

## **Australian Education Journals: Quantitative and Qualitative Indicators**

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### **Abstract**

**This paper reports on a study which applied citation-based measures to Australian education journals. Citations data were drawn from two sources, Web of Science and Scopus, and these data were used to calculate each journal's impact factor, *h*-index, and diffusion factor. The rankings resulting from these analyses were compared with draft rankings assigned to the journals for Excellence for Research in Australia (ERA). Scopus emerged as the citation source most advantageous to these journals and some consistency across the citation-based measures was found.**

### **Introduction and background**

Recent initiatives in the way research is funded in Australian higher education, firstly the Research Quality Framework (RQF) and now Excellence in Research for Australia (ERA), have prompted many disciplinary groups in the sector to focus on journal ranking and the use of citations as a measure of quality and impact, respectively. Together these comprise the cornerstone of ERA's method to assess research outputs in the form of journal articles. This paper reports on the findings of a study which, like several earlier studies, has examined a selection of Australian journals to determine their impact.<sup>1-4</sup> It differs from previous research in that ERA's draft list of ranked journals is available to compare tier ranking with citation-based metrics for those journals included in the study. Furthermore, the citation data used to calculate impact measures were drawn from two sources, Web of Science and Scopus, enabling additional comparisons to be drawn. In this study, Australian journals in the discipline of education are examined, extending the authors' previous investigations of social science and humanities journals.<sup>5-7</sup>

Two papers released in December 2008, *ERA Indicator Principles* and *ERA Indicator Descriptions*, provided the higher education sector with a general outline of the indicators to be applied in the ERA process (commencing in 2009).<sup>8,9</sup> Assessment of journal articles will be based on a list of ranked journals and citation data, the latter being drawn from 'the most appropriate citation data supplier for each discipline'.<sup>9</sup> These indicators, among others, will be tested in the first ERA round for the discipline cluster Physical, Chemical and Earth Sciences (PCE). However, citation data is not being used as an indicator in the second cluster being assessed, Humanities and Creative Arts (HCA), due the lack of available, reliable citation data in these disciplines. Instead, peer review will be applied to 20% of the research output reported.<sup>10</sup> At the time of writing no information is available regarding the specific indicators to be applied in the cluster Social, Behavioural and Economic Sciences (SBE), in which the education discipline is located. In the opinion of the current authors the likelihood that citation data *will* be used in the SBE cluster is high, for two reasons. Firstly, the cluster includes a number of disciplines that are relatively well

indexed in the main citation sources; and secondly, due to the workload involved the ARC will be reluctant to undertake extensive peer review if citations data are available.

Using citations data as a measure of research impact is not a new phenomenon, nor is the ranking of journals. Citations were the measure applied in one of the first journal ranking exercises, conducted in 1927.<sup>11</sup> Over the last decade, however, there has been a heightened interest in these aspects of publication, largely driven by government research assessment activities, such as the Research Assessment Exercise (RAE) in the UK.<sup>12</sup> In attempting to evaluate the effectiveness of public funding of research, assessment activities require transparent and 'objective' criteria with which the impact and quality of research outputs can be measured, facilitating comparisons between individuals, disciplinary groups, and institutions. For the last twenty years the RAE has used peer review to assess research, but an announcement in 2008 indicated that some form of metrics would be used in the future.<sup>13</sup> Citations data, already a component of ERA, some research grant applications, and applications for academic positions and promotions, are the obvious form these metrics might take.

Once the province of librarians and bibliometricians, citations data have become increasingly important as they have emerged as a key component of research assessment and increasingly accessible due to the move from print to electronic indexes. Citations have been the subject of debate regarding their meaning and application for many years,<sup>14-16</sup> and their adoption for measuring research impact has intensified the scrutiny of their value at either individual researcher or journal title level.<sup>17-19</sup> Much of this scrutiny has fallen on the Journal Impact Factor (JIF), calculated annually by Thomson Scientific (formerly Thomson ISI) from data collected in the Thomson citation indexes, now available through the database Web of Science.

Central to the criticism of using the JIF in research assessment is that it cannot and does not reflect the complex nature of scholarly communication and was never intended as a tool for assessing the quality of an individual article.<sup>11, 18, 20, 21</sup> Even the creator of the JIF, Eugene Garfield has noted that 'the precision of impact factors is questionable',<sup>22</sup> and 'that in the wrong hands it might be abused'.<sup>23</sup> The types of 'abuse' discussed, though rarely proved, in the literature include: authors ensuring their submitted articles do not reach controversial conclusions which would risk alienating referees for the 'desirable' journals with high JIFs;<sup>24</sup> and editor and publisher manipulation of referencing practices of submitting authors in order to increase a journal's JIF.<sup>11</sup>

There are also practical reasons behind concerns about the JIF and other citations metrics being used as a research assessment tool. Firstly, while there are approximately 22,500 active peer-reviewed journals listed in *Ulrich's Periodicals Directory*, only half of these are indexed in Web of Science. Perhaps as a result of pressure from Australian agencies involved in RQF and ERA activities (and/or the arrival of a competitor in the market – Scopus), Thomson has recently changed its policy of maintaining a steady number of indexed journals and added numerous new titles. There remain, however, a large proportion of refereed journals not indexed by Web of Science. Secondly, the indexing coverage of Web of Science is skewed towards English language and North American and European publications. This latter

issue is of particular concern if the JIF or citations more generally are used to assess research and publishing in Australia and other 'peripheral countries'.<sup>25</sup>

For disciplines associated with the humanities and social sciences the JIF presents additional problems in terms of the metric itself and its coverage.<sup>7, 12, 26</sup> As it is based on the scholarly communication practices of the sciences, the JIF calculation is less suited to those of the humanities and social sciences where citations tend to be to older materials and to a greater number of non-journal sources (for example, books, government reports, conference papers). Of the total number of journals indexed by Web of Science only a third are from social sciences and humanities disciplines. Given the index's biased coverage, discussed above, this means many Australian humanities and social science journals are not included as source titles. Yet their importance to academics in the disciplines, as scholarly communication channels which facilitate discussion about national issues fundamental to many of these fields, is undeniable.<sup>26</sup> In short, Australian researchers choosing to publish their work in a journal which supports this national scholarly discussion will find very few are indexed by Web of Science, and even fewer (because a JIF is not calculated for humanities journals) will have a JIF.

However, Web of Science is no longer the sole source of citation data. In the same year, 2004, Elsevier launched the Scopus database and Google Scholar was released by Google. These new sources of citation data have their own strengths and weaknesses in terms of their coverage of the scholarly literature, but they have for the first time allowed researchers to use that data to 'test' the coverage and accuracy of the Thomson Scientific metrics.<sup>27-32</sup>

The combined effect of heightened interest in citations data as a tool in research assessment and the availability of alternative sources of citation data has resulted in discussion of a variety of new measures to evaluate research output. Most include a citation element, but others propose using: library holdings,<sup>2</sup> cognitive mapping,<sup>33</sup> article downloads,<sup>34, 35</sup> or web page visits.<sup>36</sup> A relatively new measure attracting a great deal of attention is the *h*-index.<sup>37</sup> Originally designed to measure an individual's output, it has also been applied to journal titles.<sup>38-40</sup> Yet another measure, the Journal Diffusion Factor, offers a very different metric, for which two methods of calculation have been proposed.<sup>7, 41-43</sup> Both the *h*-index and the Journal Diffusion Factor are measures derived from the frequency and/or pattern of citations.

In the Australian context, the Australian Research Council (ARC) recognised the problems involved in relying on citations, in relation to validity of measures and pragmatics of coverage, to assess research outputs. To address these issues, but retaining the option of using citations as an indicator in ERA, academics and communities of scholars working in defined subject groupings were invited by the ARC to submit lists of journals, with each title assigned a rank – A\*, A, B, or C. A draft list was finalised in 2008, with final disciplinary-based journal lists being released just prior to each cluster undergoing the ERA process. It has been argued that the development of a list of ranked journals through peer review, also called 'perception studies' or 'perceptual ratings', has limitations (McGrath, 1987). However, for some researchers in Australia the ERA list will be the only measure available for assessing the 'quality' of journal articles.

In this study, a sample of Australian education journals has been examined comparing three citation-based measures: an extended impact factor, the *h*-index and diffusion measures; using data drawn from Scopus and Web of Science. An initial analysis using data from Google Scholar, sourced from the Publish or Perish software (<http://www.harzing.com/resources.htm>), was also performed. The results of these analyses are then contrasted with the ERA tier rankings assigned to the journal titles by their disciplinary group. Education journals were selected due to the nature of the discipline, which is firmly grounded in the social sciences (for which final ERA indicators have yet to be released). Education also typifies fields of study in the social sciences in regards to the nature of its research, which is often directed towards practice and policy. In a 2006 special issue of the journal *Australian Educational Researcher*, a common concern can be detected, that is the implications of research assessment exercises for education researchers. The papers raise a number of issues that correspond with the discussion above, such as the national focus of education research, and the requirement to publish in 'high impact' journals.

Of particular interest are comments about the role of the Australian Association for Research in Education (AARE) in RQF activities.<sup>44</sup> In 2005, the AARE called for expressions of interest from members to develop ranked lists of education journals. Two lists of journals were prepared by the Centre for the Study of Research Training and Impact (SORTI) at the University of Newcastle, one based on 'esteem' and the other on 'quality'.<sup>45, 46</sup> With 'Q scores' (quality scores) ranging from 0 to 29.33, the mechanism used to rank journals comprised a calculation derived from responses to an online survey, the Thomson JIF, and evidence of an international editorial board. Survey participants were asked to rank the ten 'best' education journals in their areas of interest. It is not known if these lists contributed to the ERA process, but the document describing the 'journal banding' process suggests they may have done.<sup>47</sup>

### **Data collection and citation-based measures**

The extended impact factor, diffusion factor and *h*-index measures required the number of citations to each title, the number of articles published in each title and the number of different journals citing the title. These data were collected for the six year publication period 2001 to 2006 to reflect the requirements of the RQF. (ERA is also assessing publications over a six year period, but has stipulated the 2002 to 2007 period). It was also considered necessary to use an extended impact factor, that is an impact factor calculated over a longer publication period. The used of an extended impact factor acknowledges that scholarly communication patterns in the social sciences tend to indicate a longer time lag between publication and citation than do the sciences.

### ***Education journal sample, citations and articles***

Australian education journals listed as active, refereed, and published since at least 2001 were identified in *Ulrich's Periodicals Directory*. The 'country of publication' limit to Australia identified a number of titles with both Australia and another country listed. Generally, these are journals that have been taken up by large international publishers, but originating in Australia, and they were retained in the sample.

From the titles listed in *Ulrich's* only those in the ERA journal list assigned the two-digit Field of Research (FoR) 13 or four-digit FoR beginning with 13 were

considered. Of these 40 titles, titles with fewer than 50 citations in Web of Science and Scopus were excluded. The cut-off of 50 citations (over the six year publication period) was determined when a previous study indicated calculations using a cut-off of 25 citations resulted in anomalous findings for the one title with less than 50 citations. The eight titles meeting the criteria were:

*Australasian Journal of Educational Technology*  
*Australian Educational Researcher*  
*Australian Journal of Career Development*  
*Australian Journal of Education*  
*Distance Education: An International Journal*  
*Higher Education Research & Development*  
*Research in Science Education*  
*Teaching Education*

Total number of citations was collected from Web of Science, Scopus and Publish or Perish. Each source offered different searching functionality, requiring a range of approaches to extract data. The 'cited reference search' was used for Web of Science, while a general search, citation tracking and 'more' tab searches were required for Scopus. An automated *h*-index calculation was available for some titles in Scopus, but was manually calculated for Web of Science data.

Publisher websites and subscription databases were searched to identify the number of articles published in a journal over the six year period. Letters to the editor, obituaries, erratum, glossaries, indexes, and announcements were excluded from this count.

### ***Extended impact factor***

The annually calculated Thomson JIF divides the number of citations given in that year to articles published in a journal in the previous two years by the number of articles published in the previous two years. To allow for the longer time frame involved in citing practices in the social sciences, an extended publication period of six years was used to calculate the impact factor for the education journals. This period also reflected the assessment period of ERA. The following equation expresses the calculation for the extended impact factor:

$$\frac{\text{Number of citations (2001- 2007) to journal articles (2001-2006)}}{\text{Number of articles published in journal (2001-2006)}}$$

The inclusion of all citations (rather than citations from one year only) given to a journal over the period, allows for substantial time lags in the citation process. However, it disadvantages articles published later in the period. As this disadvantage applies to all journals in the study, reliability is maintained. Interestingly, Thomson has recently added a new 5 year JIF calculation to the Journal Citation Reports database. This differs from the extended impact factor in that only citations in one year are included in the calculation, rather than citations across all years in the time period.

### ***h-index***

Since being proposed in 2005, the *h*-index has attracted substantial attention.<sup>37-39</sup> Initially suggested as a means to assess an individual researcher's impact, the *h*-index has been successfully applied to rank journal publications.<sup>38, 48</sup> It is calculated by listing publications by the number of citations (from highest to lowest) each has

attracted, arriving at an *h*-index value when *x* number of publications have *x* or more citations. For example, an *h*-value is 7 when 7 articles have at least 7 citations and the remaining articles have less than 7 citations. The *h*-index is sensitive to the time a researcher has been active, advantaging those with longer publishing histories. All journals examined in this study had been publishing over the six year period, ensuring parity was achieved.

### ***Diffusion factors***

Two diffusion factors were calculated for the journals. The first, the Journal Diffusion Factor (JDF), was devised by Rowlands and is based on the average number of citing journals for every 100 citations.<sup>43</sup> The diffusion of a journal measures the extent to which journals are being cited by other journals. Rowland's JDF was adapted by Frandsen, who named his calculation the New Journal Diffusion Factor (N JDF), to remove the 'built-in injustice to highly cited journals', replacing the number of citations with the number of journal articles in the equation, to arrive at the 'average number of different journals an average article is cited by'.<sup>41</sup>

Examining the diffusion of Australian education journals provides an indication of the extent of exposure they gain and may provide a useful method to assess a journal as a potential publishing channel, if other indicators are unavailable. The six year publication period was used to calculate the diffusion measures.

Rowland's JDF equation was adapted to:

$$\frac{\text{Number of different citing journals (2001- 2007) to journal articles (2001-2006)}}{\text{Number of citations to journal (2001-2007)}} \times 100$$

Frandsen's N JDF equation was adapted to:

$$\frac{\text{Number of different citing journals (2001- 2007) to journal articles (2001-2006)}}{\text{Number of articles published in journal (2001-2006)}}$$

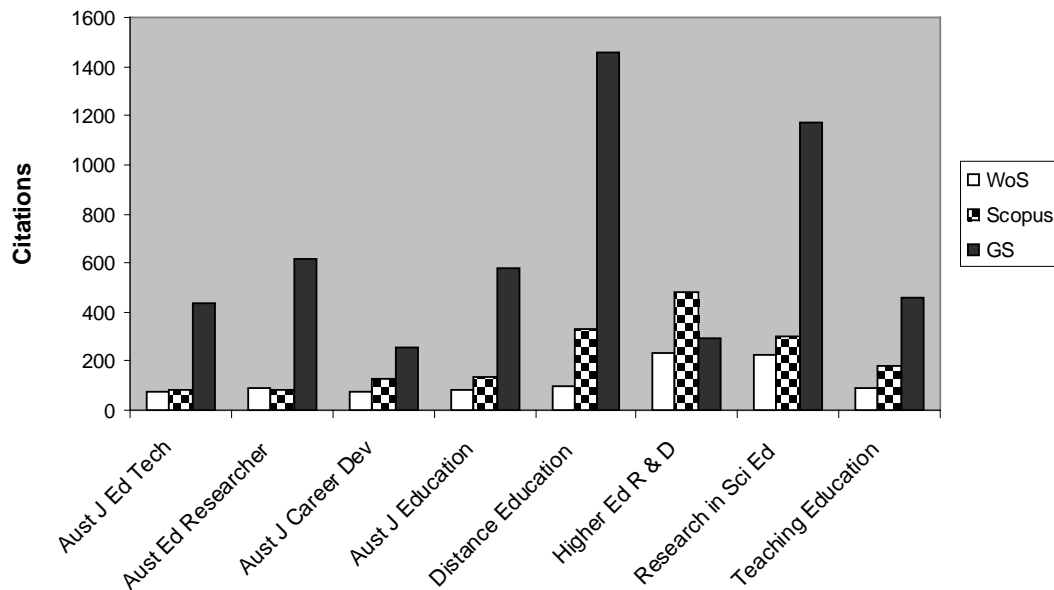
### **Results**

The first analysis compared raw citation numbers drawn from Web of Science, Scopus and Publish or Perish for each journal. Figure 1 (below), demonstrates the citation source is a major influence on the total number of citations. The results for Publish or Perish (drawing citations from Google Scholar) are consistently, and considerably, higher for all journals with the exception of *Higher Education Research & Development*. This is perhaps unsurprising, and certainly a number of authors have warned of the dangers in using Google Scholar citations,<sup>30</sup> suggesting a great deal of duplication of citations and incorrectly attributed citations are included in the count.<sup>49</sup> Previous studies indicate Google Scholar is likely to retrieve a consistently higher number of citations than Web of Science or Scopus.<sup>30, 32, 50</sup>

Google Scholar's coverage is not transparent, unlike those of Web of Science and Scopus. It includes a wide variety of 'grey literature' such as unpublished reports and papers, preprints, PowerPoint presentations, theses and conference papers.<sup>32</sup> There is no way to determine, without extensive and labour-intensive analysis, the degree of overlap that exists between the three sources. However, it is inevitable that this will

occur, with duplication possible between any two of the three sources, or between all three.

Figure 1: Total citations to journals

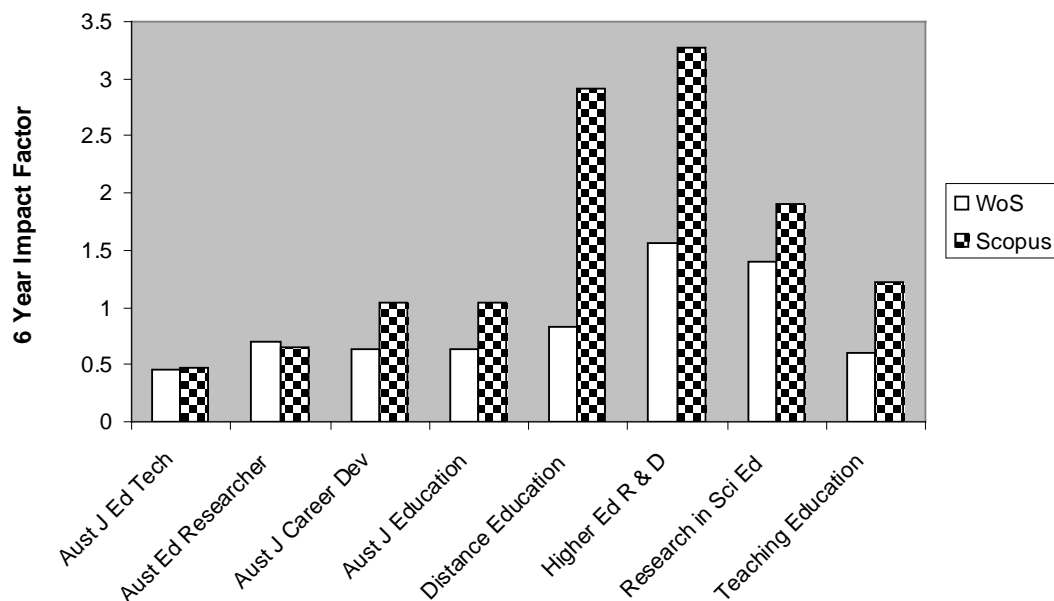


What is evident from Figure 1 is the importance of Scopus as a citation source for education titles. Only one title, *Australian Educational Researcher*, has fewer citations in Scopus than Web of Science. For the titles *Distance Education*, *Higher Education R & D*, and *Teaching Education* over double the number of citations were found in Scopus compared with Web of Science.

Due to the extraordinary and problematic results for Google Scholar, and the effect that citation numbers have on the subsequent analyses, impact factor, *h*-index, and diffusion factors are calculated using only Web of Science and Scopus data.

The impact factor calculation comprises total citation numbers (which differs for the citation sources) and the number of articles published (which is constant). Therefore, the differences between the data drawn from Web of Science and Scopus are reflected in the journals' impact. This is clearly demonstrated in Figure 2.

Figure 2: Impact for journals

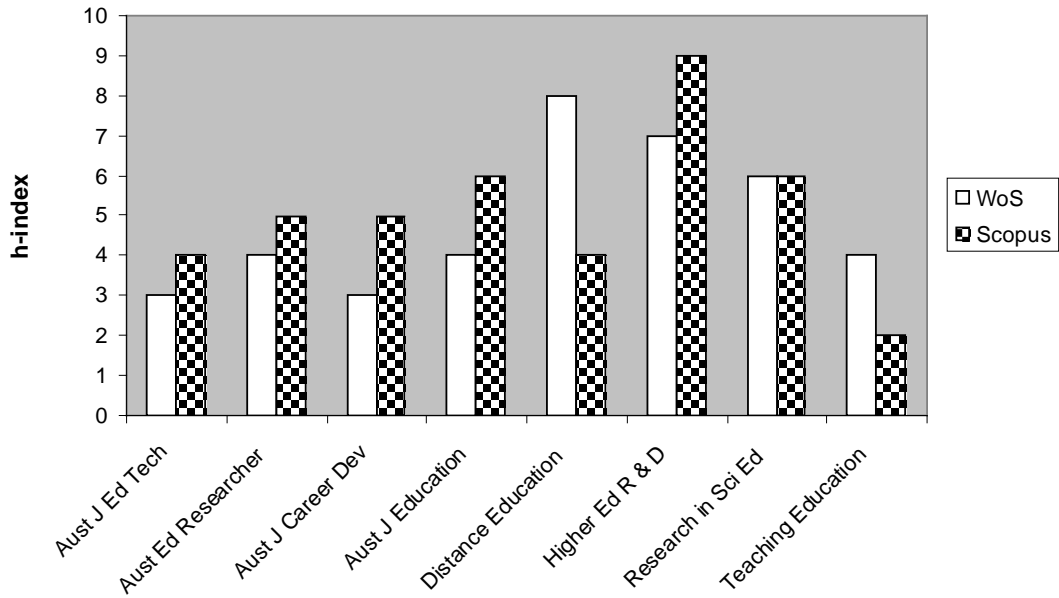


Small shifts in the rankings occur for middle ranking journals for each citation source when total citations and impact factor are compared for the two citation sources. However, at the extremes the journals remain the same for both measures. The top three journals for total citations, *Higher Education Research & Development*, *Distance Education*, and *Research in Science Education*, are the same as the top three for impact factor using Scopus data. The same journals, but in a slightly different order, are ranked in the top three for both measures using Web of Science data. *Higher Education Research & Development* is ranked first and, at the other end of the scale, *Australasian Journal of Educational Technology* is ranked lowest for both measures using both citation sources.

As a potentially useful measure of journal output and an alternative to the impact factor, the *h-index* was calculated for the journals using citation data from both sources. The *h-index*, illustrated in Figure 3 below, produces ‘flatter’ results due to the whole number results. So, while there is a sole top ranked journal by *h-index* for both citation sources, two or more journals share equal rankings for Web of Science and Scopus results. When the *h-index* is compared with impact factor findings the top ranked journal for Web of Science and Scopus remains constant. Importantly, however, the citation sources used affect the calculations. This is evident when comparing Web of Science and Scopus across the two measures for *Distance Education* and *Teaching Education*. For these journals Web of Science data results in a higher *h-index* measure, while Scopus would be preferred for an impact factor measure. The opposite is true, to a lesser extent, when these measures are compared for *Australian Educational Researcher*.

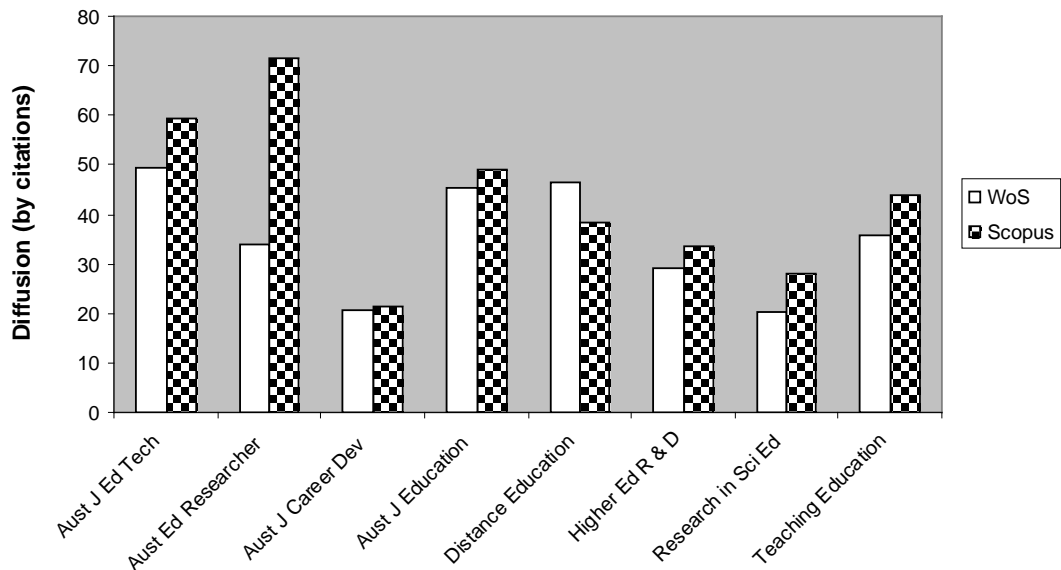
Figure 3: *h-index* for journals





Figures 4 and 5 present the results for the two diffusion calculations. Figure 4 displays the results using Rowlands' original JDF, using citations as the denominator. Note that the scales for the two values differ due to the equation used to calculate scores.

Figure 4: Diffusion of journals (by citations)

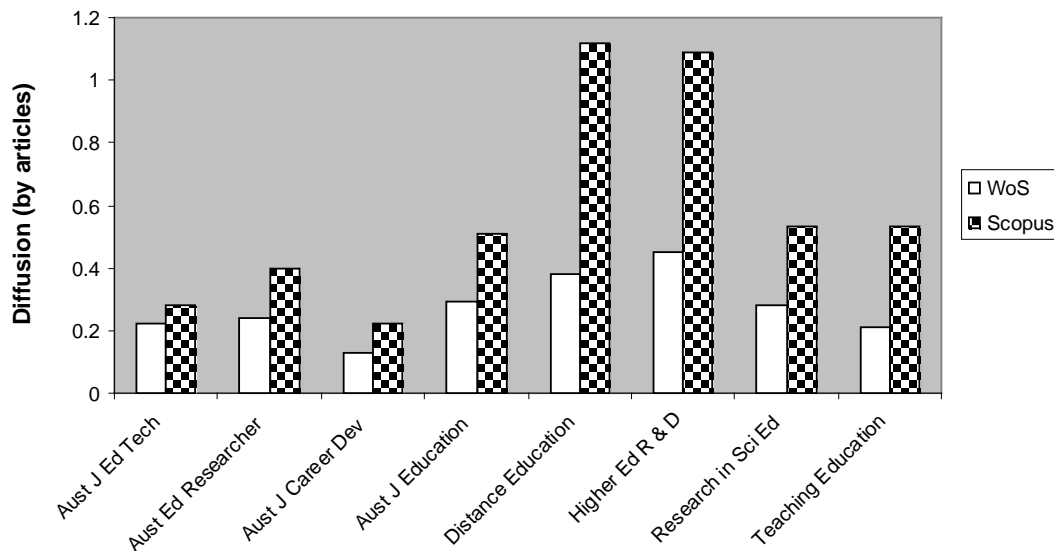


The diffusion (by citations) calculation produces very different results from the impact factor and *h*-index. *Australasian Journal of Educational Technology*, the lowest ranking journal for total citations, impact factor and *h*-index (with the journal *Teaching Education*) is now ranked highly using Web of Science and Scopus. The diffusion (by citations) calculation for *Australian Educational Researcher* using Scopus data lifts the journal from middle-to-low ranking to first place. Conversely, relatively high ranking journals such as *Higher Education Research & Development* and *Research in Science Education* are in 6<sup>th</sup> and 7<sup>th</sup> place, respectively. Scopus data appears to provide better

results for most of the journals, particularly in the case of *Australian Educational Researcher*. However, *Distance Education* is better served by Web of Science for *h*-index and diffusion (by citations). Rowlands noted the tendency for generalist journals to perform better than journals in a more specialised subject area using this measure.<sup>43</sup> This does not appear to have occurred to any significant degree in this study. However, the observation by Frandsen that journals with fewer citations are advantaged by the measure is substantiated in the results for the *Australasian Journal of Educational Technology* and *Australian Educational Researcher* when compared with the results for *Distance Education*, *Higher Education Research & Development*, and *Research in Science Education*.<sup>41</sup>

Frandsen’s New Journal Diffusion Factor is calculated by using the number of articles published as the denominator. As Figure 5 illustrates, this measure returns the journals to ranks similar to those seen in the total citations, impact factor and *h*-index.

Figure 5: Diffusion of journals (by articles)



*Distance Education* and *Higher Education Research & Development* are the highest ranked journals using Scopus data for total citations, impact factor, and diffusion (by articles). *Research in Science Education* also performs well across these measures. Web of Science data produce a lower result for all journals for diffusion (by articles). Going against the trend, the rank for the *Australian Journal of Career Development* maintains its low position in both diffusion measures.

Table 1 presents the draft ERA ranking for the education journals with the rank of each journal (1-8) when examined for total citations, impact factor, *h*-index, and diffusion (by articles) using both citation sources. Note: for some measures a number of journals were equally ranked.

Table 1: Journal rankings: ERA rank and citation-based measures

	ERA rank	WoS total citations	Scopus total citations	WoS impact	Scopus impact	WoS <i>h</i> -index	Scopus <i>h</i> -index	WoS diffusion*	Scopus diffusion*
Aust Ed	A*	5	7	4	6	4	3	5	5

Researcher									
Aust J Education	A*	6	5	5	5	4	2	3	4
Higher Education R & D	A*	1	1	1	1	2	1	1	2
Aust J Ed Tech	A	8	8	7	7	5	4	6	6
Research in Sci Education	A	2	3	2	3	3	2	4	3
Distance Education	B	3	2	3	2	1	4	2	1
Teaching Education	B	4	4	6	4	4	5	7	3
Aust J Career Development	C	7	6	5	5	5	3	8	7

\*diffusion ranks are based on the diffusion (by articles) calculation

The journal rankings presented in Table 1 indicate the draft ERA rank is not supported by citation-based measures for a number of the journals. Only one of the A\* journals, *Higher Education Research & Development*, was ranked consistently high in the citation measures. The *Australian Educational Researcher* and *Australian Journal of Education* rankings vary considerably, but are generally not ranked highly using citations-based measures. On the basis of these measures, an ERA ranking of B would appear to be more appropriate. In contrast, the journal *Distance Education* is assigned a B rank in the ERA list, but the citation-based analyses suggests it merits a higher rank. Of the eight journals, only two, *Australian Educational Researcher* and *Research in Science Education* have been assigned a JIF by Thomson. The new five year JIF is 0.171 for *Australian Educational Researcher* and 0.444 for *Research in Science Education*. While statistical tests have not been conducted to analyse the significance of these results, the citation-based measures tend to reflect the JIFs, whereas the ERA rankings do not.

## Discussion

Ranking journals using citations data has been the subject of debate for many years. In part, this is related to the limitations of the Thomson citation indexes, but it is also due to the equation used to calculate the best known citation-based measure, the Journal Impact Factor. However, as alternative citations sources are now available and a range of new citation-based measures proposed, the focus of the debate is shifting. The research reported in this paper contributes to the current discussion about the influence of different citation sources on citation-based assessment, the appropriateness of citation sources in different disciplines, and the usefulness of new citation-based measures.

Firstly, it is argued that Google Scholar produces results for citation numbers which deviate so far from those found in Web of Science or Scopus, that to compare the

citation-based measures using data from Google Scholar with the same measures using Web of Science or Scopus data would produce findings of dubious value.

Secondly, what can be stated as a result of this research is that Scopus out-performs Web of Science for citations data in the field of education. Of the five analyses for the eight journals (40 in total) presented above, only five individual results indicated that Web of Science would be the preferred citation source.

Of particular note are the ranking differences that occur when citation-based measures are compared using data from the two sources. For example, the extended impact factor for the journal *Distance Education* is higher with Scopus data than with Web of Science data, but the opposite is found when the *h*-index for the journal is calculated. This is an important issue to consider if research assessment exercises apply a range of citation-based measures but select only one 'appropriate' source of citations data.

When the journals are examined for their ranking using the different citation-based measures there does appear to be some consistency across the analyses performed, excluding diffusion (by citations). Generally, both citation sources produce similar rankings for total citations, impact factor, *h*-index and diffusion (by articles), with very few measures varying by more than two places in the ranking. The *h*-index calculated using Scopus data produces the greatest discrepancy across these rankings.

The results of this study do raise concerns regarding the use of citations data for ranking Australian education journals. To be included in this study a journal was required to have attracted 50 or more citations over the six year publishing (seven year citing) period. Only 20% of Australian education journals in the draft ERA list achieved this criterion. In other words, 80% of Australian education journals attract less than eight citations each year. Again, the coverage limitation of the citation sources is a factor in these findings, but the problem is difficult to resolve in the context of Australian social science and humanities journals. Certainly, the results suggest that citation-based measures will not be particularly useful for the majority of Australian education journals.

However, the draft ERA list of ranked journals is also problematic. The differences between the ERA rank and the performance of journals using citation-based measures are such that the criteria used to rank the journals for ERA may be called into question. An important aspect of the ranking process is the perception of 'best' journals to Australian education researchers. It is highly likely, and common to other social sciences and humanities, that national journals play an important role in the scholarly communication of researchers in the field because their research is framed by relevant national legislation and social and educational policy. The preliminary ERA ranking of these journals, determined as it is by the input of interested parties, will be influenced by the importance of Australian journals to the national scholarly discourse. However, if the purpose of ERA is to assess research against international benchmarks it is very doubtful that some of the Australian education journals will retain their high ranking in the final list.

Finally, this research may add to the speculation that it is necessary to develop separate methods of impact assessment for the social sciences and humanities as

distinct from the sciences. Whereas the latter might proceed with heavy reliance on citation-based metrics, the non-science disciplines might require at the very least a modified citation measure to be used in conjunction with more subjective measures.

This possibility was mooted recently by Linda Butler, who has played a key role in determining assessment methods for ERA, when she expressed a ‘personal opinion’ that the Australian research assessment authorities could look at “concentrating on science first, where the metrics are accepted, and take a little time in developing metrics for other disciplines”.<sup>51</sup>

The ARC has in effect responded to such concerns, not by delaying assessment of the non-science disciplines as suggested by Butler, but by *not* mandating the use of citation metrics in journal ranking. The choice of methods to be used in journal ranking for ERA has effectively been ‘outsourced’ to relevant discipline groups and experts who are free to devise methods for journal ranking that respond to the characteristics of their own discipline. While it is apparent that some disciplines—and not exclusively the sciences—will persevere with citation-based assessments, others will elect to implement alternative or mixed forms of assessment that *may* include an element of citation metrics. As a result of this devolved process there is an onus on disciplines and individual researchers to familiarise themselves with the value of citations for assessing issues of ‘quality’ relative to their patterns of scholarship and communication, and to understand how citation data might be used in conjunction with other forms of assessment relevant to their discipline.

It is also critically important for librarians working in universities and other research institutions to develop their own expertise in this regard. Research assessment and journal ranking are increasingly important issues to many users of research libraries, and subject or liaison librarians in particular should be able to discuss with and advise users regarding the ranking process applied within particular disciplines. Academic librarians have a long history in evaluating journals as part of their collection development practices, and bibliometrics, including citation analysis, have played an important role in this regard. Understanding the function and limits of citation data is a professional skill that has recently been ‘mainstreamed’ by the increased focus on research accountability, and librarians should ensure that they remain important players by developing and sharing their knowledge.

The results of this research point to the difficulty in devising a useful measure of journal impact based upon citation data alone for Australian education journals, and suggest that Australian research managers need to continue working towards the development of a journal assessment method that is sensitive to this discipline. The implication for academic librarians is that this is but one more example of how they might become increasingly important partners in the research enterprise.

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