were translated into Turkish. Journal facilities can be argued to have played a vital role in formation of accumulation of knowledge in this field. Journal facilities in education started during the Ottoman times, continued throughout the Republican era and contributed to the accumulation of knowledge in today's world both within and the beyond academia.

The journal facilities in Turkey correspond to the years before the educational sciences and teacher education field started to institutionalize academically. In these years journal publications were mainly led by personal endeavours, organizations, and charities. They

followed a publication policy and procedure different to academia. Some of the leading and important journals of the time that include the work and writings of important authors are as follows: Knowledge [Bilgi], Educational Acts [Eğitim Hareketleri], Retired Teacher [Emekli Öğretmen Dergisi], Ideas [Fikirler], Community Cooperation [İmece], Teacher's Voice [Muallimin Sesi], School and Teacher [Okul ve Öğretmen], School and Nation [Okul ve Ulus], Teacher [Öğretmen], Journal of Teacher [Öğretmen Dergisi], Pedagogy [Pedagoji], Schooling Perodical [Tedrisat Mecmuası], Awakening [Uyanış], Modern Man [Yeni Adam], Modern Culture [Yeni Kültür], Modern School [Yeni Okul], Modern Teacher [Yeni Öğretmen], Modern Turkish Periodical [Yeni Türk Mecmuası], Ideal [Ülkü], Upbringing [Terbiye], Journal of Village Institutes [Köy Enstitüleri Dergisi], Classroom Teacher [Sınıf Muallimi], Knowledge of School [Okul Bilgisi], Journal of Pedagogical Community [Pedagoji Cemiyeti Dergisi], The Child's World [Çocuk Dünyası], Elementary Education [İlköğretim], Modern Education [Çağdaş Eğitim] (Hesapçıoğlu & Deniz, 2008).

As of 2015, there are many academic journals in the field of educational sciences and teacher education, majority of which are led and run by universities and academicians. Most journals in the field are in national and international indexes. Among them, two journals in the field of educational sciences and teacher education are covered by one of the world's most important indexes called SSCI (Social Science Citation Index): *Education and Science*, and *Educational Sciences: Theory & Practice.*

Study Aim

In Turkey, there has been an increase in the number of publications in the field of educational sciences and teacher education. Although the interest in bibliometric studies increased, there cannot be seen any bibliometric studies in the field. Within this context, this study aims to apply a comprehensive bibliometric analysis to articles published in peer–reviewed journals in the field of educational sciences and teacher education and to draw out a *scientific route map* of the field in Turkey. The study seeks to answer following questions:

- What is the distribution of published articles across the years and journals?
- Does the distribution of articles conform to the Bradford's, Price's and Pareto's Laws?
- To what extent articles are multiple–authored and who are the most productive authors?
- Does author productivity conform to Lotka's Law?
- What are the most used words in the titles of articles?
- Do these most used words conform to Zipf's Law?

Method

Design

The intellectual analysis of the research and journals in educational sciences and teacher education field in Turkey was carried out by *bibliometric analysis*. Bibliometric is based on mathematical and statistical methods to identify some features of the publications in a given field (Pritchard, 1969). Bibliometric analyses specific features of the publications in a particular field (*for instance*, number of publications in each year, highly studied topics, the institutions made the most contributions to the field, keywords) and finds out several findings in relation to scientific production. Within this context, in this study, educational sciences and teacher education journals and the articles published in these journals are analyzed by bibliometric method.

Table 1
Numbers of Journals and Articles

Journal Title	***N***	***%***
Hacettepe University Journal of Education	782	10.18
Educational Sciences: Theory & Practice	731	9.52
National Education	642	8.36
Education and Science	616	8.02
Elementary Education Online	530	6.90
Eurasian Journal of Educational Research	502	6.54
Kastamonu University Kastamonu Education Journal	471	6.13
Ankara University Journal of Faculty of Educational Sciences	255	3.32
Cukurova University Faculty of Education Journal	255	3.32
Erzincan University Journal of Education Faculty	254	3.31
Journal of Kırşehir Education Faculty	248	3.23
Journal of Turkish Educational Sciences	244	3.18
Abant İzzet Baysal University Journal Of Faculty Of Education	235	3.06
Journal of Educational Administration – Theory and Practice	233	3.03
Gazi University Journal of Gazi Educational Faculty	168	2.19
Turkish Psychological Counseling and Guidance Journal	167	2.17
Ondokuz Mayis University Journal of Faculty of Education	159	2.07
Journal of Turkish Science Education	154	2.00
Inonu University Journal of The Faculty of Education	153	1.99
Mehmet Akif Ersoy University Journal of Education Faculty	145	1.89
Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education	131	1.71
Pamukkale University Journal of Education	104	1.35
International Journal of Environmental and Science Education	94	1.22
Turkish Online Journal of Distance Education	82	1.07
Journal of Values Education	66	0.86
Mediterranean Journal of Educational Research	58	0.76
Mersin University Journal of the Faculty of Education	56	0.73
Journal of Education Science Society	44	0.57
Pegem Journal of Education and Instruction	42	0.55
The Journal of Theoretical Educational Science	34	0.43
Journal of Measurement and Evaluation in Education and Psychology	14	0.18
Cito Education: Theory and Practice	12	0.16
Total	7,681	100.00

Sampling, Data, and Data Collection

In bibliometric studies, citations of publications are used as a source of data and several conclusions are made by analyzing these data. Within this research, data are extracted from the educational science and teacher education articles indexed in ULAKBIM Social Sciences database. This study has been carried on since January 2015 and therefore, the articles published between 2005 and 2014 are included in the study. Thus, 7681 articles in 32[8] journals in ULAKBIM social science database form the data of this research. In the selection of journals, the article titles including the words "*education*," "*teaching*," "*educational sciences*," "*teacher education*," and "*teacher training*" were chosen and these words are used as criteria. Number of analyzed journal and articles are presented in Table 1.

The Process

First of all, bibliographic information of the articles in journals was accessed through ULAKBIM Social sciences database. 7,681[9] articles (*for instance*; such as, author information, name, years) are transferred to *Eskişehir Osmangazi Univesity Bibliometrics and Citation Analysis Program* [ESOGU–CAP] for data cleansing and organization. Then, each datum is given a code number. After coding, data cleansing and organization processes were conducted. Data cleansing and correction was verified by using different techniques. To do this, (*i*) ESOGU–CAP software was used and (*ii*) data cleansing was conducted by more than one researcher separately to verify data; thus errors resulting from data base are cleaned. Data cleansing process is explained below;

- First, spelling mistakes in journal names and name changes of some journals were identified. Necessary amendments were made by checking ULAKBIM periodicals catalogue and relevant journal's website (*for instance*; Gazi University Journal of Kırşehir Education Faculty operating between 2002 and 2006 changed its name to Ahi Evran University Journal of Kırşehir Education Faculty from 2007 onwards. In such a case, the latter name of the journal was taken to consideration and previous articles in these journals were incorporated under the new name.

- In author name column of ULAKBIM Social Sciences database, different types of entries and spelling mistakes were detected. Firstly, the author names listed as "*name–surname*" was corrected as "surname–name." Then, spelling mistakes in author names were corrected. All author names in multiple authored articles were entered in the appropriate columns and the author names are separated by each other by using semicolon (;). Since the author names were not entered in a standard

8 Since the last issues of Uludağ University Journal of Education Faculty indexed in ULAKBIM Social Sciences database belongs to 2006, this journal has been included in the analysis.

9 Final number of articles comes out only after data cleansing. The number of articles is higher before the data cleansing.

way, it was difficult to identify the common authors of multiple authored articles and following the data cleaning, each author of the multiple authored articles were saved separately for bibliometric analysis.

- It was found out that a standard structure was not used in the "*publication year*" column of the journals in ULAKBIM Social Sciences database. For instance, publication year was sometimes entered as only year or as month–year. In addition, some data were entered in wrong or irrelevant columns (*for instance*, volume or issue column). Such mistakes were identified and the publication year of articles was corrected.

- All the characters in article titles were converted to lowercase to identify the most frequent words in the titles, which is listed as one of the sub–goal of the research. Punctuation marks such as ", ^, /, :, ?, ;" and words like "and, with, one" in the title were omitted.

- In addition to the research articles, it could be seen that book reviews, translation articles, and editorials were also indexed in ULAKBIM social sciences database. These publications were identified and omitted from the data file.

- Although all the analyzed journals are in the field of educational sciences and teacher education, several issues of the journals included publications irrelevant with educational sciences and teacher education (*for instance*, 'Fine arts and literature in Turkish novels during the "Tanzimat Reform Era [Tanzimat dönemi Türk romanında güzel sanatlar ve edebiyat]" in National Education (2009, 183, p. 95–109); "On the Plasma Concept… [Plazma Kavramına Dair...]" in Kastamonu University Kastamonu Journal of Education Faculty (2009, *17*(1), pp. 279–288); "Analysis of geographic information on websites of Civil administration and municipality [Mülki İdare ve Belediye WEB Sitelerinde Yayınlanan Coğrafi Bilgilerin İncelenmesi]" published in Erzincan University Journal of Education Faculty (2008, *10*(1), pp. 91–103). These publications were omitted from the data file.

Data Analysis and Assessment

Before bibliometric analysis, descriptive statistics were produced by calculating the frequency (*N*) and percentage (*%*) of distribution of articles across the years and journals. Article features were revealed by forming several tables and graphics. Then, within the scope of author, journal and article information, various bibliometric distribution and concentrations were analyzed. To do this;

- Bradford's, Price's and Pareto law with Lorenz curves and Gini coefficient was used to analyze distribution of articles across the journals,

- Lotka's Law was used to look into author productivity.
- Zipf's Law was used for distribution of words across the article titles.

To make the above mentioned analysis, (ESOGU–CAP) software was developed for this particular research, and SPSS, NVivo and Excel programmes were used. Findings are limited with the educational sciences and teacher education journals indexed in ULAKBIM Social sciences data base, articles published in these journals between 2005 and 2014, and the articles accessed in the aforementioned database.

Findings

This section first presents the descriptive analysis in the aforementioned journals and then the bibliometric analysis of 7681 articles published in these journals.

Descriptive Analysis of Articles

Distribution of articles according to years. The distribution of 7681 articles across the years is presented in table 2.

Table 2
Distribution of Articles Across the Years

Year	*N*	*%*
2005	529	6.9
2006	577	7.5
2007	640	8.4
2008	771	10.0
2009	900	11.7
2010	832	10.9
2011	993	12.9
2012	1,056	13.7
2013	952	12.4
2014	431	5.6
Total	7,681	100.0

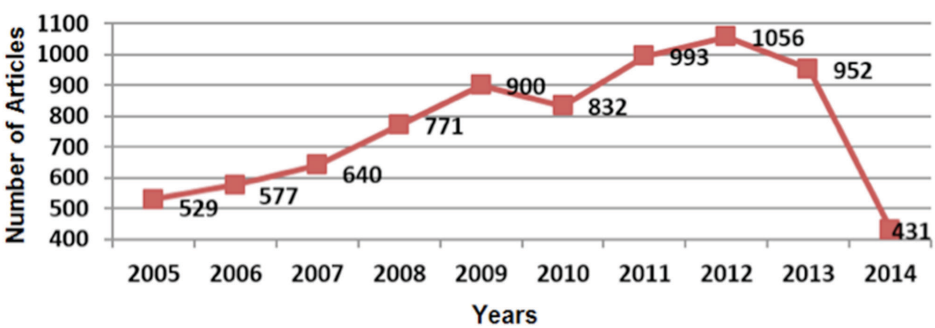

Figure 1. Distribution of number of articles by years.

As seen in the table, approximately 768 articles are being published in the field of educational sciences and teacher education every year. The highest number of articles (1,056) is published in 2012 whereas 2014 has the lowest number of published articles (431). It could also be argued that number of published articles in the field of educational sciences and teacher education increases between 2005 and 2012 but a decrease can be noted between 2012 and 2014 (*see* figure 1).

The number of articles published between 2009 and 2013 doubled compared to the number of articles between 2005 and 2007. However, it should be noted that articles published between 2005 and 2007 are not indexed systematically. On the other hand, despite the increase in the number of educational sciences and teacher education journals indexed in ULAKBIM social sciences (ULAKBİM, 2015), no increase was noticed in the number of articles. The disposition of academicians in Turkey to publish in international journals because of associate professorship criteria can be accounted for this.

Distribution of articles across the journals. The distribution of 7,681 articles across the journals are as follows: Hacettepe University Journal of Education has the most number of articles (n = 782, 10.18%). This is flowed by Educational Sciences: Theory & Practice (n = 731, 9.52%) and National Education journal (n = 642, 8.36%). Almost half of the articles (3,341) were published in the first five journals. Although the published articles were mostly in Turkish, it could be seen that there has been an increase in the number of articles written in English during the last years.

Bibliometric Analysis

This section looks into distribution of articles in the field of educational sciences and teacher education across journals, the author productivity and the distribution of words across the article titles. These were analyzed according to *Bradford's*, *Pareto'*s, *Lotka's* and *Zipf's Laws* and the findings were presented in tables.

Distribution of articles across the journals. The distribution of 7,681 articles across 32 journals are analyzed within the scope of *Bradford's Law of Scattering*. Bradford's Law of Scattering looks into the distribution of articles in a field or on a topic in the journals. The law predicts that majority of articles on a topic or in a field are published in a limited number of core journals.

Egghe and Rousseau (1990) formulas were used to test whether the distribution of articles across the journal conforms to Bradford's Law of Scattering. The number of articles in 32 journals was sorted by diminishing order, then the number of journals in the first zone was determined as 3 by using Bradford factor, which calculated for initial 32 journals, (k value =11.17) and $r0$ (0.23) values whereas the number of

Table 3
Distribution of Articles by Journals

Order	Journal Title	*N*	Order	Journal Title	*N*
1	Hacettepe University Journal of Education	782	**17**	Ondokuz Mayis University Journal of Faculty of Education	159
2	Educational Sciences: Theory & Practice	731	**18**	Journal of Turkish Science Education	154
3	National Education	642	**19**	Inonu University Journal of The Faculty of Education	153
4	Education and Science	616	**20**	Mehmet Akif Ersoy University Journal of Education Faculty	145
5	Elementary Education Online	530	**21**	Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education	131
6	Eurasian Journal of Educational Research	502	**22**	Pamukkale University Journal of Education	104
7	Kastamonu University Kastamonu Education Journal	471	**23**	International Journal of Environmental and Science Education	94
8	Ankara University Journal of Faculty of Educational Sciences	255	**24**	Turkish Online Journal of Distance Education	82
9	Cukurova University Faculty of Education Journal	255	**25**	Journal of Values Education	66
10	Erzincan University Journal of Education Faculty	254	**26**	Mediterranean Journal of Educational Research	58
11	Journal of Kırşehir Education Faculty	248	**27**	Mersin University Journal of the Faculty of Education	56
12	Journal of Turkish Educational Sciences	244	**28**	Journal of Education Science Society	44
13	Abant İzzet Baysal University Journal Of Faculty Of Education	235	**29**	Pegem Journal of Education and Instruction	42
14	Journal of Educational Administration – Theory and Practice	233	**30**	The Journal of Theoretical Educational Science	34
15	Gazi University Journal of Gazi Educational Faculty	168	**31**	Journal of Measurement and Evaluation in Education and Psychology	14
16	Turkish Psychological Counseling and Guidance Journal	167	**32**	Cito Education: Theory and Practice	12

journals in the second zone was calculated as 28[10]. Thus, if the distribution of articles conforms to Bradford Law, one third of the articles (2,560) should be in the most productive (core) journal in the core zone; one third should be in the less productive 3 journals in the first zone; and the last one third should be published in the least productive 28 journals. The distributions of articles across the journals according to Bradford's law and the required distributions according to the Bradford's Law are presented in Table 4.

10 The numbers were rounded up to integer.

Table 4
The Distribution of Current Articles Across the Journals and the Required Distributions According to Bradford's Law

	In Terms of Data				In Terms of Bradford's Law			
	Number of journals		Number of articles		Number of journals		Number of articles	
Zone	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Core Zone	4	12.50	2,560	33.4	1	3.125	782	10.18
Zone 1	7	21.88	2,560	33.4	3	9.375	1,989	25.90
Zone 2	21	65.63	2,560	33.4	28	87.5	4,910	63.92
Total	32	100.00	7,681	100.0	32	100	7,681	100.00

As seen in the table, the distribution of articles across the journals does not conform to Bradford's Law. According to the law, 1 core journal in the first group (Hacettepe University Journal of Education) should include one third of all articles (2,560 articles), 3 journals (Educational Sciences: Theory & Practice, National Education, Science and Education) in the second group should include the second one third of articles and 28 journals (all other journals) in the last group should include the last one third of articles, however the data shows that each group of journal respectively includes 10.1%, 25.9% and 63.9% of articles. When analyzed from another perspective, the number of core journals that provide one third of all articles is indeed not 1 (Hacettepe University Journal of Education) but four (Hacettepe University Journal of Education, Educational Sciences: Theory & Practice, National education, Education and Science). Likewise, number of journals in the second group is 7 and in the third group are 21.

In this research, conformity of articles to *Price's Law* was also analyzed. Price's Laws states that half of the literature on a subject will be contributed by the square root of the total number of authors publishing in that area. According to the data in educational sciences and teacher education field, the most productive 6 journals ( ) include 49.5% of all articles. Yet, it should be noted that 4 *'core journals'* that form

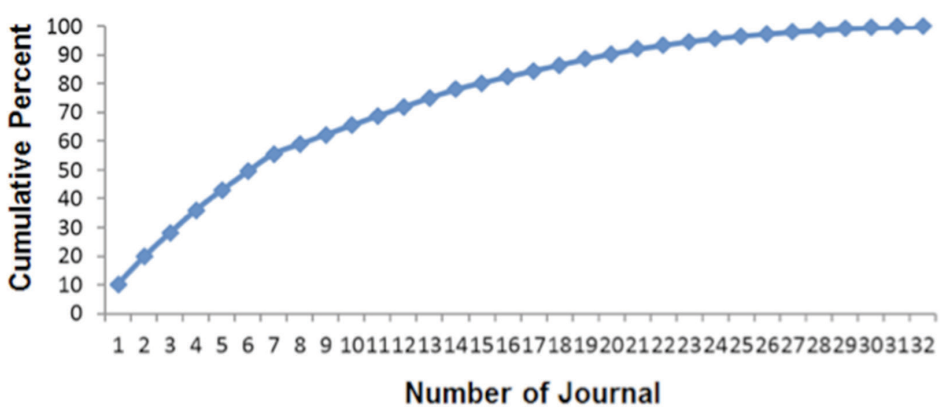

Figure 2. Cumulative distribution of articles across the journals.

12,5% of all journals publish one third of all articles, and 11 journals forming 33.4% of all journals publish two–thirds of all articles. The least productive 21 journals forming 65.6% of all journals publish only one third of all articles. This situation shows that articles conform to Price's Laws.

The cumulative distribution of educational sciences and teacher education articles indexed in ULAKBIM Social Sciences database across 32 journals is presented in Figure 2.

As seen in the figure, articles focused on a small number of journals and half of the articles were published in 6 journals (18.75% of all journals). This could be explained by the fact that some journals publish more volumes in a year and more articles per volume, and some journals started publishing before other journals.

It could be argued when the distribution of journal and article for each group is closer with the required distribution of journal and articles according to Bradford's law are, the distribution of data conforms more to Bradford's law. *For instance*, according to Bradford's Law, the first journal with the highest number of articles (Hacettepe University Journal of Education) should have included one third of all articles, but this ratio is 10.1%. According to this research, the most productive 4 journals has one third of all articles, and the numbers of *'core journal'* in the first group are higher than Braford's Law estimates. Moreover, repeated tests for conformity to Bradford's Law conducted by taking *p* as 4, 5, 6 and 7 (by dividing articles into equal number of different groups) also revealed similar findings. Figure 3 presents numbers of cumulative logarithmic journals and cumulative article volumes.

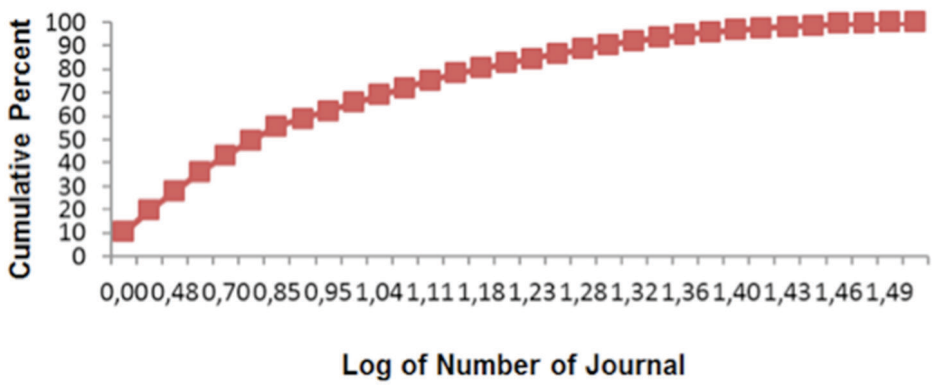

Figure 3. Numbers of cumulative logarithmic journals and percentages of articles.

Since the distribution lines do no look like "S" letter, it does not look like *Bradford–Zipf's* distribution. Distribution line increases in a non–linear way for core journals. The points in which linear increase starts mean that core journals has finished and less productive journals start to show up. However, as seen in the figure, *Groos droops*[11] breaks be seen in journals publishing educational sciences and teacher education articles. Although the distributions of articles across the journals do not conform to Bradford's Law, a significant majority of articles are being established in a small number of *core journals.* The number of journals publishing 33%, 50%, 67%, 80% and 100% of the articles are presented in table 5.

Table 5
The Distribution of Journals Covering 33%, 50%, 67% and 100% of Articles

Total Number of Journals	33%		50%		67%		80%	
	N	%	*N*	%	*N*	%	*N*	%
32	4	12.5	6	18.7	11	34.3	15	46.8

One third articles within the scope of this research are published in 4 core journal whereas half of them are in 6 journals; two thirds in 11 and 80% of them are published in 15 journals, and the ratio of core journals to the total number of journals is low. This stands for the fact that educational sciences and teacher education literature can be seen in more journals.

In addition, the distribution of articles across the journals is also analyzed according to 80–20 rule of Pareto's law (Ravichandra Rao & Neelanghan, 1992). As seen in the last column of table 5, the distribution of articles across the journals does not conform to Pareto's Law and 46% of the journals in the field have 80% of the articles. Unequal distribution of the articles (*see* Figure 2 and 3) across the journals can be explained with the condensation theory. To explain this situation, Lorenz curve and Gini coefficient has been used. Contrary to Bradford distributions, in Lorenz curves publication of small number of articles on a specific topic in a large number of journals becomes prominent (Tonta & Al, 2007b). The Gini coefficient is calculated as 0.47 in the research. If the Gini coefficient is 0, it means articles are equally distributed across journals whereas if it is 1, this shows that all articles are published in one journal. The Gini coefficient in this research shows that articles are not equally distributed across journals.

Author productivity. Distribution of 7,681 articles according to the number authors is shown in table 6. 43.6% of the articles ($N = 3,348$) are single–authored and 38.7% of them are ($N = 2,073$) co–authored. Only 17.6% of the articles ($N = 1,360$) are multiple–authored and number of author per article is 1.81.

11 The point gross starts to decrease is related to number of total journals in that field and the number of journals that publish the least number of articles.

Table 6
Distribution of Articles According to the Number of Authors[12]

Number of Authors per Article	*N*	*%*
1	3,348	43.6
2	2,973	38.7
3	987	12.9
4	264	3.4
5	71	.9
6	16	.2
7	12	.2
8	6	.1
9	3	.0
16	1	.0
Total	7,681	100.0

The distribution of articles' publication years according to authors is presented in Table 7.

Table 7
Average Number of Authors According to Years

Publication Year	Number of Articles	*Author*	
		X	*SS*
2005	529	1.56	.77
2006	577	1.72	.91
2007	640	1.70	.91
2008	771	1.71	.85
2009	900	1.82	.98
2010	832	1.90	.96
2011	993	1.89	.99
2012	1,056	1.88	.99
2013	952	1.87	.99
2014	431	1.98	1.07
Total	7,681	1.81	.94

When the number of author per articles is analyzed according to years, it could be seen that average author number per article increases from 1.56 in 2005 to 1.98 in 2014. The other evaluation is author productivity; this evaluation has a bit of error margin. For instance, in a time span of 10 years, it is not difficult to distinguish the authors with the same name and surname (*for example;* Bülent Güven, Ali Eryılmaz), the authors using different initials with three and more names and authors with a change in their surnames. The most productive 30 authors are presented in Table 8.

12 The percentage (ratio) in the articles with 9 and 16 authors is 0 because of the small number of articles and rounding up.

Table 8
The Most Prolific Authors

Order	Author	Number of Articles	Order	Author	Number of Articles
1.	Kürşad Yılmaz	31	16.	Kürşat Yenilmez	18
2.	Engin Karadağ	27	17.	Mediha Sarı	18
3.	Gülay Ekici	26	18.	Buket Akkoyunlu	17
4.	Adnan Baki	24	19.	Ömer Ergin	17
5.	Adnan Kan	21	20.	Özgen Korkmaz	17
6.	Haluk Soran	21	21.	Songül Tümkaya	17
7.	Mehmet Nuri Gömleksiz	21	22.	Yüksel Dede	17
8.	Rüştü Yeşil	21	23.	Mehmet Barış Horzum	16
9.	Ahmet Akın	19	24.	Murat Özdemir	16
10.	Ahmet Doğanay	19	25.	Salih Çepni	16
11.	Ali Eryılmaz	19	26.	Bülent Güven	15
12.	Ali Paşa Ayaş	19	27.	Petek Aşkar	15
13.	Hasan Demirtaş	19	28.	Selahattin Gelbal	15
14.	M. Engin Deniz	19	29.	T. Fikret Karahan	15
15.	Hülya Kelecioğlu	18	30.	Yahya Altınkurt	15

As seen in the table, *Kürşad* Yılmaz is the most indexed author in the field of educational sciences and teacher education with 31 articles. Kürşad Yılmaz is followed by *Engin Karadağ* (27) and *Gülay Ekici* (26). The most productive 10 authors are in the field of educational management and administration, (K. Yılmaz and E. Karadağ), 4 of them are in curriculum and instruction (G. Ekici, M. N. Gömleksiz, R. Yeşil, and A. Doğanay), one of them is in maths education (A. Baki), the other one is in assessment and evaluation in education (A. Kan) and lastly, one is in guidance and psychological counselling (A. Akın). Each author in this list has more than 15 articles. Table 9 presents the ratio of authors according to the number of articles.

Table 9
The Ratios of Authors with One, Two, Three, ... Ten and Above Articles

Number of Articles	Number of Authors	Percentage of Authors
1	4,918	68.1
2	968	13.4
3	470	6.5
4	272	3.8
5	190	2.7
6	106	1.4
7	83	1.1
8	67	0.9
9	58	0.8
10+	97	1.3
Total	7,229	100.00

7,681 articles were written by 7,229 different authors in total ($X = 1.06$)[13]. Majority of authors wrote only one article ($N = 4{,}918, 68.0\%$). The analysis of author distribution according to the number of article is important for author productivity. When Lotka's Law taken as basis in author productivity analysis, it could be seen that 60% of authors publishing on a particular topics has one articles; 15% of them has two, 6.6 % has three and 3.75% of them has 4 articles (Price, 1963). As seen in Table 10, author data shows that author–article relationship in the field of educational sciences and teacher education conform to Lotka's law and the author diversity is not high.

Conformity of distribution of author data of articles to Lotka's Law was tested. Table 10 presents the followings: (i) third columns of table shows expected number of authors per article number by Lotka's law; (ii) fourth column presents the difference between observed author number and expected number of author by Lotka's law; (iii) the subsequent three columns displays observed and expected ratio of authors and cumulative ratio of authors; (iv) the last column shows absolute value of the difference of the cumulative observed author ratio to the cumulative expected observed author ratio.

Table 10
The Distribution of Authors According to Lotka's Law

No. of Articles	No. of Authors Observed	No. of Expected Authors according to Lotka's Law	Difference	Observed Frequency of Authors	Observed Cumulative Frequency of Authors	Expected Frequency of Authors	Expected Cumulative Frequency of Authors	Difference
31	1	1.59	–0.59	0.00014	0.00014	0.00022	0.00022	0.00008
27	1	2.20	–1.20	0.00014	0.00028	0.00030	0.00052	0.00025
26	1	2.40	–1.40	0.00014	0.00041	0.00033	0.00086	0.00044
24	1	2.90	–1.90	0.00014	0.00055	0.00040	0.00126	0.00070
21	4	3.96	0.04	0.00055	0.00111	0.00055	0.00181	0.00070
19	6	5.01	0.99	0.00083	0.00194	0.00069	0.00250	0.00056
18	3	5.68	–2.68	0.00041	0.00235	0.00079	0.00328	0.00093
17	5	6.49	–1.49	0.00069	0.00304	0.00090	0.00418	0.00114
16	3	7.48	–4.48	0.00041	0.00346	0.00104	0.00522	0.00176
15	5	8.70	–3.70	0.00069	0.00415	0.00120	0.00642	0.00227
14	5	10.23	–5.23	0.00069	0.00484	0.00142	0.00784	0.00300
13	12	12.17	–0.17	0.00166	0.00650	0.00168	0.00952	0.00302
12	13	14.67	–1.67	0.00180	0.00830	0.00203	0.01155	0.00325
11	14	17.99	–3.99	0.00194	0.01024	0.00249	0.01404	0.00380
10	23	22.48	0.52	0.00318	0.01342	0.00311	0.01715	0.00373
9	58	28.76	29.24	0.00802	0.02144	0.00398	0.02113	0.00032
8	67	37.89	29.11	0.00927	0.03071	0.00524	0.02637	0.00434
7	83	51.79	31.21	0.01148	0.04219	0.00716	0.03353	0.00866
6	106	74.29	31.71	0.01466	0.05685	0.01028	0.04381	0.01305
5	190	113.81	76.19	0.02628	0.08314	0.01574	0.05955	0.02358
4	272	191.85	80.15	0.03763	0.12076	0.02654	0.08609	0.03467
3	470	376.12	93.88	0.06502	0.18578	0.05203	0.13812	0.04766*
2	968	971.36	–3.36	0.13391	0.31968	0.13437	0.27249	0.04719
1	4918	4918.00	0.00	0.68032	1.00000	0.68032	1.00000	0.00000

* The biggest difference (D) = 0.04766.

13 The total number of authors in the articles is 13937.

To test whether observed author productivity conform to the expected values according to Lotka's law, the maximum value among the differences in the last column was calculated as (*D*) 0.04766. After determining the *D* value, the conformity of author productivity to Lotka's Law was calculated by using Kolmogorov–Smirnov test. The critical value for *Kolmogorov–Smirnov* was calculated as 0.15 within the .95 confidence interval (1.36 / $7{,}229^{1/2}$) . Since D value (0.04766) was bigger than critical value for Kolmogorov–Smirnov (.015), there is a difference between the number of observed author and the number of expected author. In other words, author productivity does not conform to Lotka's Law. Table 11 presents *D* value, critical value for Kolmogorv–Smirnov, the test result showing whether author productivity conforms to Lotka's Law and α value.

Table 11
A Critical Value *for Kolmogorov–Smirnov and Lotka's Law*

D value	Kolmogorov–Smirnov [KS] critical value	Result	Lotka (α) coefficient
0.0476	0.015	*D>KS**	2.34

**p* < .05.

Analysis of Words in the Titles of Articles

The words analyzed in the titles of 7,681 articles (*N* = 11.427) were put into a normalizing process (*for instance,* converting all words into lowercase letters, translation of English titles into Turkish, omitting punctuation and conjunctions). Then, they are sorted with a decreasing order according to their frequency of use and the most used words were identified. As seen in table 12, the most frequently used first 50 words are presented after omitting the transition words such as "and" (*N* = 3,869), "*one*" (*N* = 1,010), and "*with*" (*N* = 604). The most used five words are; (i) "teacher" (*N* = 2,009), (ii) "student" (*N* = 1,998), (iii) "education" (*N* = 965), (iv) "primary education" (*N* = 956) and (*v*) "teaching" (*N* = 895). However, collocations (*for instance* teacher candidate, education faculty) were not analyzed.

The words in the titles of articles were analyzed by Zipf's Law. In Zipf's law, when words in a text are sorted by decreasing frequency, number of occurrence of a single world and the frequency number of that word always stands for a constant number. Accordingly, it argues that the most frequent word is used two times more than the second word on the array and three times more than the third word on array. In this research, words in the article titles were sorted however rarely used words in the titles of article were not sorted as they form a long list. Therefore, it could not be test whether the words conform to Zipf's law.

Table 12
The Most Used 50 Words in the Titles of Articles

Order	Word	Frequency	Order	Word	Frequency
1.	Teacher	2,009	26.	High School	244
2.	Student	1,998	27.	Field	241
3.	Education	965	28.	Reliability	241
4.	Elementary	956	29.	Validity	234
5.	Teaching/Instruction	895	30.	Scale	227
6.	Candidate	862	31.	Academic	211
7.	Grade	808	32.	Knowledge	208
8.	Lesson	675	33.	Language	205
9.	Learning	631	34.	Management	203
10.	Attitude	553	35.	Turkish	201
11.	Science	545	36.	Psychological	193
12.	School	508	37.	Science	191
13.	Skill	465	38.	Organizational	187
14.	Mathematics	437	39.	Computer	175
15.	Social	386	40.	Activity	173
16.	Child	378	41.	Cognitive	163
17.	University	339	42.	Comprehension	159
18.	Competence	312	43.	Reading	159
19.	Technology	302	44.	Value	152
20.	Turkish	293	45.	Success	151
21.	Perception	280	46.	Biology	141
22.	Turkey	273	47.	Secondary Education	139
23.	Problem	271	48.	Thinking	135
24.	Profession	267	49.	Curriculum	131
25.	Behavior	255	50.	Concept	130

Conclusion, Discussion and Suggestions

7,861 articles were indexed in 32 educational sciences and teacher education journals in ULAKBİM Social Sciences database between 2005 and 2014. This finding shows that every year approximately 768 articles are being published. 2012 has the highest number of articles with 1056 articles whereas the least number of articles belong to 2014 with 431 articles. Although number of articles increased between 2005 and 2012, there was a decrease in the number between 2012 and 2014. The ratio of published article per lecturer is 0.09. Annual 768 articles were not enough in a field in which 8000 lecturers were employed (YÖK, 2005). Research of Denkel, Kağıtçıbaşı, Pak, and Pamuk (1996; 1999) in the field of social sciences also revealed similar findings. The main reason for this is that in social sciences, publications other than journals (*for instance*, proceedings, book or translation) are frequently being used. In addition, the low acceptance rate in social science journals and the long review processes (often longer than science, medicine and engineering fields) could be listed as a reason for low number of publications. Also, the fact that Turkey is down in the social science publication rankings also supports this (SJR, 2016).

Almost half of the published article are singled authored whereas two fifth of it are multiple–authored. Articles written by more than 3 authors are less than one fifth of the all articles. Almost all contributors of the articles were from universities or institutions in Turkey. This shows that journals in the field are local. In terms of language, Turkish articles were in majority yet we can see that English articles are also increasing. When the number of authors were analyzed in Turkish context, the findings did not mirror the findings in other fields of social sciences (*for instance*, business administration, and psychology) (Al & Çoştur, 2007; Yozgat & Kaplan, 2008). Research of Yozgat and Kaplan (2008) and Al and Costur (2007) show that co–authored or articles with 3 authors are in majority. On the other hand, majority of articles in educational sciences and teacher education field are single authored. The requirement of single authored articles in associate professorship criteria and lack of collaborative work culture among researchers can be argued as a reason for so many single authored articles.

Studies in the field show that the number of authors increases gradually every year (Dehdarirad, Villarroya, & Barrios, 2015; Glänzel, 2002; Glänzel, Schubert, & Czerwon, 1999; Gu, 2004; Liu, 2003; Tonta, 2000; Tonta & İlhan, 2002) and this increase can be explained with the big budget projects that require collaboration of many people (Yurtsever, Gülgöz, Yedekçioğlu, & Tonta, 2002). The fact that research in educational sciences and teacher education are largely descriptive (Arık & Türkmen, 2009; İşçi, 2013; Karadağ, 2009; Selçuk, Palancı, Kandemir, & Dündar, 2014; Turan, Karadağ, Bektaş, & Yalçın, 2014) and lack of projects in the field can be listed as other reasons of the finding.

The distribution of articles indexed in UKALBIM social sciences database across the journals do not conform to Bradford's Law. Findings show that the number of '*core'* journals in the first and second group that has the most articles is higher than what Bradford's Law estimates; and the number of journals in the third group is less than the expected. There could be several reasons why distribution of articles does not conform to Bradford's law:

- It could be seen that in the previous research (Brookes, 1977; Coleman, 1993, 1994; Leydesdorff & Bensman, 2006), the distribution in homogenous areas show more conformity with Bradford's law. Since the educational sciences and teacher education field has many sub–fields and is an interdisciplinary field, it has a heterogeneous distribution of topics. This makes it hard for the distribution of data to conform to Bradford's law. Likewise, Coleman' research (1993; 1994) on six and 10 different areas of social science presents similar findings. Social sciences have a more heterogeneous structure than medicine, science and engineering sciences.

- The second important reason is that some of the subfields of educational sciences and teacher education in Turkey (*for instance*; such as special education and higher education management) have been recently developed. Since these fields are relatively emerging and new, the literature has not been expanded yet. This

situation also affected journal facilities. Despite the increasing number of journals, the decrease in number of articles per journals also decreased homogeneity.

When research on publications in Turkey and studies on Bradford's Law were analyzed, findings overlapped with the research results. For instance, in the most comprehensive bibliometric and citation analysis of research in Turkey conducted by Tonta and Al (2007a), the distribution of 520,000 articles indexed in Republican Period Articles Bibliography between 1923–1999 across the journals do not conform sufficiently to Bradford's Law.

Although the distribution of articles across the journals does not conform to Bradford's Law, a significant majority of articles in educational sciences and teacher education were published in 3 *core journals*. These journals are; (i) Hacettepe University Journal of Education, (ii) Educational Sciences: Theory & Practice, (iii) National Education, and (iv) Education and Science. Another striking point is that almost half of the articles were published in five journals (Hacettepe University Journal of Education, Educational Sciences: Theory & Practice, National Education, Education and Science, Elementary Education Online).

In addition, in distribution of articles across the journals, no conformity was identified to 80/20 rule of Pareto's Law which estimates that the most efficient 20% make up 80% of the literature in a particular field. Despite this, findings conform to Price's Law. The most productive 6 journals in educational sciences and teacher education field includes 49.5% of all articles. 21 unproductive journals that form 65.6% of the journals have only one third of all the articles. This is an indication that articles conform to Price's Law.

Three authors whose work are most indexed in the field are Kürşad *Yılmaz*, Engin Karadağ and Gülay Ekici. Two of the most productive 10 authors are in the field of educational management and administration (K. Yılmaz and E. Karadağ), four of them are in curriculum and instruction (G. Ekici, M. N. Gömleksiz, R. Yeşil and A. Doğanay), one of them are in maths education (A. Baki), one is in assessment and evaluation (A. Kan) and one in psychological counselling and guidance (A. Akın).

In the research, α value for the conformity of author productivity with Lotka's Law was determined as 2.34. Although α value is close to 2 as suggested by Lotka's Law, in this study author productivity do not conform to Lotka's law. Likewise, in the research conducted by Tonta and Al (2007a), the distribution of authors in the areas which have more than 7,000 words does not conform to Lotka's law. The reason why author productivity distribution does not conform to Lotka's Law is that there are many authors that contribute to the literature with only one article.

The most used 5 words in article titles are (i) teacher (ii) student, (iii) education, (iv) primary education and (*v*) teaching. Several studies in various fields in Turkey (Aypay et al., 2010; Balcı & Apaydın, 2009; İşçi, 2013; Karadağ, 2009a, 2009b, 2009c) also

produced similar findings. Balcı (1993) argues that studies in educational sciences in Turkey reproduce themselves. In other words, researchers prefer to conduct previous studies with different participants and sampling rather than studying new and original topics. This statement mirrors the findings in this research.

In addition, it could not be test whether the distribution of the words across the article titles conform to Zipf's law because the number of words that appear only once in the titles are pretty high.

Some suggestions were made in accordance with the findings of this research:

- Findings suggest that ULAKBIM social sciences database needs to be updated in a way that it can provide detailed data; and offer a more user friendly interface and better visuality.
- ULAKBIM social sciences database have several index errors and this needs to be addressed urgently
- To address the low number of publications in educational sciences and teacher education in Tukey, national journals should be encouraged
- In international literature, interdisciplinary work or co–authored or multiple–authored publications are encouraged however due to associate professorship criteria, Turkish academics are pushed to publish single authored articles. Therefore, these criteria should be changed or updated.
- It could be seen that published articles do not address the primary problems of Turkish education system. For instance, studies focus on student attitudes and teacher candidates and methodological issues on validity and reliability. Researchers should be directed towards studying the foremost education problems.
- Very few foreign researchers publish in national journals. Therefore, international recognition of national journals should be promoted.
- Web–sites of some journals are not user–friendly and they are not open to online access. Online access is rather important to increase the impact factor of the journals. Therefore, websites should be designed in a user friendly manner.
- This researcher did not cover the sub fields of educational science and teacher education. Therefore, further research could conduct bibliometric analysis of articles in terms of sub–fields.

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