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U.S. Institutional Research Productivity in Major Science Education Research Journals: Top 30 for 2000's

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Abstract

VonAalst (2010) used Google Scholar to identify the top four science education research journals: *Journal of Research in Science Teaching, Science Education, International Journal of Science Education, and Journal of Science Teacher Education*. U.S. institutional productivity for 2000-2009 for the above journals was the data for the study. The major domestic science education programs were identified for raw and weighted counts. For the top 10, there was a 100% agreement with different ranks while there was only a 60% agreement among the bottom 10. These results demonstrated that dominant science education faculty published their research in multiple empirical journals.

Keywords: institutional/faculty productivity, science education research journals, domestic higher education institutions

1. Introduction

The first purpose of this study was to identify the major domestic science education programs based upon recognized research journals. VonAalst (2010) used Google Scholar and identified *Journal of Research in Science Teaching (JRST)*, *Science Education (SE)*, and *International Journal of Science Education (IJSE)* as the top three market shares for science education. The *Journal of Science Teacher Education (JSTE)* had the next greatest number of articles published. These four journals collectively were used to establish U.S. institutional productivity. In recording data for the above journals, there were a large number of multiple authors (up to eight); therefore, a second purpose was to compare raw and weighted count to determine institutional productivity.

Earlier, Barrow, Settlage and Germann (2008) used eight science education journals (*JRST, SE, IJSE, JSTE, Journal of Computers in Mathematics and Science Teaching, Journal of Elementary Science Education, School Science & Mathematics, and Journal of Science Education and Technology*) that publish empirical research to identify the top 30 domestic science education programs for 1990s. They reported variation in journals where research was published. There was a greater agreement between the raw and weighted counts for the top 10 than bottom 10.

2. Related Literature

Institutional research is either perception (rankings based upon perceptions [e.g., *U.S. News and World Report's* annual ranking of best graduate schools]) or productivity (e.g., faculty members' publications). Recently, the National Research Council (2010) published an extensive U.S. graduate review, but most areas of education, including science education, were excluded. No published study based upon perceptions on science education was located; although, many science educators probably have a personal view of the dominant programs.

The vast majority of U.S. institutional research studies have been productivity oriented. Three fields (library and information science, counseling psychology, and reading/literacy education) have varied objective measures over the years.

Budd and colleagues (Budd & Seavey, 1996; Budd, 2000; Adkins & Budd, 2006) have conducted a series of reviews of library information and science program rankings using *Social Science Citation Index (SSCI).* There has been an increase in research productivity at institutions in library information and science for individuals and programs. Adkins and Budd (2006) noted the potential bias that larger number of faculty could result in greater productivity. Although some specialties in the discipline are omitted from *SSCI*, they concluded that a productive program tends to remain productive, but some changes occur over time. Since *SSCI* was the source of data, faculty with longer careers (higher ranks) had more publications and work cited.

Tracey et al. (2008) conducted the most recent impact of programs in counseling psychology which used the h-index (Hirsch, 2005) which is based upon career productivity citations. Initially, only the *Journal of Counseling Psychology* was used to rate counseling psychology programs (Bohn, 1966; Cox & Catt, 1977). Subsequently, Howard (1983) and Delgado and Howard (1994), and Smith et al. (2003) used different time periods and additional journals to rank counseling psychology programs. Variation was noted between studies. Delgado and Howard (1994) recommended using a 10 year time span. Smith et al. (2003) noted that counseling psychologists publish their work in numerous journals rather than the five used in their ranking. A similar observation was made for science education (Barrow, Alspaugh & Mitchell, 2002).

Morrison and Wilcox (2008) have extended the study of reading/literacy education regarding institutional productivity. Eight different reading journals from 1978-83 were analyzed by Johns and Others (1986) and they concluded that all top ranked institutions had state assisted funding. Hollingsworth and Reutzel (1994) studied the ranking from 1983-91 and reported that several institutions continue to be major contributors to the field. Morrison and Wilcox (2008) included nine literacy journals and they noted consistent top rankings of institutions over time. An additional pattern they noted was an increase in multiple authors from collaborating institutions; including precollege.

Productivity research studies have been reported in other disciplines. West, Armstrong, and Ryan (2005) combined perception and productivity of six rehabilitation counseling journals from 1997 to 2002. Both raw and weighted rankings were used for productivity ratings. Variations between rankings were observed. Ku (2009) recently calculated productivity rankings for authors (only first three) in the *Educational Technology Research Development (ETR & D)* for 20 years. Ku used an "Olympic-type scoring: a score of three for first author (gold), two for second (silver) and one for third (bronze)" (p. 802). Ku concluded first authors differed for productivity and total authorship in *ETR & D*. Barrow, Settlage and Germann (2008) provides an overview of other productivity studies.

For this study, we elected to focus upon contributions of all authors at institutions rather on journal articles of recent graduates (Tauer & Tauer, 1984). In addition, we choose a ten year period (2000-2009) for the focus of four major science education research journals (*JRST*, *SE*, *IJSE* and *JSTE*).

3. Methodology

These four journals *JRST, SE, IJSE* and *JSTE* were selected for this study because they are recognized for publishing empirical science education research and are frequently used by science education researchers at domestic institutions of higher education. Generally, journal editors were science education faculty at major research institutions. Table 1 contains a listing of journal's volumes, editors, years, and institutional affiliation of editors. These journals focus on research on science teaching and/or learning. Reviewers sometimes serve this function for more than one of these journals. Two of the journals *JRST* and *JSTE* are affiliated with a professional organization.

Table 1. Volumes, institutional affiliation, editors and years for journals

	Volume	**Institution Affiliation**	**Editors**	**Years**
Journal of Research in Science Teaching	35-46	Arizona State University	D. Baker	2000-2005
			M. Pilburn	
		University of Maryland	R. McGinnis	2006-2009
			A. Collins	
Science Education	84-93	Kings College	R. Duschl	2000-2001
		University of Delaware	N. Brickhouse	2001-2006
		Pennsylvania State University	G. Kelly	2006-2009
International Journal of	22-31	University of Reading	J. Gilbert	2000-2009

Science Education				
Journal of Science Teacher Education	11-20	University of Wisconsin-Milwaukee	C. Berg	2000-2003
		Oregon State University	L. Enochs	2004-2008
		University of Toledo	C. Czerniak	2009
		Purdue University	J. Staver	
			L. Bryan	

This analysis included every issue over the decade (2000-2009), but excluded editorials, letters, and book reviews. Table 2 contains acceptance rates for the four journals. Cabell (2011) or a personal communication from the editor was used to identify acceptance rates. This multiple journal perspective was recommended by Howard (1983) and earlier used by Barrow, Settlage & Germann (2008). For each article, the data included title of article, author(s) and their affiliation, and listing of volume and pages. If more than one author all were listed in the same order as they appear in each journal. All authors whether associated with science education or not were included in the data (Howard, Cole, & Maxwell, 1987). Researchers who moved during the time period were identified with the institution at the time of submission.

Table 2. Acceptance rate for each science education journal

	Acceptance Rate
Journal of Research in Science Teaching	11-20% a
Science Education	21-30% a
International Journal of Science Education	32% a
Journal of Science Teacher Education	7-15% b

a. Cabell (2011)

b. Personal note from the editor

Two different approaches were used to calculate institutional productivity – raw count and weighted. For raw count, all researchers, including graduate students, receive equal credit (1.0) because of the team effort provides recognition for the total program, (Barrow, Settlage, & Germann, 2008). Howard, Cole and Maxwell (1987) were used to determine weighted value. In this approach, each article has a value of 1.0 where senior author receives greater credit for their contribution to the manuscript. Each author's lower position indicates less contribution to the manuscript in this approach. For the 1990's, we noted a greater tendency for more authors per manuscript in the 2000s publications. Therefore, both approaches were used. A separate ranking from high to low of top 30 institutions for raw and weighted values was calculated.

4. Results

There were a total of 1109 research publications (raw) in the four dominant research journals during the 2000's. Each journal was totaled for the top 30 for both raw and weighted rankings. Table 3 contains data for each journal and total raw counts. The top five for the raw count were: University of Michigan, Indiana University, Purdue University, University of Georgia, and Arizona State University. Table 4 contains the rankings for both raw and weighted approaches. In contrast, the top five (weight) were: University of Michigan, Indiana University, University of Georgia, Teachers College Columbia University, and Michigan State University. For the top 10, there was 100% agreement with different ranks. However, for the bottom 10 there was only a 60% agreement. The raw count for three institutions (University of Texas-San Antonio, Texas A&M University, and Iowa State University) failed to be in the top 30 weighted. On the weighted, three institutions appeared that were not in the top 30 raw approach. These institutions and their weighted rank were: University of Toledo (24), University of Pennsylvania (27) and University of Massachusetts -Amherst (28).

Table 3. Total publications (raw count) in each journal for each of top 30 programs

Institution	*JRST*	*SE*	*IJSE*	*JSTE*	Total
Arizona State University	28	6	17	-	51
Florida State University	8	9	6	3	26
Indiana University	24	18	13	11	66
Iowa State University	8	3	9	1	21
Michigan State University	13	22	4	5	44
North Carolina State University	11	11	18	5	45
Northwestern University	13	7	5	-	25
Pennsylvania State University	7	5	2	9	23
Purdue University	22	13	9	15	59
Stanford University	20	6	4	-	30
Teachers College, Columbia University	22	9	7	5	43
Texas A&M University	7	4	-	12	23
University of Arizona	11	2	6	7	26
University of California – Berkeley	4	14	10	1	29
University of California – Santa Barbara	16	11	-	3	30
University of California – Santa Cruz	7	4	14	1	26
University of Delaware	15	12	-	1	28
University of Florida	5	5	9	6	25
University of Georgia	22	7	6	20	55
University of Illinois	13	3	8	1	25
University of Maryland	16	10	2	2	30
University of Massachusetts - Amherst	6	1	3	2	12
University of Miami (FL)	22	6	3	11	42
University of Michigan	52	17	9	6	84
University of Minnesota	18	5	6	1	30
University of Missouri	13	9	8	15	45
University of North Carolina	17	10	1	5	33
University of Pennsylvania	14	3	2	-	19
University of South Florida	8	12	6	4	30
University of Texas – San Antonio	15	8	6	-	29
University of Toledo	5	2	2	10	19
University of Washington	9	6	7	-	22
University of Wisconsin	12	6	4	-	22
Total	485	266	206	152	1109

Table 4. Ranking of top 30 science education programs raw and weighted for 2000's

Institution	Raw Total	Rank	Weighted Total	Rank
University of Michigan	84	1	28.09	1
Indiana University	66	2	24.34	2
Purdue University	59	3	19.59	6
University of Georgia	55	4	20.50	3
Arizona State University	51	5	15.96	8
North Carolina State University	45	6	14.66	10
University of Missouri	45	6	16.06	7
Michigan State University	44	8	19.76	5
Teachers College, Columbia University	43	9	20.33	4
University of Miami (FL)	42	10	15.53	9
University of North Carolina	33	11	10.94	19
Stanford University	30	12	12.96	13
University of California – Santa Barbara	30	12	10.13	24
University of Maryland	30	12	12.98	12
University of Minnesota	30	12	11.20	18
University of South Florida	30	12	11.14	17
University of California – Berkley	29	17	12.60	14
University of Texas – Santa Barbara	29	17	3.86	-
University of Delaware	28	19	13.38	11
Florida State University	26	20	10.14	23
University of Arizona	26	20	12.04	15
University of California – Santa Cruz	26	20	8.72	29
Northwestern University	25	23	9.76	24
University of Florida	25	23	11.85	16
University of Illinois	25	23	8.99	28
Texas A&M University	23	26	6.74	-
Pennsylvania State University	23	26	8.71	30
University of Washington	22	28	10.91	20
University of Wisconsin	22	28	10.82	22
Iowa State University	21	30	6.83	-
University of Massachusetts – Amherst	12	-	8.81	-
University of Pennsylvania	19	-	9.43	27
University of Toledo	19	-	9.76	24

JRST and *SE* had the highest frequency with 100% for the top ranked programs. Other journals and their frequencies were: *IJSE* and *JSTE* had 90% and 80% publications from the top 30 programs, respectively.

The rankings were compared for each journal for top 10 institutions (Table 5). *JRST* was the mode journal for all the top 10 except for North Carolina State University (*IJSE)* and University of Missouri (*JSTE*). Only Arizona State University (*JSTE)* lacked a publication in each of the four journals. The dominance of *JRST* was evident where it contributed 50% of raw counts for University of Michigan, Arizona State University, Teachers College

Columbia University, and University of Miami (FL). Only Michigan State University had more publications in *SE*.

Table 5. Top 10 ranked institutions and raw count for each journal

Institution	*JRST*	*SE*	*ISTE*	*JSTE*
University of Michigan	52	17	9	6
Indiana University	24	18	13	11
Purdue University	22	13	9	15
University of Georgia	22	7	6	20
Arizona State University	28	6	17	-
North Carolina State University	11	11	18	5
University of Missouri	13	9	8	15
Michigan State University	13	22	4	5
Teachers College, Columbia University	22	9	7	5
University of Miami (FL)	32	6	3	11

5. Discussion

Historically science education research journals impacts teaching of both pre-service and in-service teachers of science. The findings of this study can inform faculty, current and future graduate students, teachers of science, and stakeholders for U.S. K-12 science. These resources can assist pre-service science education faculty at non-research institutions about sources of cutting edge research to use in their methods courses. Also, prospective graduate students, both domestic and international, will be able to identify institutions that match their interests. The identified science education programs can also inform U.S. policy makers, state education leaders, and local school personnel.

This study focused upon recognizing dominate science education research journals (VonAalst, 2010) while the earlier study of the 1990's included an additional four science education research journals (Barrow, Settlage, Germann, 2008). Several changes occurred from previous decade with the University of Iowa, Kansas State University, and Ohio State University no longer ranked in the top 30 for 2000s. Florida State University, Pennsylvania State University and University of Wisconsin now rank in the bottom 10 rather than top 10 of the 1990's. The University of Michigan which was ranked 26 (raw) and 21 (weighted) in the 1990's now is the top ranked program. Retirement, administration, relocation, responsibility, and decreased funding for graduate students could have reduced research productivity. Increased rankings could be due to increased number of faculty and funded graduate students and hiring assistant professors who are active researchers. Individuals involved in the promotion and tenure process tend to submit their work regularly.

The increased pattern of qualitative methodologies since 1985 results in longer articles with fewer manuscripts in *JRST* and *SE*. However, White (2001) noted that *IJSE* still has large number of quantitative articles. Qualitative based articles could involve more researchers to present their positions. The similarities between raw and weighted showed consistency especially for the top 10 U.S. institutions who utilize productivity data should clarify which method is to be emphasized. Using a baseball analogy, is the best hitter based upon batting average, runs batted in or home runs? New science faculty need to be aware of which is to be emphasized early during the tenure process and establish their realistic expectations (Boice, 1992).

This study identifies the major programs in science education. Campus administrators can utilize the results to determine the quality of their institution's science education program. Administrators should not base their decisions only on dominate research journal publications. This study did not consider other issues such as publications in other science education journals (research and practitioners), grant funding, books and chapters, conference research presentations, etc. The use of 10 years of research journals provides identification of those most stable programs; while retirement and faculty mobility could have contributed to lower 2000s ranks for top science education programs of the 1990's. In addition, campus administrators might use faculty from top ranked programs to evaluate promotion dossiers of their faculty. Graduate students can utilize this ranking to identify how different science education programs compare and where their emphasis is published. However, other factors such as financial assistance, location and personal interest could have greater impact. New science education Ph.D graduates will be able to identify research expectations at interview site. Established science education researchers probably will provide a positive mentoring environment as new faculty establish their research history.

6. Implications

Future follow-up study could be based upon productivity for 2010's to establish a three decade trend analysis. This would identify whether there is an ebb and flow of science educations research institutions. Does the movement of science education researchers impact both his/her new institution in relation to former institution? An analysis of the authors and their position in relation to new faculty publication could provide evidence of mentoring.

There was more than one manuscript that had eight or more authors. Consequently, junior authors would appear to have minimum impact. We noticed an increase of multiple authors from the 1990's study. We recommend that the weighted ranking be given greater emphasis, or an alternative would involve only the first three authors as utilized by Ku (2009). APA guidelines about multiple authors needs to be followed in submitted research. If alphabetic listing of authors is used, it should be identified and could not be used in the weighted ranking.

We acknowledge that different journals (including a wide number of international resources), time period, and broader selection of journals could produce different results. Second, larger programs (faculty and graduate students) and their perceived importance for these four journals could have influenced their selection of a journal to submit their research.

A future study could analyze highly productive science education faculty who reside in a small program versus multiple faculty institutions. Also, an employment pattern of top 30 programs faculty could include their source of Ph.D, doctoral advisor, institutions employed, and graduates from the top programs for their subsequent employment patterns, research activities, and involvement in leadership (journal reviewers, conference committee chairs, grant funding, officer of professional organizations, department leadership roles, etc).

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