

RESEARCH REPORT

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## Scientometric Approaches to Better Visibility of European Educational Research Publications: a state-of-the-art-report

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**ABSTRACT** This article reports on methodological approaches to evaluate the relevance and quality of educational research publications. In the first section it focuses on the *ISI Social Science Citation Index* and shows that this standard instrument for bibliometric measurement is insufficient for the representation of European educational research. In the following sections, alternative approaches are delineated in order to constitute the proposal of a multi-attributive setting for a new observation and evaluation instrument for social science academic publications. The final section outlines a project proposal submitted to the 7th Framework Programme of the European Union, supported by the European Educational Research Association (EERA).

The evaluation of research quality by scientometric or bibliometric measurement is not a very popular issue.[1] Scholars are not normally comfortable about being put on performance scales. Bibliometric tools are definitely not undisputed: the overall majority of comments on bibliometric methods like citation analysis are very critical on a general scale as well as in detail, even if the authors of these critical comments are very often insiders who use these methods themselves.

However, the truth is that the application of bibliometric analyses is more and more on the agenda of administrative bodies which fund and evaluate scientific research. But it is not only the political threat which should move the scientific community to pay more attention to these instruments. There are also internal reasons for taking bibliometric representations and questions of the quality of the publishing process more seriously. Especially in a European and international perspective, researchers and scholars should agree on certain common standards that render their work better visible, understandable and comparable in a productive way. As research results are reflected in publications, transnational research perception and cooperation needs assessable benchmarks of quality for publications relevant to research. Accepted quality criteria of publications are the precondition for good scientific information services.

### **Quality Indicators for Scientific Publications and the ISI Citation Indexes**

This article is addressed to an audience of educational research scholars. Results of information science research are presented in a limited and selective way in order to provide information about the observation of educational research publications by scientometric methods.

The standard assessment of quality of scientific publications is based on citation analyses, i.e. on the counting of references. A comprehensive overview of citation analysis – including special chapters on the relevance of ISI indexes in the social sciences – is offered by Moed (2005). The assumption is that articles and journals that are quoted frequently are relevant and of high quality. This correlation is widely accepted and therefore a basic element of research evaluation in many science disciplines, especially in the STM (science, technology, medicine) area: ‘On the one hand, *quantitative studies of science and technology* explore and apply methodologies enabling policy makers to carry out their research and innovation policies; on the other, they provide tools to critically assess the effectiveness of such policies’ (Moed, 2005, p. 16).

The *Science Citation Index* (SCI) of the Institute for Scientific Information has achieved such a reputation in STM that the publication culture in these sciences is subjected to the mechanisms of the SCI. As a result of this alignment between citation indexes and science authors and journal publishers, many critical arguments against the imbalance of the SCI forfeit their eligibility. According to investigations by Moed, the SCI covers 90% of the internationally relevant journal literature and thus 75% of all relevant literature in the natural and technological science fields (Moed, 2005, p. 124). Physicists and physicians who want to be recognized in their scientific community publish according to the standards of the SCI.

The picture is much different if you look at the representation of social or even educational sciences in the ISI indexes *Social Science Citation Index* (SSCI) and *Arts and Humanities Citation Index* (AHCI). For the educational sciences, coverage goes down to 65% for internationally relevant journals and 27% for overall coverage of the field’s relevant literature (Moed, 2005, p. 130). Obviously, the publication standards in social sciences are not yet adjusted to these indexes. In other words: the SSCI does not represent the publications in social sciences adequately. An up-to-date overview of the research about the limitations of the SSCI and the AHCI, and of possible extensions of citation analyses for these sciences, is provided by Nederhof (2006).

Hence, it is not surprising that strong resentment among European social and humanities scientists can be expected if the SSCI is used for the evaluation of research productivity. A closer look at the representation of the SSCI sub-domain *educational sciences* shows that a negative prejudice is very much in line with the facts. The following data based on the 2006 edition of the ISI indexes underline that older research results presented by Nederhof (2006) and Van Leeuwen (2006) are still valid.

The first informational basis is the *Journal Citation Report* (JCR), a compilation of journals covered by the ISI indexes. The social sciences edition comprises 1700 journals in all, i.e. for all disciplines and all countries. The sub-disciplinary selection of ‘education’, ‘special education’, ‘psychology, educational’ comprises 153 journals. Only seven of them are not exclusively English-language journals: three are multilingual, three German, and one Russian language. Some 66% are US journals, 24% are British. Some internationally-edited journals come from the Netherlands because the publishing houses are based there. With the exception of the three German journals, the journals of all the other countries do not appear at all or only once.

Among these 153 ‘educational’ journals there is a strong bias towards *psychology*- and *medicine*-related topics; only a few journals are devoted to the *sociological* and *political* aspects of education. Even the central area of *teaching/instruction* appears infrequently – unlike learning, which is more highly represented because it is also a field of psychology. A look at the so-called ‘journal impact factors’ (a measurement for relevance in correspondence with citation rates) aggravates the impression: among the first 20 journals only 4 are not primarily dedicated to psychology or medicine, and two of the four to the topic of learning which is – as already mentioned – also close to psychology.

Another element of criticism is how ISI generates the ‘journal impact factor’. The main deficit can be exemplified as follows: the impact factor of Journal X for the year 2005 is calculated by the number of citations directed to articles in Journal X during only the two preceding years 2004 and 2003: ‘This is evidently a very short-term impact indicator’ (Nederhof, 2006, p. 82). We know that most articles in social sciences have not reached half of their citation frequency after five years (Glänzel & Schoepflin, 1999; Moed, 2005; Nederhof, 2006). The journal impact factor is one of the

most criticized elements of the ISI indexes, because it is also easily biased by single articles that are quoted extremely often.

The second informational basis is a topical search for 'educational research' in the SSCI. The share of US authors is less than 50%, which is confirmed by several other search topics and seems to be representative. A slowly declining contingent of about 50% of US authors for the whole SSCI is also found by other studies (Nederhof, 2006, p. 140). This percentage still shows a US dominance, but – compared to the number of US journals in the journal selection – it is a reduced rate. It proves that there is only one way for European authors to be better represented in the SSCI, i.e. to publish in US journals, or at least English-language journals. Nevertheless, there is no reason why American educational journals should be more internationally oriented than European ones. That earlier findings that the SSCI is too strongly biased towards American (and English-language) publications is confirmed by our up-to-date sampling for the special selection of educational publications.

An even more relevant fact is that it is almost only journals that are processed for the ISI citation indexes and only these publications bear an influence on the impact factors. However, there is strong evidence that for the time being books and book chapters are still very important, if not dominant publication types, within the educational field, a fact confirmed by all studies on this topic (most recently Archambault et al, 2006). This means that the coverage of the SSCI even for internationally relevant literature is very moderate. This evidence can partly be gained from the analyses of journal article citations themselves. While in the SCI most of the references found in any of the articles apply to journal literature, which once again is part of the SCI, the references in the SSCI concerning educational topics mostly apply to books, book articles and journal articles which are not part of the ISI journal family. Moed measured the percentages of references to ISI journals in relation to all references and found very low rates for the educational sciences (29%, in Moed, 2005, p. 130).

In summary, we can say that the publication culture in social sciences (cf. Hicks, 2005) is more complex and less harmonized than a good coverage by the ISI indexes would suggest. This is the reason why even strong supporters of the evaluative value of citation analysis admit that

in fields such as sociology, education, political sciences, anthropology and related parts of social sciences and in arts and humanities, the 'national publication model' plays an important role. To a considerable extent the literature in these fields is dispersed among various language domains ... As a result, the journal communication system does not reveal a core-periphery structure as pronounced as it is found to be in science. The basic principles of a citation index ... tend to be less appropriate in these fields than in science disciplines. (Moed, 2005, p. 148f.)

### **Adequate International Visibility of Educational Research Publications and the Advantage of International Standards**

European publications in social sciences are put in a disadvantaged position by the SSCI. The disadvantage may be different for various subfields and different research areas.[2] Hence, it is not recommendable to base the evaluation of the publication output of European researchers in many fields in a great measure on the SSCI (Moed, 2005; Nederhof, 2006; van Leeuwen, 2006).

Irrespective of the indubitable value of nationally targeted high-quality publications, many European publications are not internationally visible, because these publications are not adjusted to international publication conventions. In the European Research Area, and with the ambition to improve it, 'outcomes of genuine scholarly research, even those primary related to national aspects, deserve to be communicated – in an appropriate form – to scholars in other countries as well' (Moed, 2005, p. 149).

An international orientation of the scientific publication would include the following basic conditions:

1. It should be common to perceive and quote foreign research as a representation of a cross-national research communication.
2. Major educational scientific publications should be directly addressed to an international

audience by using the English language.[3]

3. Editorial and conference boards should be international.[4]

4. International publication standards for peer review processes should be followed.

If continuous European research cooperation is a goal of European associations like the European Educational Research Association (EERA), a shift of the publication culture must be supported by European learned societies as a necessary step towards an international research frontier which does not exist in many social sciences (Nederhof, 2006). And the effort must be taken up by publishers, universities and research institutes which have to build up the infrastructures for new publication procedures. There is no doubt that public bodies on national and European levels will encourage such processes (European Commission, 2006).

The adaptation of international publication standards would also serve another need. They support the effectiveness of proper instruments (databases) for the observation and retrieval of research publications and they are preconditions for future new information systems which register classified scientific publications more completely and which are aware of the specific disciplinary conditions. However, for the time being a good representation of international educational research has to cover non-English language publications better than the SSCI and successful approaches for the measurement of research output have to cope with the multilingual complexity of international scholarship in the past and in the present (Archambault et al, 2006).

### **New Approaches to Relevance Measurement and a Multi-attributive Setting**

We detected that two major failures prevent the SSCI from a proper representation of educational scientific publications. SSCI does not cover all relevant publications and the exclusive role the number of citations plays for a quality ranking is insufficient.

For some fields of social sciences an 'expanded citation analysis' may open a loophole for a cautious use of the SSCI as an evaluation instrument [5] but education is definitely not among them. Additional evaluation methods based on citation analysis have been tested (Bonniev-Nebelong, 2006), but a new generation of quality assessment methods for scholarly publications reaches beyond citation analysis by creating indicators based on alternative attributes of literature production and reception.

Still, the main deficit new instruments should cope with is the lack of coverage of the SSCI, i.e. all internationally relevant journals, books and book articles, and the upcoming online documents, should be incorporated in a new bibliometric information system. It is useful to investigate new methods of selective measuring processes which have been developed.

There are two anchors where you can attach an attribute of relevance. One is to measure or rate well-defined characteristics of the specific publication itself, the other one is to measure characteristics of the editorial process, i.e. to base the measurement on the affiliation of this specific publication to a certain journal, publisher or editor. In more complex quality assessments both principal approaches are applied.[6]

Looking at the most meaningful anchor usable for relevance assessment, the characteristics of the single publications, a first group of data is based on usage. The growing use of computers for ordering, downloading and reading articles, books and documents opens the door for many statistical procedures, which provide quantifiable data about usage. The first promoters of these approaches were libraries wishing to measure usage (number of orders/accesses/downloads) of their resources and to identify user needs for prospective decision making. One of the most prominent initiatives in this area is COUNTER [7] – Counting Online Usage of NeTworked Electronic Resources – which resulted in a code of practice for journals and databases.

In the line of traditional citation analysis the Web offers new opportunities: you can follow web 'links' as criteria of an intended reference to a document which may be available online or also offline. The most well-known use of counting web links is the Google ranking, which turned the Google search engine into a near-monopoly. Concepts based on the assessment of links and citations created a new line of information science, the *link analysis*, partly aiming at the creation of a so-called Web-impact-factor, partly also analysing social structures of web communication

(Thelwall & Ruschenburg, 2006). The whole field of web analyses, including lock-file analyses of search engines or semantic decoding of the discourses developing in Web 2.0 applications, is now termed *webometrics* (Thelwall et al, 2005; Ingwersen, 2006).

Another group of document characteristics derives from more traditional descriptions of literature often available in bibliographic databases: content, target group, purpose. In a German project, for instance, we wanted to find out if special metadata for social science publications could be generated and processed as evaluative indicators which characterize the status of the document in the scientific process: research report, state-of-the-art report, summary, commentary, handbook article or theory discussion.

The automated revealing and assessment of attributes signalling relevance partly based on linguistic and semantic structures and patterns can be applied to generate indicators for quality. Information scientists aim at sophisticated algorithms (Bollen et al, 2005) to serve as the mathematical backbone of a new scientometric instrument. Thematic and cooperation mappings (Buter et al, 2006) are an additional outcome of quantitative structuring. This relatively new line of information research created only intermediary results, because some of the alternative indicators are not as scalable as the impact factors of ISI and the underlying procedures are not yet approved. However, the broad digitalisation planned by Google Science, Google Books, and others will soon enhance the usefulness of approaches based on the online availability of documents.

Also, the standardization and broad usage (!) of formats and of metadata will significantly improve the outcome of these procedures. These programmes have to be developed for each scientific discipline specifically, because content or methods will probably differ. In this context of standardized meta-information it is once again important to name translations into the English language. Only if titles, keywords and abstracts are provided also in English machine-based selection procedures will the programmes be successful.

The second way (anchor) of rating scientific publications is based on the reliability of the source respectively on the evaluation of the editorial process. It is not only journals that can be peer-reviewed or not, but also all kinds of serial editions of books and papers. In the near future, repositories of online documents could be peer-reviewed, or a repository could be singled out by the reputation of the institution that stands behind it. A key element of these procedures is peer review or peer questioning:

Lists of journals and publishers are rated in surveys of both national and international experts, and based on the ratings, trimmed statistical weights are computed. (Nederhof, 2006, p. 94)

Different methodological approaches (Fernandez-Cano, 2002; Jeannin, 2005) try to supplement peer judgement for the assessment of relevance with more statistical methodologies which seem to be less vulnerable to scholarly insider groupings.

Scientific associations – like the EERA – are interested in enforcing the role of peer-review in the field. In this context a project by the European Science Foundation and the EU must be mentioned, which also addresses educational sciences. The project is entitled *ERIH, European Reference Index for the Humanities*. It is part of a larger EU programme called *HERA, Humanities in the European Research Area*, carried out since March 2005 by 14 national research funding organizations and the European Science Foundation with the objective of firmly establishing the humanities in the European Research Area and in the 6/7th Framework Programmes. Here, it is interesting that Pedagogical and Educational Research is one of the 15 disciplines covered by ERIH.

ERIH is based on a peer review process. Fifteen expert groups delegated by national scientific associations compiled a selection of highly and internationally relevant journals in their discipline. The journals are selected according to strong criteria of international relevance into three categories.[8] The ERIH journal lists are due to be published soon; insider information suggests that for educational research there are about 400 journals in the lists. Four hundred journals may be too many according to the strong criteria of international recognition that was designed for the selection, but it will probably be too few to represent all European high-level research in education.

The project's schedule is already delayed and there is much evidence that the crucial parts of the development of the ERIH are not yet detailed: for example, it is also planned to add books (monographs and collections of papers) to the index, but there is no news of plans for the very

problematic peer-reviewed compilation of books. Furthermore, there is no information about the gathering of single publication entries for the planned reference database, and no precise concept of announced 'citation calculations' is available. Nevertheless, at the moment this project is the most advanced attempt at European level to improve the visibility of scholarly activity in the social sciences and humanities, involving the most well-known participants.

All the new approaches mentioned above, when combined with traditional methods, form a suitable basis for a concept of a multi-attributive analysis of publications relevant to educational research. The idea is to use a combination of the above-mentioned new ways of assessment of research relevance of publications as an alternative to the citation analysis process. The combination of these ways and metrics provides advantages:

- A multi-attributive measurement of relevance puts every attribute in its perspective and leaves it with a limited impact: the resulting indicator is more balanced.
- The indicator is generated in the close context of a scientific discipline, but it can easily be adjusted to a multidisciplinary setting/database.

In the following a project proposal will be presented which takes up some of the above-mentioned approaches.

### **EERQI: a project proposal for the EU Framework Programme 7**

The EERA promotes a proposal for an EU project which aims at a better visibility of European educational research. The project proposal, named *EERQI, European Educational Research Quality Indicators*, was submitted to the EU Commission within the 7th Framework Programme in May 2007. Coordinator of the project is Professor Dr Ingrid Gogolin, University of Hamburg, president of the EERA. The consortium includes learned societies (EERA and European Association for Research on Learning and Instruction [EARLY]), universities, research laboratories, computing centres, academic publishers and commercial partners.

The focus of EERQI is a collaborative, evidence-based effort to develop new indicators and methodologies which can be used to determine research quality of scientific publications and, in turn, research results and their means of dissemination. This affects not only the impacts of research efforts and scientific publications, but also the policies of research funding bodies and assessment boards, national higher education and research councils and, at the European level, the policies and programmes on scientific advancement and research orientation.

Traditional methods of assessing research quality of scientific publications have depended heavily on ranking methods according to citation frequency and journal impact factors, both of which are based on an instrument which does not reflect adequate coverage of European scientific publications. The EERQI Project proposes an evidence-based prototype framework that relies on new knowledge about how quality and relevance in research publications can be determined using new indicators, as well as on new technological possibilities provided by natural language processing tools for content analysis and extraction as well as for text mining of digitally-available scientific documents.

A core target of the project will be to develop innovative methods of semantic analysis and comparisons, including the challenge of multilingualism and specific 'cultural heritage' of research traditions in the European countries. In order to transform these innovative approaches into an information tool for the observation of European scholarly publications the project will also make use of search engine technology based on linguistic and ontological structuring.

The EERQI project will bring together researchers in the target field of educational research as an exemplary field for such an endeavour. It will suggest and discuss the new research indicators and methodologies (analytic techniques) for obtaining fundamental evaluation criteria. Moreover, it will provide relevant proofs of concept for testing these new indicators and methodologies. Testing this set of new indicators will take place on a domain-centred content base which consists of an aggregated set of subject-relevant documents contributed by the participating publishers and other publishers in negotiation with the project team, as well as subject-relevant open access and other Internet-based resources harvested by the EERQI search engine to be developed within the

project. Testing will also take place using innovative query modules integrated into the search engine and refined through reiterative auto-learning processes. Hence, the search engine re-programmes itself to recognize relevant documents to the respective query parameters.

The EERQI Project will produce the following tools and methodologies as follows:

- A federated, aggregated content base formed by drawing on available and accessible datasets, repositories, publisher contributions and databases in the field of educational research, augmenting these by harvesting the Internet for institutional, individual and association home pages, links and following references extrapolated from citations, bibliographies, etc.
- A harvesting protocol/search engine for identifying relevant scientific documents in electronic repositories with the possibility of harvesting according to a corpus of subject terms and/or on the basis of institutional affiliation of the author(s).
- Automated evaluation procedures and modelling frameworks based on the suggested new indicators of research quality which can be applied to the aggregated content base compiled by the harvesting protocol and which can provide statistical evidence on semantic/linguistic analyses of full texts, type of texts, references, types and language of references, etc., as well as correlations between author information, institution, content, references, environment of published item (journal, country, context, etc.) and other newly defined research quality indicators. Such modelling frameworks will support ex-post and ex-ante quantitative and qualitative analysis by investigating context, correlations between indicators, semantic and linguistic indicators, etc.
- An assessment of how such indicators can be used to improve research quality evaluation in the field of educational research (as a case study for other social sciences and humanities).
- Demonstration of transferral of these methodologies to another area of the social sciences and humanities with subsequent 'Guidelines for transferring these indicators and methodologies to other areas.'
- Finally, a sustainability plan integrating the project results into the scientific publishing environment. This will consist of a prototype framework containing organisational models and possible business models.

If this proposal is accepted the project can probably start at the beginning of 2008.

### Notes

- [1] For a definition of bibliometrics see: <http://en.wikipedia.org/wiki/Bibliometrics>
- [2] A discrimination line which works for many disciplines is that quantitative research tends to more international orientation than qualitative research. Also, psychology and economy are less culturally bound than law and education.
- [3] The use of English as a lingua franca in scientific communication seems to be a key question for standardization. In spite of many good arguments for the justification of the use of national languages when scientific knowledge is verbalized, there can be no doubt that international cooperation needs a common communication language.
- [4] It is, of course, not sufficient to publish only in English. There are examples of English language journals which did not evoke very much international awareness (e.g. *Psychological Research*). Nevertheless, the English language seems to be essential for international awareness.
- [5] Moed reports on two case studies where – on the basis of SSCI citations – an extended number of publications were incorporated in the evaluation and the general methodological principles of citation analysis were kept. Cf. Moed, 2005, p. 153ff.
- [6] It is interesting that even the Thomson ISI company uses both anchors for the quality assessment. Their well-known pre-selection of relevant journals is mostly based on editorial aspects of the journal as a whole, whereas the citation analysis processes absolutely focus on single articles.
- [7] <http://www.projectcounter.org/>

- [8] Cat A: worldwide cited journals of high international reputation, cat B: standard international journals with a good reputation in different countries, cat C: research journals with an important local/regional significance in Europe, at least occasionally cited outside the publishing country.

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