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Samuel Otten
University of Missouri

Ryan Andrew Nivens
East Tennessee State University, nivens@etsu.edu

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JOURNAL RANKINGS AND REPRESENTATION IN MATHEMATICS EDUCATION

Ryan A. Nivens & Samuel Otten

East Tennessee State University, USA & University of Missouri – Columbia, USA
nivens @ etsu.edu & ottensa @ missouri.edu

Introduction

Publish or perish has long been the mantra academics live by. For decades, this referred to a list of publications on a researcher's Curriculum Vitae. One can assess the impact of a publication on the scholarly literature by looking at citation counts – that is, how many times a publication has been cited by other peer-reviewed publications (Garfield, 1963). In the modern age of technology and big data, however, new ways to measure scholarly output and impact have led to the creation of large databases. Moreover, the sources and targets of the citations can be identified and aggregated in various ways (Jiménez-Fanjul, Maz-Machado, & Bracho-López, 2013). University administrators are having discussions about how to use these technological capabilities to rate the scholarship of their professors and researchers (Howard, 2013; Shapiro, 2006).

Looking at databases of scholarly journals, education and educational research is a relatively well-represented social science field. Within that community, there has frequently been talk of top-tier journals and what constitutes quality research (e.g., Hostetler, 2005). Mathematics education is typically treated as a sub-field of education and educational research. As such, it can be more difficult to find specific and comprehensive information on the relevant journals. Toerner and Arzarello (2012) presented the results of a survey completed by 75 experts in mathematics education who were asked to assign a letter grade to various journals with an international scope in the field. Their survey initially included 28 journals, but the results yielded rankings for only 17 because the respondents were unfamiliar with some of the journals. Additionally, Williams and Leatham (unpublished manuscript) conducted a similar survey around the same time. They produced a set of top-tier, mid-tier, and low-tier journals in mathematics education based on survey responses and citation counts. Although unpublished, their work has been shared with many scholars and used in tenure-and-promotion dossiers. Anecdotally, both studies found *Educational Studies in Mathematics* (ESM) and the *Journal for Research in Mathematics Education* (JRME) to be more highly regarded by mathematics education scholars than the other journals. However, these survey studies provide only a snapshot in time, and only from a subset of the researchers in the field.

New databases, such as the Social Science Citation Index, keep a current list of journals that can be helpful for scholars to see the reputation of journals in their field. This can be helpful, since researchers usually know intimately only a subset, which might introduce regional bias or impartial comparisons based only on second-hand experience with some journals. Additionally, these databases are updated yearly.

The balance of this article presents our research study in analyzing the current status of journal rankings in mathematics education, focused on the following question:

To what extent do journal rankings and representation change over time, in particular the years 2010 – 2013?

JOURNAL RANKING SYSTEMS

While there are three major journal ranking systems currently in use: Web of Science, Scopus, and Google Scholar Metrics, we focus exclusively on Scopus for this study because it is freely available, and according to their webpage Scopus is the world's "largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings," spanning "the fields of science, technology, medicine, social sciences, and arts and humanities." Additionally, they list 5,000 publishers, 21,915 titles, and over 53 million records. The *SCImago Journal Rank* (SJR) is Elsevier's indexing metric that uses the Scopus database. As such, we treat the SJR and Scopus database as one indexing source for our article and refer to it as Scopus throughout the paper.

The SJR algorithm assigns journals prestige values and then begins adjusting the value with each citation from one journal to another, giving more value to citations from within the same field. As journals gain prestige, the citations from that journal begin to carry more weight. This algorithm continues until a relative steady-state is reached. At this point, the journal prestige measure is standardized by taking into account the number of publications contained in each journal over the relevant timespan (Butler, 2008).

METHOD

Looking through the Scopus database, we used the *Social Science* subject area, *Education* sub-category, and downloaded each dataset for years 2010 to 2013. To focus of our study on the field of mathematics education in particular, we searched for those journals that specifically target mathematics education, but we did not include general education research journals such as the *Educational Researcher* or *Journal of Teacher Education*. In our opinion, these journals are best compared to other general education journals rather than discipline-specific journals.

Using these datasets, we identified the mathematics education journals as described in another study (see Nivens & Otten, in press). For each journal present in the database, we collected all journal statistics available. This resulted in the four datasets presented below.

RESULTS

Scopus Journal Rankings Across Time

In answering our research question, we started with the Scopus 2010 dataset we compiled. It was the smallest of the four-year span. As you can see in Table 1, the representation of mathematics education grew over time.

The Scopus database contains both journals and conference proceedings. We looked at the years 2010 through 2013 within the *Social Sciences* subject area and the *education* sub-category. The entire dataset is available to the public and can be found here. (link to: http://www.scimagojr.com/journalrank.php?area=3300&category=3304&country=all&year=2012&order=sjr&min=0&min_type=cd). For our study, we note that within this subset that 2010 has 803 journals & proceedings listed, 2011 has 932, 2012 has 987, and 2013 has 1035.

Table 1. *Scopus Journals and Proceedings 2010-2013*

Year	Total number of journals & proceedings	Total number of mathematics education-specific journals & proceedings	Number of Mathematics Education journals by Quartile Rank			
			Q1	Q2	Q3	Q4
2010	803	16	2	5	4	5
2011	932	19	2	7	5	5
2012	987	22	4	2	12	4
2013	1035	23	5	3	8	7

Each of these lists were compiled in spreadsheet files from which we parsed out lists of mathematics education journals, keeping them in order of the SJR journal rank indicator. Table 2 shows the results of the 2013 dataset. The color indicates the quartile of the larger set the journal falls within. The "H index" is the Hirsch index as described in Hirsch (2005). "Total Docs 2013" is the number of articles in the journal that year, and "Total Docs 3 years" is the number of articles published in the three years 2011 – 2013. "Total Refs" is the number of references cited within all articles within the journal. "Total Cites 3 years" is the number of citations garnered from other sources for the articles contained within the journal over the three years 2011-2013. "Citable Docs 3 years" is the total number of articles available for citation counts. This column is slightly lower than the Total Docs 3 years column due to editorials and reviews being excluded. "Refs/Doc" is the average number of references per document published in a journal in the year.

Table 2. *2013 Scopus data for journals in mathematics education.*
(Title abbreviations are used, see Appendix A for full names).

Scopus Rank	Title	ISSN	Quartile	SJR	H index	Total Docs (2013)	Total Docs (3 years)	Total Refs	Total Cites (3 years)	Citable Docs (3 years)	Refs/ Doc	Country
32	JRME	00218251	Q1	2.019	44	34	62	1,545	91	57	45.44	United States
116	JMTE	13864416	Q1	1.042	14	38	96	1,483	81	77	39.03	Netherlands
185	JMB	07323123	Q1	0.766	24	52	72	2,220	71	72	42.69	United States
189	IJSME	15710068	Q1	0.759	15	131	178	5,651	174	173	43.14	Netherlands
209	MTL	10986065	Q1	0.723	7	15	44	603	50	42	40.2	United Kingdom
321	ZDM	18639704	Q2	0.496	14	84	143	3,213	93	132	38.25	Germany
354	EJMSTE	13058223	Q2	0.458	14	38	77	1,658	76	75	43.63	Turkey
390	MERJ	10332170	Q2	0.408	5	30	69	1,147	26	64	38.23	Netherlands
461	RMECJSMT	17540178	Q3	0.331	4	29	88	547	26	87	18.86	United States
469	E	19424051	Q3	0.321	5	26	75	1,079	28	68	41.5	United States
470	JSE	10691898	Q3	0.321	13	29	85	541	58	78	18.66	United States
473	JMD	1735322	Q3	0.319	6	12	38	507	18	35	42.25	Germany
497	IJMEST	0020739X	Q3	0.295	11	135	313	2,056	82	308	15.23	United Kingdom
523	TMA	14716976	Q3	0.276	6	22	57	377	16	57	17.14	United Kingdom
524	FLM	02280671	Q3	0.276	3	0	47	0	16	38	0	Canada
680	BMEB	19804415	Q3	0.188	1	65	150	1,437	12	137	22.11	Brazil
694	IJISME	22004270	Q4	0.178	3	28	39	929	10	36	33.18	Australia
704	TS	14679639	Q4	0.174	2	38	51	333	11	39	8.76	United Kingdom
711	CMJ	07468342	Q4	0.166	3	59	181	384	21	168	6.51	United States
712	SERJ	15701824	Q4	0.163	2	9	22	317	5	18	35.22	New Zealand
721	IEJME	13063030	Q4	0.158	2	6	24	237	8	19	39.5	Turkey
756	AMAPN	8660182	Q4	0.146	8	10	82	159	15	80	15.9	Hungary
789	IJTME	17442710	Q4	0.137	1	19	19	328	3	15	17.26	United Kingdom

The presence of journals indexed in Scopus in the field of mathematics education has grown over the years. The Scopus *Education* category grew nearly 29% from 2010 to 2013, but the number of mathematics education journals increased by nearly 44% in the same span.

The representation by country also increased as shown in Table 3. In 2010, seven countries were represented yet by 2013 there are ten represented. All of the countries listed in 2010 increased in representation by 2013, and three new countries were added.

Table 3. *Representation by Country in Scopus in 2010 and 2013*

2010		2013	
Country	Number of Journals	Country	Number of Journals
United States	4	United States	6
United Kingdom	3	United Kingdom	5
Netherlands	3	Netherlands	3
Germany	2	Germany	2
Turkey	2	Turkey	2
Australia	1	Australia	1
		Brazil	1
		Canada	1
Hungary	1	Hungary	1
		New Zealand	1

IMPLICATIONS AND DISCUSSION

The Williams and Leatham (unpublished) survey contained all three NCTM practitioner journals, none of which were listed in the Toerner and Arzarello (2012) article, and which we did not find listed in the Scopus database, despite their importance to our field of research. Additionally, the Australian practitioner journals are also not found in any of these compilations. This indicates that Scopus is more specifically focused on research, which confirms the presence of research journals over practitioner journals. Another example, the NCSM Journal of Mathematics Education Leadership, which is intended for teacher leaders, was also not listed in Scopus across the years investigated.

Another interesting outlet is Facebook. Through the use of Groups, researchers can join and discuss topics, share ideas, and even share titles of newly published books and articles. By sharing such things with audience members who are apt to cite your work, this sort of media becomes a news feed for researchers in the field. As an example, the group "Mathematics Education Researchers" on Facebook contains 1,374 members, "Mathematics Methods Discussion Group" contains 825 members, "Mathematics Education and Society" has 122 members, "Center for the Study of Mathematics Curriculum" has 47 members. You can also find many Facebook pages for the journals.

Even more scholarly than Facebook groups are similar sites for researchers. In particular, ResearchGate is a site where researchers can follow one another, post articles,

and easily share articles and ideas before or after publication. With sites such as ResearchGate, articles in conference proceedings that were not published for a year after a conference can now be made available immediately, even at the conference. The power of this resource is only in the early stages of use, and soon we will see just how well our field will use it.

Jiménez-Fanjul, Maz-Machado, and Bracho-López (2013) conducted an in-depth study of four journals (JRME, ESM, BMEB, and RELIME) over a few decades. They looked at authorship and co-authorship patterns as well as language and institution. Our study provides a broader landscape of the journals in one of the largest databases available. Studies like theirs fill in more detail not focused exclusively on journals but about what is being produced and by whom. While their analysis tracked the quantity of articles produced over time and frequency of country representation, our study showed the increase of country representation over time.

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Appendix A

ACRONYM	Journal	URL	Year founded	# issues per year	Avg # articles/issue
AMAPN	Acta Mathematica Academiae Paedagogicae Nyíregyháziensis	http://www.emis.de/journals/AMAPN/index.html	1998	2	14
BMEB	BOLEMA: Mathematics Education Bulletin	http://www.scielo.br/scielo.php?script=sci_serial&pid=0103-636X&lng=en&nrm=iso	1986	4	16
CJSMTE	Canadian Journal of Science, Mathematics and Technology Education	http://www.tandfonline.com/toc/ucjs20/current#.VDarwOe7nzU	2001	4	6
CMJ	College Mathematics Journal	http://www.maa.org/pubs/cmj.html	1970	5	10
EJMSTE	EURASIA Journal of Mathematics, Science & Technology Education	http://www.ejmste.com/	2005	6	19
FLM	For the Learning of Mathematics	http://flm-journal.org/	1981	3	9
IEJME	International Electronic Journal of Mathematics Education	http://www.iejme.com/	2006	3	6
IJISME	International Journal of Innovation in Science and Mathematics Education	http://openjournals.library.usyd.edu.au/index.php/CAL	1997	6	7
IJMEST	International Journal of Mathematical Education in Science and Technology	http://www.tandfonline.com/toc/tmes20/current#.VDare-e7nzU	1970	8	8
IJSME	International Journal of Science and Mathematics Education	http://www.springer.com/education+%26+language/mathematics+education/journal/10763	2003	6	13
IJTME	International Journal for Technology in Mathematics Education	http://www.researchinformation.co.uk/time.php	2004	4	6
JMB	The Journal of Mathematical Behavior	http://www.journals.elsevier.com/the-journal-of-mathematical-behavior/	1980	4	10
JMD	Journal fur Mathematik-Didaktik	http://link.springer.com/journal/13138	1980	2	6
JMTE	Journal of Mathematics Teacher Education	http://www.springer.com/education+%26+language/mathematics+education/journal/10857	1998	6	5
JRME	Journal for Research in Mathematics Education	http://www.nctm.org/publications/toc.aspx?jrnl=jrme	1970	5	3
JSE	Journal of Statistics Education	http://www.amstat.org/publications/jse/	1993	3	5
MERJ	Mathematics Education Research Journal	http://www.springer.com/education+%26+language/mathematics+education/journal/13394	1989	4	8
MTL	Mathematical Thinking and Learning	http://www.tandfonline.com/toc/hmtl20/current#.VDas_ue7nzU	1999	4	5
RME	Research in Mathematics Education	http://www.tandfonline.com/toc/rrme20/current#.VDauCee7nzU	1999	3	10

SERJ	Statistics Education Research Journal	http://iase-web.org/Publications.php?p=SERJ	2002	2	5
TMA	Teaching Mathematics and its Applications	http://teamat.oxfordjournals.org/	1982	4	5
TS	Teaching Statistics	http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291467-9639	1979	3	5
ZDM	ZDM – The International Journal on Mathematics Education	http://link.springer.com/journal/11858	1997	7	11