

The European Journal of Engineering Education as a venue for engineering education research publication: a meta view

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ABSTRACT

Responding to growing international interest in the growth and evolution of engineering education research (EER), this paper reviews six studies of the European Journal of Engineering Education (EJEE) published from 2004 to the present and synthesizes their findings. It observes a steady movement towards more research-based content over the 40 years of the journals existence, one that has involved an expanding and increasingly connected community of scholars. It notes that its authors are not restricted to European scholars but are drawn from a global EER community. The paper points to the most influential topics for EJEE authors both in the 1990s and in more recent years. It also indicates some specific areas for authors to improve the reporting of research submitted to the journal.

Conference Key Areas: Engineering Education Research

Keywords: engineering education research; citation analysis; bibliometric analysis, globalization.

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INTRODUCTION

Over the last decade there has been increasing interest in mapping the overall evolution of EER as a field of inquiry. Lohman and Froyd [1] looked at the process from a predominantly U.S. perspective, van Hattum-Janssen et al. [2] studied EER evolution in Portugal while Edstrom et al. [3] have characterised it in the Nordic context. In parallel with this tendency, there have been a number of more specific studies of research published in the main EER journals. This paper examines 6 published studies that considered aspects of the European Journal of Engineering Education (EJEE) and synthesises their main findings and draws out conclusions about the journal as a publication venue for engineering education research.

1 RESEARCH QUESTION

What can be concluded about the European Journal of Engineering Education as a venue for EER publication from a review of empirical studies of the journal's content?

2 METHODOLOGY

A systematic review approach [4] was adopted to identify relevant publications, these were then analysed, and their findings synthesized.

3 PROCEDURE

Three databases ERIC, Google Scholar and B-on (a Portuguese database accessing 26 academic and scientific data collections) were searched with the strings indicated in Appendix 1. 44 papers were identified that provided some analysis of EJEE articles and when these were read by the authors, 14 were selected on the basis that they included empirical bibliometric data on the journal's articles. As the authors wished to focus on studies presenting original research that was based on empirical bibliometric data, 8 of these 14 were eliminated on the basis of the following criteria:

- editorials (2);
- were previous conference papers by authors where more complete data was published in a later journal article (4);
- analyzed less than 30 EJEE papers (2).

The remaining 6 studies were selected for analysis in this study (see Table 1).

In the next section, we will briefly describe each of the studies (here listed alphabetically based on first-author name) and summarize their main findings.

Table 1. Details of the 6 studies analysed

Title of study	Authors	Year published	Years analysed	# of EJEE articles analysed
1. Women Studies in Engineering Education: Content Analysis in Three Refereed Journals [5]	Chou	2013	2000 to 2009	450 (approx.)
2. Detecting phase transitions in community structures using big data analysis of the engineering education research landscape: a European perspective [6]	Madhavan & Williams	2016	1993 to 2014	1028
3. How authors did it—a methodological analysis of recent engineering education research papers in the European Journal of Engineering Education [7].	Malmi et al.	2016	2009, 2010, 2013	155
4. Engineering education in Europe and the USA: An analysis of two journals [8].	Osorio & Osorio	2004	1998 to 2000	150 (approx.)
5. Engineering education research in European Journal of Engineering Education and Journal of Engineering Education: citation and reference discipline analysis [9]	Wankat, Williams & Neto	2014	1975, 1983, 1993, 2003, 2013	187
6. Not so global: a bibliometric look at engineering education research [10]	Williams, Wankat & Neto	2016	2010 to 2014	251

4 FINDINGS

1. Women Studies in Engineering Education: Content Analysis in Three Refereed Journals

The author applied content analysis to articles in EJEE and two other journals: the Journal of Engineering Education (JEE) and the International Journal of Engineering Education (IJEE) with the aim of investigating the research characteristics found in women's studies publications.

He observed that "unless the editorial teams for engineering journals create a special issue for research on the topic, the number of annual publications for women studies is limited". In the decade under study the author noted that the number of such studies published was similar across the 3 journals (18, 17 and 16 for EJEE, JEE and IJEE). He concluded that "analysing female engineering students' learning experiences is a mainstream research trend. Recruitment and career development for female college engineering students are less discussed research topics." It was also noted that in the articles analysed, JEE published predominantly US authors whereas the other two tended to publish authors from Europe, the US and from South Asia.

2. Detecting phase transitions in community structures using big data analysis of the engineering education research landscape: a European perspective.

The authors applied a big data analysis and network visualization techniques to examine the evolution of EER via a study of articles published in EJEE and IJEE assuming that as the two journals are published in Europe that they broadly reflect trends in European research.

The authors note that “the engineering education community publishing in these two journals has grown significantly. Starting with just 912 authors in 1997 with 4,066 connections, the community has grown to 15,577 authors with a staggering 114,398 connections.” Nevertheless, they comment that “there is still a significant amount of community building that needs to take place to connect various parts of the European and international EER community (...) there is currently a significant potential to connect and grow within this network. Given the growth of the network over the years of our analyses, the effect or ability of the individual within the larger context of the community remains particularly low. This may be a significant bottleneck to achieving major advances within the international community.” They conclude by suggesting that “the topical maps show that the European community is broad and diverse – but may lack a particular focus or may need to focus on some key big ideas to promote propagation.”

3. How authors did it – a methodological analysis of recent engineering education research papers in the European Journal of Engineering Education.

This study investigated research processes applied in recent publications in EJEE to explore how papers link to theoretical work and how research processes have been designed and reported. The paper’s authors concluded that EJEE papers build moderately on a wide selection of theoretical work and that while a great majority of papers have a clear research strategy, data analysis methods have tended to be mostly simple descriptive statistics or simple/undocumented qualitative research methods. They further noted that in a significant number of papers there were “shortcomings in reporting research questions, methodology and limitations of studies”.

4. Engineering education in Europe and the USA: An analysis of two journals.

The paper presents a comparison between EJEE and JEE in the late 90s based around a content-analysis approach. It found that there was a strong similarity in the top topics covered by both journals: “courses,” “programs,” “assessment,” and “society” account for 52.8% in JEE, and 59.7% in EJEE. On the other hand, “The topic “women and minorities” in engineering education appears several times in JEE. This reflects the interest of this topic in American education. By contrast, in EJEE there are no articles covering these subjects.” It is interesting to note from the Chou study that in the subsequent decade EJEE went on to be comparable with JEE in coverage of this sub-field.

The international nature of EJEE was indicated by the diverse number of countries represented amongst its authors while 90% of JEE authors came from the United States and excluding Canada (3.8%), other countries of the world were represented in JEE in only 6.2% of the papers. The European publication had a high count of papers about the topic “countries” (papers about a specific country) (...) the subject term “countries” appears only once in the American publication. This is another indication of the international orientation of EJEE.

5. Engineering education research in European Journal of Engineering Education and Journal of Engineering Education: citation and reference discipline analysis

The study employed citation and reference discipline analysis to trace the evolution of the research published by EJEE and JEE over a 40-year period. It did so by sampling papers published in issues of each journal at 10-year intervals from the 1970s to the present day. It focused on changes over time of the type of scholarship found in the articles samples. It also investigated the disciplinary background of the references cited by article authors as underpinning their research (reference disciplines).

Its authors concluded that “both journals followed similar trends. They progressed from opinion essays, reports, and descriptive articles to research articles. JEE and EJEE both became more frequently cited. There was a qualitative evolution in breath of scholarship with increasingly interdisciplinary research articles with more collaboration and more references. This is more accentuated in JEE.”

They also noted that “the citation data and reference discipline data show that there has been a notable tendency in both journals, but most particularly in the case of JEE, to cite and build upon research in other disciplines” They went on to caution that “while some will see this as a welcome indication of growing interdisciplinarity and developing maturity of EER as a field of research, others may perceive it as a sign that the published articles may be losing their engineering and scientific character and becoming less accessible to the broad mass of engineering educators”.

With regard to the affiliations of the authors published in the two journals, the findings were similar to those of the earlier Osorio & Osorio study in that “EJEE currently publishes authors from all over the world. EJEE authors in the issues sampled have come from the following 44 countries: Algeria, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Cyprus, Czechoslovakia (before the split into the Czech Republic and Slovakia), Denmark, Finland, France, Germany, Ghana, Greece, Hong Kong, Hungary, India, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Korea, Lithuania, Malaysia, Malta, Norway, Poland, Portugal, Saudi Arabia, Slovenia, South Africa, Spain, Sweden, Switzerland, the Netherlands, Trinidad, UK, and USA.

The geographical spread of the authors of JEE is significantly less broad than that of EJEE. If the data is representative of all years, 97.7% of the authors are from the USA and Canada and the remaining eight countries (Denmark, Greece, Hong Kong, India, Nigeria, Singapore, Thailand, and UK) share the remaining 2.3%”.

6. Not so global: a bibliometric look at engineering education research

Given that EJEE and JEE are published by the European Society for Engineering Education (SEFI) and the American Society for Engineering Education (ASEE) respectively, it is perhaps not surprising that 4 of the 6 studies that were sampled for this analysis include some comparison between the two journals. The final study analysed here focused on the global character of publications in the two journals along with those published in the annual conference proceedings of the two societies (4321 papers in all).

The authors present lists of the most cited authors in each of the four publication venues. Considering the fields of scholarship of the most cited scholars, they conclude that while work on active and collaborative learning is highly influential on both sides of the Atlantic, PBL (project and problem based learning) is a major reference for European scholars.

The principal finding of this comparative study was that “citations in ASEE conferences are dominated by sources with US affiliations, whereas the SEFI data show that while US sources are frequently cited, European and other authors are also well represented. With regard to the journals JEE and EJEE, a similar pattern is observed. These results suggest that, in citation terms, European EER is relatively global but US EER is not”. The authors conclude by suggesting that if the EER community is to aspire to quality scholarship, there needs to be debate around how such issues can be tackled. An initial sign of such a debate getting underway could be seen in the fact that JEE later invited two of the authors of that study to write a guest editorial for its October 2016 issue discussing how such a silo effect could have come about [11].

5 CONCLUSION

The journal has been published by SEFI for over 40 years and while in the earlier decades it served mainly as a house organ to publish information for members and opinion articles, the past fifteen years have seen a steady movement towards more research-based content and this has come from a rapidly expanding and increasingly connected community of scholars. Over the last five years' citation analysis suggests that the research around the topics of active and collaborative learning and of PBL have been the most influential to the authors published in the journal. Gender and diversity issues have been receiving growing attention since the turn of the century.

Authors published in the journal are not restricted to European scholars but are drawn from a global EER community and this is also the case with those who are cited in its research articles. Empirical data presented in the studies do indicate that EJEE has been progressively strengthening as a venue for EER publication. Nevertheless, authors could improve the reporting of research submitted to the journal by giving more attention to the presentation of research questions, methodology and the limitations of studies.

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APPENDIX 1

Table A1. Strings used for searching the databases consulted

Search strings	Total hits			Hits with analysis of EJEE articles		
	ERIC	B-on	Google Scholar	ERIC	B-on	Google Scholar
"citation analysis"; "European Journal of Engineering Education"	1	11	52	0	8	26
"bibliometric analysis"; "European Journal of Engineering Education"	1	6	24	0	5	18