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Impact factor and education journals: a critical examination and analysis

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Abstract

Scientific journals are the primary mode of formal communication in science. The ISI Impact factor, a bibliometric indicator that measures the citation rate of the "average" article in a journal, has been widely used for the assessment of the quality of scientific production of individuals, research teams or institutions. The purpose of this paper was to present the impact factor, examine the main limitations in its calculation and applications and to give a general overview of the impact factor of education journals for the period 2000–2005. Several problems related to the calculation of the impact factor have raised serious concerns about its validity and usefulness. Our findings suggest that education journals included in the *Journal Citation Reports* (JCR) represent about 11% of the active, referred, academic journals. Education journals have relative low impact factors, in absolute values and in comparison to other Social Science categories. Application of the intraclass correlation coefficient showed that journals belonging to the "Education and Educational Research" category had relative stable impact factor values for the examined 6 years. This was not the case for the journals from the "Education, Special" category. It was concluded that the use of impact factor for the evaluation of journals, articles and researchers should be done with considerable care.

1. Introduction

The measurement of research quality is an issue that has increasingly interested governments, higher education institutions and funding bodies and it has been employed

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as a means of assuring that public funds are rationally allocated. As the demand for greater accountability in all areas of public expenditure is constantly growing, the topic of research assessment becomes very relevant. In Europe, for instance, research assessment has been considered an instrument of New Public Management and a part of the efforts to create a new European Research Area, especially in the light of the findings of a recent analysis, according to which in many European countries there is no linear correlation between research investments and performance (Orr, 2004). Publication metrics are increasingly being employed as indicators for assessment, "university league tables and research assessment exercises have proliferated in the last 3 years and grown in perceived importance with institutions scrambling to follow new ranking systems" (Steele, Butler, & Kingsley, 2006, p. 278). Within this context, bibliometric indicators, such as the impact factor of journals, and citation data "are gaining increasing attention, perhaps because they are viewed as the easiest and most objective way to measure quality and impact of research. In addition, they can be used to provide numeric data that can be used to rank researchers and the institutions in which those researchers work" (Cheek, Garnham, & Quan, 2006, p. 424).

The Impact factor was introduced in the 1960s by Eugene Garfield, founder and chairman emeritus of the Institute for Scientific Information (ISI), now a part of Thompson Scientific, as a measure for the evaluation of scientific journals. Its original purpose was to help the selection of journals for inclusion in the *Science Citation Index* (SCI) (Garfield, 1999). Since 1975 the impact factor has been published annually in *Journal Citation Reports* (JCR), also a product of ISI, which is available in two editions: the Science Edition and the Social Sciences Edition. The ISI, after using the computer-generated data on the output of journals and on citation frequency "in-house" for the compilation of SCI for many years, began to publish JCR as part of the SCI and the *Social Science Citation Index* (SSCI) (Garfield, 1994). "Generally speaking, the JCR is a statistical data set providing information on how often journals are cited, how many items have been published, and how often, on average, each item is cited" (Rousseau, 2002, pp. 421–422).

The impact factor, which assess the frequency with which the 'average article' in a journal has been cited in subsequent publications, is only one of the three indicators introduced by ISI for the measurement of the citation patterns of a journal over time. The other two indicators, which when combined with impact factor can provide useful information, are the *immediacy index* and the *cited half-life*. The immediacy index reflects how quickly the papers of a journal get cited (Amin & Mabe, 2000). It is the ratio between the number of citations to articles published in a particular year and the number of articles published in that year. For example, the immediacy index for the Journal of the Learning Sciences for 2004 was 1.917 and was calculated by dividing the number of cites in 2004 to articles published in 2004 (23) by the number of articles published in that journal in 2004 (12). This value means that in 2004, citations to the articles of that journal are almost double the number of articles contained in the journal.

The cited half-life measures how long the articles of a journal continue to receive citations after publication (Amin & Mabe, 2000). For example, in JCR 2004 the journal Education and Urban Society had a cited half-life of 7.0. That means that articles published in that journal between 1998 and 2004 accounted for 50% of all citations to articles from that journal in 2004.

Of the measures mentioned above, the impact factor is the most widely used for "ranking, evaluating, categorizing, and comparing journals" (Thomson Scientific, 2007). One of the earlier and most important applications of the impact factor has been its utilization by librarians and information professionals as a guide to journal selection, cancellation and weeding. It has also been used by publishers for marketing decisions and by scientists for selecting the best and most appropriate journals to publish their work (Broome, 2005).

In recent years, there is some evidence, especially in Europe, that journal impact factors are used in academic settings for the evaluation of individual scientists or research teams (Bloch & Walter, 2001; Linardi, Coelho, & Costa, 1996, Saha, Saint, & Christakis, 2003). The assumption behind this practice is that articles published in journals with high impact factor are by definition better than those appearing in journals with a lower impact factor. Within this context, impact factors are used by committees responsible for appointment, promotion or tenure (Broome, 2005; Calza & Garbisa, 1995; Leff, 2005), as well as for resource and staff allocation (Taubes, 1993; Vinkler, 1986), as a highly objective and appropriate indicator of scientific value. However, many problems associated with impact factor and its use as a tool in the evaluation of journals, papers and researchers, have been pointed out.

The purpose of this paper is to present the impact factor, to focus on the main limitations in the calculation of the impact factor and its applications and to give a general overview of the impact factor of education journals.

2. Calculation of the JCR impact factor and the main problems surrounding it

The annual JCR impact factor of a journal is a ratio between the number of citations the journal receives the current year to articles published in the two previous years (numerator) and the number of articles (source items) published in that journal during the same two years (denominator) (Amin & Mabe, 2000; Bloch & Walter, 2001; Garfield, 1999; Kurmis, 2003). For example, the impact factor for a journal for 2004 is calculated by dividing the number of citations in the year 2004 to articles published in the journal in 2002 and 2003 by the number of articles published in the journal in 2002 and 2003. It is obvious that the greater the number of citations, the higher the impact factor will be. The impact factors are then placed in a sequence and the journals are ranked according to their "impact" (Hecht, Hecht, & Sandberg, 1998).

Much of the impact factor popularity is attributed to certain technical advantages, such as comprehensibility, robustness, fast availability and relatively easy accessibility (Glanzel & Moed, 2002). It is comprehensible because it measures the relative frequency with which the average article of a journal is being cited in a 2-year period. It is robust because a journal impact factor does not change substantially from 1 year to another, "so that in practice one or two years old Impact Factors are sometimes used for evaluation purposes where most recent indicators are not available" (Glanzel & Moed, 2002, p. 174). Ready accessibility and annual updates by the ISI make impact factors the best available and most widely accepted indicators for journal evaluation.

However, the validity and usefulness of the impact factor have been seriously questioned, due to several problems inherent in its calculation. Some of these problems and limitations are outlined below.

2.1. The inappropriate definition of citable items

As it was mentioned above, the impact factor is a ratio between the number of citations to the articles of a journal and the total number of articles published in this journal. The problem here is that citations to all kinds of papers—including editorials, letters to the editor, conference abstracts, etc.—are counted in the numerator, whereas only certain types of papers, those defined by the ISI as research articles, technical notes, reviews and proceeding papers, are included in the denominator (Amin & Mabe, 2000; Glanzel & Moed, 2002; Kurmis, 2003; Scully & Lodge, 2005). In many journals, editorials or letters to the editor are cited quite frequently. These items however are excluded from the denominator because they are not considered as "source items", but the citations to them are used in the denominator. It has been noted that "if a very strict definition of the impact factor is used, where citations to only selected article types are divided by the number of those selected article types, considerable differences can emerge from the published impact factors." (Amin & Mabe, 2000, p. 6). This is particularly the case in medical journals, where a large proportion of the journals studied, had impact factors that were 10% lower than the impact factors calculated and published by ISI.

2.2. The two-year citation period

The 2-year citation period has been also criticized as arbitrary and problematic by many authors (e.g., Aguillo, 1996; Amin & Mabe, 2000; Bloch & Walter, 2001; Hanson, 1995; Kurmis, 2003; Seglen, 1997). Dynamic and rapidly developing scientific fields with short publication lags, such as biochemistry and molecular biology, seem to be favored over slowly evolving fields, such as mathematics, education and other social sciences. Journals that receive the majority of citations over the period of 2 years after publication tend to have higher impact factors than journals in fields with different ageing behavior, where the impact of published articles reaches its maximum after a longer period (Glanzel & Moed, 2002). According to Amin and Mabe, even within the same subject field, journal rankings change significantly, when the citation period increases from 2 to 5 years: "(…) of 30 chemistry journals examined, 24 changed in rank by up to 11 positions when changing from a two-year to a five year impact factor." (p. 5).

2.3. Coverage and language bias

Only journals included in the ISI citation indexes are used for the calculation of the impact factor and these represent only a small proportion of the peer-reviewed journals published worldwide. On the other hand English-language journals, as well as those published in the United States, seem to be favored (Bloch & Walter, 2001; Dong, Loh, & Mondry, 2005; Seglen, 1997). Non-English language publications are underrepresented in the ISI databases and generally have lower impact factors, given the preference of English-speaking authors, who dominate the database, to cite English-language articles (Kurmis, 2003).

Another source of bias is that books and book chapters are not included, and coverage variations also exist between research fields. Seglen (1997) gives an example of the discrepancy between chemistry and biology, pointing out that 90% of chemistry and only 30% of biology journals are included in the database.

2.4. The subject field of the journal affects the impact factor

Different subject areas have different practices and characteristics, making comparisons between disciplines problematic (Saper, 1999; Seglen, 1997). This has been recognized by Garfield himself (Garfield, 1999), who warns of possible problems, when making cross-disciplinary comparisons: "all citation studies should be normalized to take into account variables such as field, or discipline, and citation practices." (p. 979).

In general, impact factors are higher in fundamental and pure subject areas than in applied ones (Amin & Mabe, 2000). Multidisciplinary journals and journals of general interest that cover a wide range of subjects are more likely to be cited than specialized publications with a much narrower focus and target audience (Ganzel & Moed, 2002). Impact factors can be further influenced by the average number of authors per paper, which is dependent on the subject field (Amin & Mabe). In life sciences, the collaborators of an article are usually more than four, whereas in social sciences the average number of authors per paper is about two. Amin and Mabe support that there is a significant correlation between the average number of co-authors and the average impact factor for a subject field, a phenomenon that can be interpreted by the common practice among authors of research papers to cite their own previous work.

2.5. Journal and article type determines the impact factor

Even within the same field, impact factors are biased towards certain types of journals and articles. For instance, journals published at short intervals, with papers of current interest tend to have higher impact factors (Amin & Mabe, 2000). In addition, review journals, or journals that publish regularly review articles have increased impact factors, because reviews are cited more frequently than original research papers, due to the fact of summating literature on a particular topic (Leff, 2005; Scully & Lodge, 2005; Seglen, 1997; Schulman, 2005). Similarly, longer articles receive many citations and enhance the impact factors (Seglen).

2.6. Errors in citations damage the calculation of the impact factor

Typographical errors, misprints and inaccuracies in references lists scanned by the ISI for the calculation of the impact factor result in incorrect identification of cited journals, thus affecting the accuracy of the impact factor (Scully & Lodge, 2005; Seglen, 1997; Whitehouse, 2002).

2.7. There is no distinction between positive and negative citations

The widespread use of the impact factor as a measure of scientific quality is based on the assumption that the more citations an article collects, the greater its importance and impact on the scientific community. However, it should be noted that there is no indication in the calculation of a journal's impact factor whether an article is cited because it contains valuable information or as an example of bad science (Bloch & Walter, 2001; Scully & Lodge, 2005).

Similarly, a journal's impact factor does not reflect the quality of every article published in it. It has been suggested that a relative small number of a journal's articles contribute to its impact factor, since only a proportion of them are cited in future publications (Hamilton, 1991). It has been estimated that the most cited 50% of the articles published in a journal account for 90% of that journal's citations (Seglen, 1997). In addition, journals with relative low impact factor may contain articles that are cited more frequently than articles in journals with higher impact factor (Opthof, 1997) and journals ranked higher publish articles that never get cited in subsequent publications (Seglen).

2.8. *Calculation of impact factor is not corrected for self-citations*

Self-citation occurs when an author is referred to his/her previous work in a new publication, or when an article of a journal cites other articles published in the same journal. Self-citations are included in the numerator and they help raise the level of the impact factor quite considerably (Fassoulaki, Papilas, Paraskeva, & Patris, 2000; Seglen, 1997; Sims & McGhee, 2003; Walter, Bloch, Hunt, & Fisher, 2003; Whitehouse, 2002). The extent of self-citation in unknown, however, a study carried out by Gami, Montor, Wilczynski, and Haynes (2004) demonstrated that ''author self-citations comprise nearly one-fifth of all citations to articles about diabetes published in clinical journals in 2000'' (p. 1926).

2.9. *Journal's internet access increases its impact factor*

Electronic availability of journals on the Internet attracts more readers and thus more citations. Given the tremendous increase in the electronic versions of journals, Internet access has evolved in an important factor affecting the impact factor of many publications (Curti, Pistotti, Gabutti, & Klersy, 2001; Dong et al., 2005; Scully & Lodge, 2005).

2.10. *Impact factor can be easily manipulated*

The way the algorithm of the impact factor is calculated offers scope for deliberate manipulation by journals policy. Several ways of manipulation have been recognized (Bloch & Walter, 2001; Dong et al., 2005; Kurmis, 2003; Neuberger & Counsell, 2002; Rogers, 2002; Sevinc, 2004). Publication of a long correspondence or numerous commentaries and other such items, that are likely to collect citations and contribute to the numerator of the equation but are not considered as ''source items'' and therefore are not included in the denominator, can inflate a journal's impact factor. On the other hand editors can also increase the number of reviews and technical reports because they have higher citation rates. In the same sense editors can reject articles on narrow or unpopular subjects in favor of papers dealing with subjects appealing to a wider audience, because the latter will receive more citations.

Self-citation is another way in which impact factors can be improved. Authors might be encouraged or even requested to include in their reference lists articles previously published in the same journal. Some years ago a journal was actually accused of deliberately attempting to increase its impact factor by asking all authors who were submitting manuscripts to include references to articles published in that journal (Smith, 1998).

However, despite the above mentioned weaknesses, impact factor still can be applied, and actually it is widely used as an indicator of journal quality, especially in pure and applied sciences.

3. Impact factor of education journals

As it was mentioned earlier, Journal Citation Reports has two editions, the Science and Social Sciences Edition. In the Social Sciences Edition the education journals are classified into two subject categories, entitled "Education and Educational Research" and "Education, Special". The first category covers resources on the full spectrum of education while the second covers resources that are dealing with the education of individuals with special needs, including the gifted as well as those with learning disabilities. In the Science Edition the educational journals are located in the category "Education, Scientific Disciplines", which covers all education resources in the scientific disciplines, including biology, pharmacy, biochemistry, engineering, chemistry, nutrition, and medicine.

A first, general remark, with regard to the coverage of JCR, is that while a total of 1226 active, refereed academic/scholarly journals are entered under the subject "Education" in Ulrich's Periodicals Directory, only 136 are included in the JCR databases in 2004: 91 titles in the "Education and Educational Research" category, 26 in "Education, Special" and 20 in "Education, Scientific Disciplines". This means that approximately 11% of the total output is represented in the ISI databases. Of the 136 titles, only one is non-English, confirming the predominance of the English language in the JCR databases.

The analyses presented below are based on the educational journals included in the two categories of the Social Sciences Edition of JCR, namely "Education and Educational Research" and "Education, Special". Journals included in the category "Education, Scientific Disciplines" were excluded from the analysis. The Social Sciences Edition of JCR database contains 54 subject categories. Aggregate median and mean impact factors for each of these categories for 2004 and 2003 are presented in Table 1. When the 54 subject categories were sorted in descending order according to aggregate median or mean impact factor, it was found that the "Education and Educational Research" position in relation to other categories was quite low, ranging from 43rd to 49th. Higher positions were noticed for the "Education, Special" category (19th to 39th), but with noticeable fluctuation, depending on which central tendency index (mean or median) is selected for classification. In addition, subject categories that have stronger bonds with Science Citation Index (e.g., Psychiatry; Psychology, Applied; Psychology, Biological; Social Sciences, Biomedical) tend to have higher aggregate impact factors, well above unity.

Table 2 presents the descriptive statistics of the impact factor of education journals included in the Social Science Edition of JCR database for the period 2000–2005. According to Carr and Britton (2003) a journal having an impact factor less than unit is characterized as "low impact" journal. The mean impact factor of the educational journals included in the ISI for six consecutive years was 0.584 (0.554 for the "Education and Educational Research" and 0.701 for the "Education, Special"). Lower values were noticed for the median (0.463 overall, 0.431 for the "Education and Educational Research" and 0.605 for the "Education, Special), suggesting that the data were positively skewed. This fact suggests the existence of journals of certain high values in relation to the mean. Indeed further analysis showed that 23 journal yielded impact factor values above unity in 2005, 19 in 2004 and 20 in 2003.

Table 1
Aggregate median and mean impact factors for the social sciences category of the ISI for two consecutive years

Social sciences edition subject categories	2004					2003				
	Me	*M*	Max	Min	*N*	Me	*M*	Max	Min	*N*
Anthropology	0.454	0.903	2.767	0.000	50	0.407	0.739	2.786	0.000	53
Applied linguistics	0.741	0.976	3.153	0.000	38	0.660	0.951	2.736	0.045	37
Area studies	0.373	0.394	1.280	0.043	33	0.336	0.374	1.062	0.045	32
Business	0.673	0.836	3.717	0.066	57	0.741	0.862	4.415	0.082	57
Business, finance	0.759	0.726	3.110	0.043	37	0.618	0.614	3.844	0.024	36
Communication	0.705	0.737	1.526	0.140	40	0.631	0.641	1.612	0.039	44
Criminology and penology	0.682	0.730	1.923	0.103	26	0.633	0.659	2.424	0.139	24
Demography	0.927	0.935	2.000	0.059	17	0.661	0.915	3.241	0.121	18
Economics	0.546	0.782	4.412	0.000	172	0.561	0.761	5.243	0.000	169
Education and educational research	0.462	0.525	2.280	0.000	91	0.425	0.493	1.690	0.037	92
Education, special	0.697	0.713	1.260	0.032	26	0.714	0.803	1.707	0.083	25
Environmental studies	0.644	0.811	1.818	0.143	50	0.693	0.828	2.269	0.100	50
Ergonomics	0.741	0.838	1.297	0.067	13	0.660	0.707	1.075	0.200	13
Ethics	0.460	0.653	1.721	0.062	28	0.469	0.650	1.372	0.061	28
Ethnic studies	0.445	0.445	0.732	0.149	6	0.524	0.432	0.744	0.075	7
Family studies	0.742	0.830	2.000	0.04	29	0.681	0.827	3.241	0.023	30
Geography	0.947	1.253	3.139	0.192	35	0.924	1.231	3.653	0.037	35
Gerontology	0.701	1.907	4.122	0.048	24	0.828	1.924	4.369	0.196	23
Health policy and services	1.036	1.571	3.657	0.058	38	0.912	1.523	3.673	0.000	38
History	0.353	0.429	1.642	0.034	15	0.302	0.333	0.883	0.018	15
History and philosophy of science	0.298	0.434	0.967	0.033	27	0.310	0.433	1.069	0.045	27
History of social sciences	0.378	0.410	0.769	0.121	16	0.447	0.363	0.722	0.045	17
Industrial relations and labor	0.790	0.753	1.579	0.171	16	0.742	0.777	1.308	0.051	17
Information science and library science	0.539	0.814	4.292	0.068	54	0.486	0.673	2.864	0.013	55
International relations	0.560	0.743	2.404	0.024	54	0.508	0.668	2.952	0.062	52
Law	0.890	1.381	6.623	0.037	101	0.836	1.366	7.179	0.026	103
Management	0.828	0.978	3.717	0.105	67	0.672	1.012	4.415	0.106	67

Table 1 (*continued*)

Social sciences edition subject categories	2004					2003				
	Me	*M*	Max	Min	*N*	Me	*M*	Max	Min	*N*
Nursing	0.632	0.735	1.981	0.238	32	0.598	0.713	1.709	0.045	31
Planning and development	0.578	0.730	1.536	0.086	38	0.574	0.696	1.467	0.045	39
Political science	0.435	0.553	2.744	0.016	79	0.432	0.525	2.674	0.021	78
Psychiatry	1.247	2.601	11.207	0.111	76	1.212	2.542	10.519	0.048	77
Psychology, applied	0.810	1.052	2.592	0.067	50	0.790	0.988	2.173	0.176	49
Psychology, biological	1.518	1.815	7.125	0.512	16	1.417	1.883	10.625	0.707	16
Psychology, clinical	1.077	1.687	4.806	0.098	84	0.958	1.568	4.978	0.127	83
Psychology, developmental	1.086	1.724	7.286	0.305	49	1.081	1.694	7.500	0.226	51
Psychology, educational	0.707	1.118	3.718	0.080	38	0.699	1.134	3.324	0.118	36
Psychology, experimental	1.417	1.853	7.992	0.125	68	1.400	1.792	7.528	0.138	67
Psychology, mathematical	0.715	1.107	1.931	0.227	10	0.794	1.092	1.984	0.487	10
Psychology, multidisciplinary	0.704	1.321	12.800	0.054	100	0.633	1.229	9.896	0.056	101
Psychology, psychoanalysis	0.623	0.950	3.987	0.378	12	0.806	1.092	3.949	0.357	12
Psychology, social	0.963	1.323	6.231	0.196	46	0.726	1.261	7.333	0.067	46
Public administration	0.545	0.593	1.256	0.156	26	0.367	0.483	1.070	0.074	24
Public, environmental and occupational health	0.992	1.371	4.293	0.156	60	0.925	1.367	5.179	0.000	56
Rehabilitation	0.682	0.768	1.652	0.137	45	0.707	0.773	1.707	0.042	47
Social issues	0.463	0.640	1.771	0.037	31	0.528	0.646	2.361	0.065	31
Social sciences, biomedical	0.899	1.358	2.523	0.125	26	0.737	1.219	2.222	0.133	25
Social sciences, interdisciplinary	0.413	0.576	2.000	0.016	56	0.398	0.535	1.280	0.046	55
Social sciences, mathematical methods	0.673	0.927	2.163	0.000	31	0.657	0.866	2.215	0.033	29
Social work	0.388	0.537	1.116	0.000	28	0.452	0.536	1.232	0.014	29
Sociology	0.480	0.627	2.855	0.000	90	0.433	0.601	3.205	0.025	93
Substance abuse	1.010	1.541	3.102	0.172	18	1.057	1.503	3.241	0.492	19
Transportation	0.493	0.803	1.365	0.077	12	0.595	0.762	1.158	0.250	12
Urban studies	0.613	0.701	1.246	0.120	28	0.530	0.741	1.429	0.140	28
Women's studies	0.351	0.552	1.352	0.000	25	0.345	0.598	1.561	0.000	26
Relative position of Education, Educational Research	43	49				47	48			
Relative position of Education, Special	26	39				19	26			

Note: Me = Median, M = mean, IF = impact factor.

Table 2
Descriptive statistics of the impact factor for "Education and Educational Research" and "Education, Special" across six consecutive years

	Median	Mean	Standard Deviation	Maximum	Minimum
Education and educational research					
2005	0.441	0.575	0.434	2.792	0.008
2004	0.462	0.574	0.423	2.280	0.000
2003	0.442	0.548	0.400	1.690	0.037
2002	0.440	0.532	0.378	2.000	0.000
2001	0.409	0.530	0.459	3.091	0.000
2000	0.420	0.560	0.454	2.486	0.013
Education, Special					
2005	0.655	0.793	0.454	1.704	0.175
2004	0.696	0.674	0.352	1.260	0.032
2003	0.714	0.729	0.405	1.707	0.083
2002	0.532	0.711	0.535	2.219	0.139
2001	0.500	0.643	0.449	1.639	0.090
2000	0.617	0.643	0.410	1.478	0.000
Overall					
2005	0.490	0.621	0.446	2.792	0.008
2004	0.486	0.597	0.409	2.280	0.000
2003	0.475	0.587	0.407	1.707	0.037
2002	0.454	0.569	0.419	2.219	0.000
2001	0.420	0.553	0.457	3.091	0.000
2000	0.438	0.576	0.446	2.486	0.000

3.1. Differences between the two SSCI education categories

Descriptive statistics also showed that "Education, Special" category tend to have higher impact factor values than the "Education and Educational Research". Thus it was seemed rational to examine whether the observed discrepancy was also statistically significant. Application of the Kolmogorov–Smirnov test revealed that the data were deviated from the normal distribution. The square-root transformation was applied in order to reach normality. Following transformation, the Kolmogorov–Smirnov test showed that the assumption of normality was tenable. Analysis *t*-test for independent samples revealed that the two categories were statistically different for the 2005 year ($t_{122} = 2.46, p = .015$) and 2003 year ($t_{114} = 2.21, p = .029$), in which "Education, Special" category journals had higher impact factor values than "Education and Educational Research" category journals. However, these differences were not very meaningful as indicated by the small effect size ($n^2 = .047$ and .041 respectively).

3.2. Stability of education journals' impact factor

Despite the problems associated with the impact factor its application could be meaningful only if it was demonstrated that its values remain relatively stable over the years. Otherwise its application is at least questionable. However few studies specifically address this issue (Aguillo, 1996; Smart, 1983; Sutter & Kocher, 2001). In the study of Aguillo, 306 randomly selected randomly from the Science Citation Index and theirs impact factor stability was examined. His findings indicated that the impact factor would be more stable if the citations of the previous 2 years would be extended to four.

The study of Smart (1983) focused on education journals and found that the impact factor was stable. However, few shortcomings should be underlined. Apart that this study was conducted more than 20 years ago, the stability of the education journals impact factor was based on the Pearsons' correlation coefficient. The use of correlation analysis as an index of stability has been frequently criticized (McGraw & Wong, 1996; Tsigilis & Theodosiou, 2003). This statistic has been designed to investigate the bivariate relationship of only two variables representing different measurement classes. Furthermore, sources of systematic variance (bias) cannot be assessed in Pearson's r. That means that correlation coefficient is insensitive to any possible differences in the means and variances of the raw data. A more appropriate index of reliability in the case of multiple trials might be the intraclass correlation coefficient (ICC), which is estimated from the analysis of variance. Among the many alternative intraclass correlation coefficients reported by McGraw and Wong (1996), the ICC(A,1) for the estimation of absolute agreement between measurements was selected. The computation of the ICC(A,1) is based on a two-way model, in which it is assumed that there is a systematic source of variance associated with columns (years) as well as with rows (education journals). The ICC(A,1) expresses the reliability of a single measurement.

Calculation of the ICC showed that its overall value was 0.733 (95%CI 0.690–0.793), 0.752 (95%CI 0.684–0.815) for the ''Education and Educational Research'' and 0.640 (95%CI 0.471–0.802) for the 'Education, Special''. These findings suggest that education journals from the ''Education and Educational Research'' category were relative stable over the examined 6 years. Journals impact factors from the ''Education, Special'' category yielded ICC value below the conventionally accepted value (.70), indicating that were less stable in comparison to the ''Education and Educational Research''.

4. Concluding remarks

Quality of scientific journals is a multi-faceted concept that should not be assessed only on the basis of a purely bibliometric indicator such as the impact factor (Lluch, 2005). Apart from the serious technical limitations inherent in the calculation of the impact factor mentioned above, the equation of a journal's quality with the number of citations it receives over a certain period of time cannot be justified (Buela-Casal, 2004). Quality is much more associated with features such as originality, creativity, validity and so on (Buela-Casal). Even under the assumption that the impact factor can measure journal quality, the journals compared should belong to the same scientific field, be published in the same language and in the same country, and have similar form and structure (Kaltenborn & Kuhn, 2004; Manske, 2004). Only if these conditions are satisfied could comparisons on the basis of the impact factor be meaningful. According to Manske, a much better insight into a journal's value and its impact on the scientific community could possibly be acquired through the investigation of the reading behavior of its readers. Such a study revealed that impact factors did not reflect the extent to which scientific journals are used by experts (Manske).

The present study indicated that the assessment of the relative importance of the educational journals should not be relied on their impact factor absolute value. More precise information can be obtained if the mean or even better the median of the subject category is used. For example, a journal from the "Education and Educational Research" category with an impact factor above .60 (based on mean) or even .50 (based on median) it should not be regarded as a "low impact" journal, although its value is below unity.

Undoubtedly, evaluation of scientific work based on journal impact factor has significant implications for individuals (e.g., job appointments, salaries, promotion, tenure) or institutions (e.g., allocation of funds). Thus, the issue of temporal stability of impact factor is of great importance (Sutter & Kocher, 2001). The advantage of the present study over the previous ones is the application of the intraclass correlation coefficient, which is regarded the most appropriate index for examining temporal stability (Tsigilis & Theodosiou, 2003). Our findings suggest that the ranking of education journals according to their impact factor was stable across the examined 6 years for the "Education and Education Research" category. Greater fluctuations in the impact factor values were found for the journals belonging to "Education, Special" category. Given that frequently the lag-time between initial submission of a manuscript and its publication could be more than a year, considerable changes in journals impact factor could be anticipated. The reasons for this strong moving up and down in a short time period are unknown (Aguillo, 1996; Sutter & Kocher, 2001). A promising remedy to increase the stability of journals' impact factor might be to take into consideration for its calculation data from the previous four instead of 2 years (Aguillo). Future studies should address this issue.

It has to be stressed that impact factor was mostly shaped by its application in the natural sciences, so its use for the evaluation of educational journals can create many problems concerning the validity of the results. Compared to the natural sciences, the social sciences, and even more the humanities, are characterized by different literature structure, communication channels and citation patterns. In a review of social science bibliometric studies, Hicks (1999) reports a fragmentation of the social sciences literature due to the fact that "social science research is characterized by more competing paradigms and a national orientation" (p. 193). According to the Director General, Science Technology and Industry in the British Library, Maurice Line (1999) "most of the social sciences are relatively young, and scarcely organized as coherent disciplines" (p. 131). He points out various characteristics that differentiate the social sciences, such as the lack of general agreement upon which scientific fields are included in this area of study; the lack of international concepts and of terms that are being used internationally and are stable over time; a strong national orientation along with a preference of the social scientists to publish in their native language; and a relatively greater tolerance when previous research is duplicated. All these peculiarities make the organization and control of information in the social sciences much more difficult than in the sciences.

Furthermore, a number of authors (e.g. Andersen, 2000; Glanzel & Schoepflin, 1999; Hicks, 1999; Nederhof, Zwaan, Debruin, & Derek, 1989) have pointed out than in the social sciences, journals are not always the primary vehicle of scholarly communication. Books, book chapters, conference proceedings, gray literature and even non-scientific resources play an important role in the dissemination of scientific knowledge. This reliance upon non-serial document types observed in the social sciences seriously questions the appropriateness of bibliometric indicators based on databases that index only articles in scholarly journals.

On the other hand, social sciences are getting better and better organized, they are becoming more international and less fragmented, their literatures are evolving (Hicks, 1999), and therefore the need for the quantitative assessment of their outcome is also increasing. Consequently, it is essential for researchers to understand how bibliometrics can be used, to appreciate their potential and, perhaps more importantly, their limitations. In any case, anyone interested in the applicability of quantitative indicators for the assessment of research performance should be aware of the fact that the impact factor cannot be regarded as a valid indicator of the scientific value of the individual articles published in journals. As Buela-Casal (2004) states: ‘‘bibliometric indices (..) are to be interpreted as quantitative parameters of citations, which serve to quantify the production and circulation of scientific publications. And although these indices may be related in some way to the quality of the articles and the journals, they should not be used as substitutes for other parameters more directly associated with quality’’ (p. 72).

Appendix A

See Table 3.

Table 3
Impact factors of the ‘‘Education and Educational Research’’ category journals for six consecutive years

Abbreviated journal title	2005	2004	2003	2002	2001	2000
ACAD PSYCHIATR	0.808	0.657	0.281	0.431	0.275	0.340
ACADEME	—	—	0.127	0.124	0.182	0.376
ADULT EDUC QUART	0.323	0.310	0.219	0.290	0.346	0.414
ADV HEALTH SCI EDUC	1.244	1.219	0.821	—	—	—
AIDS EDUC PREV	1.700	1.238	0.973	1.237	0.688	1.044
ALBERTA J EDUC RES	—	—	—	—	0.129	0.041
AM EDUC RES J	1.383	1.103	1.635	1.438	0.914	1.065
AM J EDUC	0.353	0.000	0.100	0.238	0.333	0.900
ANTHROPOL EDUC QUART	0.195	0.261	0.234	0.452	0.500	0.293
APPL LINGUIST	—	—	—	—	—	0.692
APPL MEAS EDUC	0.419	0.371	0.487	0.548	0.273	0.279
AUST EDUC RES	0.132					
AUST J EDUC	—	—	—	—	0.176	0.054
BRIT EDUC RES J	0.526	0.612	0.821	0.711	—	—
BRIT J EDUC STUD	0.263	0.667	0.732	0.561	0.775	0.628
BRIT J EDUC TECHNOL	0.593	0.311	0.248	0.380	0.438	0.318
BRIT J SOCIOL EDUC	0.476	0.488	0.657	0.851	0.706	0.948
CAN MOD LANG REV	—	—	—	—	—	0.180
CHINESE EDUC SOC	0.098	0.009	0.075	0.017	0.020	0.024
COMMUN EDUC	—	—	—	—	0.148	0.350
COMP EDUC	0.593	0.321	0.472	0.263	1.019	0.675
COMP EDUC REV	0.562	0.485	0.472	0.300	0.605	0.710
COMPUT EDUC	0.968	0.625	0.849	0.442	0.571	0.300
CURRICULUM INQ	0.147	0.205	0.095	0.220	0.282	0.219
EARLY CHILD RES Q	0.703	0.564	0.339	0.423	0.440	0.509
ECON EDUC REV	0.495	0.382	0.473	0.587	0.667	0.280
EDUC ADMIN QUART	0.388	0.523	0.386	0.556	0.288	0.685
EDUC EVAL POLICY AN	0.703	1.342	1.424	1.135	1.136	0.857
EDUC GERONTOL	0.425	0.232	0.198	0.268	0.144	0.211
EDUC LEADERSHIP	0.283	0.221	0.154	0.164	0.146	0.255
EDUC POLICY	0.509	0.246	0.197	0.339	0.609	0.426

Table 3 (*continued*)

Abbreviated journal title	2005	2004	2003	2002	2001	2000
EDUC RES-UK	0.140	0.222	0.239	0.388	0.358	0.667
EDUC REV	0.390	0.333	0.458	0.298	0.250	0.405
EDUC STUD	0.339	0.109	0.339	0.371	0.315	0.426
EDUC TECHNOL SOC	0.267	—	—	—	—	—
EDUC URBAN SOC	0.447	0.224	0.170	0.148	0.267	0.373
ELEM SCHOOL J	0.911	0.978	0.792	0.843	0.725	0.865
ETR&D-EDUC TECH RES	0.364	0.200	0.355	0.089	0.196	0.177
FOREIGN LANG ANN	0.226	0.266	0.307	0.329	0.528	0.328
GENDER EDUC	0.642	0.776	0.500	0.380	—	—
HARVARD EDUC REV	0.862	1.125	1.212	0.833	0.758	0.963
HEALTH EDUC RES	1.303	1.405	1.358	1.177	0.922	0.922
HIGH EDUC	0.495	0.398	0.247	0.299	0.384	0.259
HIST EDUC QUART	—	—	—	—	—	0.100
INNOV EDUC TEACH INT[a]	0.200	0.194	0.231	0.278	0.188	0.130
INSTR SCI	1.000	0.659	0.366	0.550	0.350	0.651
INT J ART DES EDUC[b]	0.185	0.143	0.050	0.088	0.313	0.173
INT J EDUC DEV	0.233	0.304	0.423	0.246	0.328	0.134
INT J SCI EDUC	0.553	0.436	0.574	0.416	0.476	0.705
INTERACT LEARN ENVIR	0.435	—	—	—	—	—
J ADOLESC ADULT LIT	0.391	0.264	0.427	0.677	0.419	0.531
J AM COLL HEALTH	1.000	1.625	1.468	1.818	1.657	1.588
J COLL STUDENT DEV	0.457	0.755	—	0.505	0.514	0.470
J COMPUT ASSIST LEAR	0.556	0.298	0.216	0.403	0.232	0.212
J CURRICULUM STUD	0.239	0.309	0.361	0.390	0.282	0.438
J ECON EDUC	0.164	0.306	0.239	0.200	0.310	0.266
J EDUC BEHAV STAT	0.659	0.405	0.657	0.541	0.523	1.088
J EDUC COMPUT RES	—	—	—	—	0.125	0.086
J EDUC POLICY	0.671	0.625	0.641	0.400	0.624	—
J EDUC RES	0.377	0.439	0.343	0.466	0.408	0.351
J EXP EDUC	0.645	0.727	0.750	0.564	0.381	0.386
J GEOGR HIGHER EDUC	0.604	0.413	0.727	1.065	0.852	1.140
J HIGH EDUC	0.333	0.593	0.375	0.836	0.409	0.562
J LEARN SCI	2.792	2.280	1.600	1.107	1.269	1.286
J LEGAL EDUC	0.253	0.676	0.351	0.256	—	0.646
J LIT RES	0.379	0.500	0.641	0.438	0.975	0.909
J MORAL EDUC	0.150	0.421	0.157	0.375	0.358	0.182
J NEGRO EDUC	—	—	—	—	0.016	0.045
J PHILOS EDUC	0.342	0.463	0.250	0.125	0.421	0.463
J RES MATH EDUC	0.367	0.679	0.562	0.515	0.338	0.294
J RES READ	0.408	—	—	—	—	—
J RES SCI TEACH	1.011	1.202	1.094	0.990	0.664	0.992
J SCHOOL HEALTH	0.721	0.872	0.868	0.669	0.614	0.789
J SOC WORK EDUC	0.647	0.551	0.603	0.696	0.358	1.046
J TEACH EDUC	0.500	0.727	0.841	0.677	0.472	0.394
J TEACH PHYS EDUC	0.500	0.462	0.275	0.453	0.400	0.412
LANG LEARN	0.976	0.851	0.680	0.581	0.682	0.340
LANG LEARN TECHNOL	1.367	—	—	—	—	—
LEARN INSTR	1.548	1.617	1.300	0.756	1.021	0.536
MINERVA	0.326	0.538	0.513	0.486	0.194	0.414
NEW ZEAL J EDUC STUD	—	—	—	0.061	—	0.244
OXFORD REV EDUC	0.300	0.302	0.594	0.523	0.297	0.703
PERSPECT EDUC	0.213	—	—	—	—	—

Table 3 (*continued*)

Abbreviated journal title	2005	2004	2003	2002	2001	2000
PHI DELTA KAPPAN	0.275	0.461	0.361	0.465	0.418	0.519
QUEST	0.577	0.644	0.509	0.806	0.554	0.483
READ RES INSTRUCT	—	—	0.324	0.143	0.133	0.174
READ RES QUART	0.859	1.035	1.632	1.327	1.872	2.486
READ TEACH	0.343	0.303	0.271	0.181	0.312	0.490
READ WRIT	—	—	—	—	—	0.122
RES HIGH EDUC	0.521	0.525	0.333	0.394	0.243	0.338
RES SCI EDUC	0.370	0.269	—	—	—	—
RES TEACH ENGL	0.375	0.480	0.538	0.893	1.333	1.080
REV EDUC RES	1.760	1.960	1.690	2.000	1.429	2.088
REV HIGH EDUC	0.292	0.412	0.388	0.542	0.426	0.837
REV RES EDUC	—	—	—	0.000	3.091	2.421
RUSS EDUC SOC	0.008	0.007	0.037	0.028	0.000	0.013
SCH EFF SCH IMPROV	0.412	0.303	0.818	0.743	0.239	0.578
SCI EDUC	1.159	1.312	0.877	0.900	0.840	0.918
SCI STUD READ	1.529	—	—	—	—	—
SECOND LANG RES	0.379	—	—	—	—	—
SOCIOL EDUC	1.222	0.744	1.048	0.846	1.815	1.241
STUD HIGH EDUC	0.662	0.818	0.562	1.073	0.524	0.636
TEACH COLL REC	0.429	0.663	0.494	0.914	0.508	0.300
TEACH PSYCHOL	0.245	0.368	0.284	0.248	0.461	0.352
TEACH SOCIOL	0.623	0.197	0.043	0.397	0.565	0.484
TEACH TEACH EDUC	0.462	0.348	0.565	0.368	0.400	0.317
TESOL QUART	0.700	0.489	1.000	0.673	0.508	0.806
THEOR PRACT	0.338	0.507	0.246	0.182	0.270	0.191
URBAN EDUC	0.265	0.429	0.216	0.230	0.123	0.386
YOUNG CHILDREN	0.213	0.162	0.091	0.206	0.122	0.295
Z PADAGOGIK	0.176	0.194	0.421	0.113	0.164	0.189

[a]Title change in 2002 (previous title INNOV EDUC TRAIN INT).
[b]Title change in 2003 (previous title J ART DESIGN EDUC).

Appendix B

See Table 4.

Table 4
Impact factors of the "Education, Special" category journals for six consecutive years

Abbreviated Journal Title	2005	2004	2003	2002	2001	2000
AM ANN DEAF	0.286	0.375	0.306	0.175	0.210	0.766
AM J MENT RETARD	1.640	1.260	1.707	1.840	1.520	1.478
ANN DYSLEXIA	1.250	1.000	1.261	0.652	0.591	0.320
BRIT J DEV DISABIL	0.238	0.318	0.348	0.455	0.174	0.130
DYSLEXIA	1.290	—	—	—	—	—
EDUC TRAIN DEV DISAB[a]	0.373	0.561	0.373	0.385	0.286	0.342
EXCEPT CHILDREN	1.704	0.982	1.034	0.890	1.639	1.214
FOCUS EXCEPT CHILD	—	—	1.000	0.222	0.111	0.000
GIFTED CHILD QUART	0.409	0.302	0.476	0.419	0.425	0.737
HIGH ABIL STUD	0.227	0.571	0.286	0.200	—	—

Table 4 (*continued*)

Abbreviated Journal Title	2005	2004	2003	2002	2001	2000
INFANT YOUNG CHILD	0.579	0.305	0.475	0.322	0.379	0.297
INT REV RES MENT RET	0.676	1.083	1.138	0.952	0.500	0.375
INTERV SCH CLIN	0.175	0.172	0.303	0.139	0.090	0.237
J EARLY INTERVENTION	0.914	0.300	0.605	0.527	0.585	0.918
J EDUC GIFTED	—	0.032	0.083	0.400	0.273	0.647
J FLUENCY DISORD	1.639	1.162	0.788	0.944	0.382	0.370
J INTELL DISABIL RES	1.047	1.029	1.268	2.219	1.010	1.123
J INTELLECT DEV DIS	0.635	0.380	0.478	—	—	—
J LEARN DISABIL-US	1.011	0.711	1.211	1.568	1.333	1.000
J POSIT BEHAV INTER	0.932	0.960	—	—	—	—
J SPEC EDUC	1.154	0.902	0.833	0.600	1.116	0.617
LEARN DISABILITY Q	0.486	0.368	0.714	0.419	0.667	1.091
MENT RETARD	1.090	1.113	1.145	0.756	1.077	0.965
REM SPEC EDUC	0.453	0.771	0.464	0.478	0.310	0.603
RES DEV DISABIL[b]	0.767	0.682	0.825	1.275	0.768	0.470
RES PRACT PERS SEV D	0.425	0.953	—	—	—	—
TOP EARLY CHILD SPEC	0.594	0.862	0.742	0.537	0.860	1.081
VOLTA REV	0.629	0.393	0.368	0.690	0.500	0.021

[a]Title change in 2004 (previous title EDUC TRAIN MENT RET).
[b]Until 2000 the journal was listed in the subject category ‘‘Rehabilitation’’.

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