Journal of Agricultural Education, 61(2), 249-262
https://doi.org/10.5032/jae.2020.02249

Elevating the Impacts of Research in Agricultural Education

James R. Lindner,[1] Amy Harder[2], and T. Grady Roberts[3]

Abstract

Dissemination of research is a critical part of the research process. Researchers in agricultural education have long embraced this process. However, the Internet has changed the ways in which research is disseminated, with the potential for much broader impacts around the world. The purpose of this study was to provide a benchmark of the current impact of research in agricultural education by examining how journals and researchers in the field fare on commonly used research metrics. It was concluded that many of the common journals in agricultural education are not even listed in the indices that provide metrics to assess journals. It was also concluded that many researchers in agricultural education are not taking steps to provide public profiles of their research and thus do not have individual researcher metrics. In some ways, we are invisible to the broader scientific community. Practical suggestions are provided to elevate the reputations of our journals and the reputations of our researchers.

***Keywords*:** research; journals; metrics; impacts; academics

Author Note: Correspondence concerning this article should be addressed to James Lindner, Professor Agriscience Education, Auburn University, AL 36849; email: jrl0039@auburn.edu

Introduction

There is perhaps nothing that defines and ties together the agricultural education discipline more than the concept of change. For our purposes, we are using *agricultural education* as an inclusive term to describe our broader discipline that includes faculty in teacher education, extension education, agricultural communications, and agricultural leadership. Through our teaching, we seek to prepare our learners to create and lead change in communities, schools, and the agricultural industry. A quick look at our research suggests change has commanded our attention in that arena as well, with over 50 change-related articles appearing in a keyword search in this journal alone. We are accustomed to leading and studying change but a revolutionary change is happening in the broader academe that will have implications for agricultural education though we are not the ones driving it. It is time for those of us in agricultural education to have a serious conversation about research metrics.

[1] James R. Lindner is a Professor of Agriscience Education in the Department of Curriculum and Teaching at Auburn University, 5058 Haley Center, Auburn University, AL 36849. E-mail: jrl0039@auburn.edu
[2] [2]Amy Harder is a Professor of Agricultural Education and Communication at University of Florida, 117B Bryant Hall, Gainesville, FL 32611. E-mail: amharder@ufl.edu
[3] T. Grady Roberts is a Professor of Agricultural Education and Communication at University of Florida, 117C Bryant Hall, Gainesville, FL 32611. E-mail: groberts@ufl.edu

Research metrics have been part of university discourse since the first known mention of citation analysis in 1963 (see Garfield, 1963), but the conversation picked up momentum in the early 2000s with the introduction of new ways to measure the impact of research (Thompson et al., 2009). The Institute for Scientific Information (ISI) is credited with being the first to compile and publish citation data (Thompson et al., 2009) but multiple providers now exist. A researcher can easily access online databases to find estimates of various impact parameters, including the Hirsch's (2005) popular *h*-index, Google Scholar's *i*10-index (Google Scholar, 2011) and ResearchGate's (n.d.) RG and Research Interest Scores. Authors can and do promote their own work through the social network of Mendeley (Elsevier, 2020a) in the hopes of increasing its visibility, which may lead to better research metrics. Despite known issues with the accuracy of research metrics and how they can be manipulated (e.g. López-Cózar et al., 2014), their usage appears to be gaining momentum worldwide as universities jockey for prestige and recognition. For example, universities in India are ranked based on the cumulative citations, *h*-index, and *i*10-index metrics of their faculty (Dhamdhere, 2017).

Online databases are changing the ways researchers develop and disseminate their research. The prevalence of materials available online, sometimes in multiple locations, makes it challenging to consistently link individual pieces of research with individual researchers. Other challenges include: (a) inconsistencies in the spelling of article titles or journal names, (b) updated URLs leading to broken links to articles, and (c) common names for researchers (i.e. Smith, Jones, etc.). In 1997, the digital object identifier numbers (doi) was launched to provide a unique number for each piece of research to allow citing that work even if there are inconsistencies in author names or article titles (DOI, 2015). In 2008, ResearcherID was launched to provide a unique number for a researcher (Enserink, 2009). More recently, ORCID (orcid.org) was launched in 2017. Some journals now require researchers to have ORCID numbers to submit and review articles.

We have had individual adopters of these systems in agricultural education. Many readers will be familiar with the e-mailed requests to upload or confirm authorship on an article. Some of our discipline's editorial boards have had conversations about the copyright issues associated with such research aggregation services, suggesting we are aware of their growing usage. Yet our discipline has appeared leery of research metrics, perhaps concerned social science metrics would be unfairly compared to our colleagues in the bench sciences. Our experience working in at four universities leads us to believe that it is uncommon for those in agricultural education to have had formal training in how to raise the profile and impact of our own work. In the meantime, our European colleagues at Wageningen University and Research (WUR) – the leading agricultural university in the world (U.S. News and World Report, 2020) – are fluent in the language of research metrics. WUR faculty are on the front edge of the innovation curve (Rogers, 2003) in how they are adopting and adapting these tools to fundamentally change how they do business. A 2018 visit by the authors to WUR provided insight into how research metrics are being used for faculty performance reviews, to evaluate in which journals to publish, and even to evaluate the reputation of colleagues elsewhere. For better or worse, changes taking place at the highest echelon are bound to have a ripple effect across universities. Agricultural education faculty need to be knowledgeable about research metrics in the event they become expectations at our own institutions.

Researcher Metrics and Journal Impact Factors

Multiple metrics have been created to try to assess the impact of an individual researcher, a specific article, or a journal (Medina & Draugalis, 2019). Utrecht University's library provides an excellent side-by-side comparison of the metrics tracked by various databases, including Scopus, Web of Science, and Google Scholar (Utrecht University, 2017). An overview of popular metrics and databases is provided in this section.

h-index

In 2005, Hirsch put forth a proposal to quantify "the cumulative impact and relevance of an individual's scientific research output" (p. 16569). The *h* index is a commonly accepted metric for examining a researcher's impact. Hirsch (2005) described *h* as follows: "A scientist has index *h* if *h* of his or her N_p [number of papers published over *n* years] papers have at least *h* citations each and the other ($N_p - h$) papers have $\leq h$ citations each" (p. 16569). More simply, if a researcher has 20 papers that have 20 or more citations each, her or his *h* would be 20. Hirsch (2005) acknowledged variation would exist between disciplines, but within disciplines the *h* values could be used to compare scientific impact of individuals with similar years in the profession. Individuals with more time in the discipline would be expected to have a higher *h* value (Hirsch, 2005). This assumption can be seen in the "typical" (Hirsch, 2005, p. 16571) values of $h = \sim 12$ and $h = \sim 18$ suggested by Hirsch for faculty approaching promotion to associate and professor ranks, respectively.

*i*10-index

The *i*10-index is a metric created by Google (Conner, 2011) and is featured in the citation profiles provided in Google Scholar. The *i*10-index is a straightforward measurement that identifies the number of articles published by a researcher that have been cited at least 10 times. Google Scholar differentiates between a researcher's influence over time and recent influence by providing an *i*10-index inclusive of a researcher's entire career and an *i*10-index score for the past five years.

Scopus

According to Elsevier (2020b), Scopus "is the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings" (What is Scopus section, para. 1). Scopus provides metrics for papers, individuals, institutions, countries, and journals (Utrecht University, 2017). Scopus provides free access to some features, such as Scopus' version of a journal impact factor. However, the premier features are reserved for subscribers and subscribing institutions, presenting a potential barrier to faculty at institutions without access. Another limitation of Scopus is that the researcher metric provided – the *h*-index – is calculated based only on articles found within the journals indexed by Scopus. Later in this article, it will become more evident why this is significant for agricultural education researchers.

Scopus compares journals within its database using a proprietary metric called CiteScore™. According to Elsevier (2017), "CiteScore calculates the average number of citations received in a calendar year by all items published in that journal in the preceding three years" (What is CiteScore section, para. 2). CiteScore™ 2019 values are calculated based on the total number of citations of 2016, 2017, and 2018 articles appearing in articles published in 2019, divided by the total number of articles during that same three-year time frame. The use of the CiteScore™ methodology provides a contemporary view of a journal's impact rather

than a historical view over time.

Web of Science

Web of Science (WOS) by Clarivate Analytics (n.d.) purports to be "the world's most trusted publisher-independent global citation database" (Web of Science section, para. 1). Similar to Scopus, WOS is a curated database inclusive of a selective listing of indexed journals. It is also a subscription-based service that provides information about the same types of metrics as Scopus (Utrecht University, 2017). Interesting features of WOS include the ability to search for articles by topic and the ability to filter results to show highly cited articles, hot papers in the field, and open access articles.

A notable difference between WOS and Scopus is the method used to compare journal impact. Clarivate Analytics lays claim to creating the first journal impact factor, back when the group was still known as The Institute for Scientific Information (Garfield, 1994). Journal Citations Reports provided through WOS are based on impact factors "calculated by dividing the number of current year citations to the source items published in that journal during the previous two years" (Garfield, 1994, para. 3). The shortened time period used by WOS in its calculations (as compared to Scopus) makes it more difficult for journals with lengthy review and publishing time frames to improve their impact factors.

Google Scholar

Google Scholar is a free tool that can be used by anyone. Citation profiles are provided for individual researchers and top publications are presented using the *h*-5 index and *h*-5 median, derivations of the *h*-index framed within a five-year period. Unlike its competitors, Google Scholar provides very little transparency about its methods. The publication listing simply has a note at the bottom of the web page that reads: "Dates and citations counts are estimated and are determined automatically by a computer program" (Google Scholar, n.d., Top publications section). Individual metrics are based on all publications, rather than publications from only indexed journals. In 2011, Google released a blog post by Connor explaining "we collect citations to your articles, graph them over time, and compute your citation metrics – the widely used *h*-index; the *i*10 index, which is simply the number of articles with at least ten citations, and, of course, the total number of citations to your articles" (para. 2). In our experience, Google Scholar presents higher scores for individual researchers as compared to the same metrics presented by other competing databases (e.g. WOS, Scopus) due to using citations from non-indexed journals as well as indexed journals.

ResearchGate Metrics

ResearchGate uses three metrics: the RG score, a recently added Research Interest score, and the *h*-index. The RG Score "is calculated based on any contribution you share on ResearchGate or add to your profile, such as published articles, unpublished research, projects, questions, and answers" (ResearchGate, n.d., para 1). The RG score is heavily dependent on the researcher's engagement on ResearchGate. In fact, ResearchGate lists things a researcher can do to raise his or her RG Score, such as sharing raw data, asking another researcher a question, or following other researchers. The Research Interests score is designed to capture the way in which other ResearchGate members interact with materials a researcher has cataloged in ResearchGate. The ResearchGate *h*-index is calculated the same as others' *h*-index scores, but it is based only on articles a researcher has listed in ResearchGate. ResearchGate

does provide two *h*-index scores, one which includes self-citations and one which does not.

Literature Review

Numerous articles have examined agricultural education research and researcher productivity. A summary is provided in Table 1. A recurring theme amongst this work was an inward focus of the inquiries. Even the research focused on citation analyses (Edgar, 2010; Edgar et al., 2008; Radhakrishna et al., 1994; Radhakrishna, 1995; Swafford & Anderson; 2007) focused on who we were citing, as opposed to who is citing us.

Table 1
Articles Examining Published Research in Agricultural Education

Focus	Source
Citation analysis	Edgar (2010); Edgar et al. (2008); Radhakrishna et al. (1994); Radkakrishna (1995); Swafford & Anderson (2007)
Statistical procedures	Bowen et al. (1990)
Research methods	Edgar et al. (2008); Mannebach et al. (1984)
Research topics	Crunkilton (1988); Radhakrishna & Xu (1997)
Authorship	Edgar et al. (2008); Harder et al. (2008); Radhakrishna & Jackson (1995); Settle et al. (2019)

Purpose

The purpose of this study was to provide a benchmark of the current impact of research in agricultural education to document the external reach of our research. Specific objectives were:

1. Describe the relative impact of research journals common in agricultural education based on Scopus and WOS metrics.
2. Describe the visibility of selected researchers in agricultural education based on metrics from Google Scholar, Scopus, and ResearchGate.

Methods

Journal Analysis

Journals included in our analysis were selected based on several factors. First, studies reporting literature cited in our discipline (Edgar, 2010; Radhakrishna, 1995; Swafford & Anderson, 2007) were used as an initial basis for inclusion. Second, the collective publishing experience of the authors (journal editors with experience leading three separate publications) was also used as a basis for inclusion. Third, a review of articles published in the *Journal of Agricultural Education* (*JAE*) and the *Journal of International Agricultural and Extension Education* (*JIAEE*) over the past three years was performed to identify outliers and outlets that may not have been otherwise identified. It was not our intent to include every scholarly outlet used by researchers in our discipline, but rather to use a sample representative enough to draw conclusions, make inferences, and provide recommendations. Two leading citation indexes were included for analyses: Scopus and WOS. We choose to not include Google Scholar for the journal analysis because of the lack of information about underlying documentation. Data for this research project were harvested using 2018 CiteScores™ gathered in September 2019. Both Scopus and WOS are active databases and scores/factors change throughout the year;

additional journals are indexed throughout the year as well.

Researcher Analysis

To examine researchers in agricultural education we sought to identify a subset of our colleagues who are recognized for their "exceptional and sustained contributions" to our discipline (AAAE, n.d.). The American Association for Agricultural Education (AAAE) Fellows were deemed to meet this criterion. AAAE Fellows inducted during the 10-year period of 2010 - 2019 were included in the analysis (N = 22). We approached this inquiry as if we were outside of our discipline looking for potential collaborators (i.e. how easy would it be to learn about a potential collaborator's work?). Consequently, we used public searches in Google Scholar, Scopus, ResearchGate, and ORCID. Metrics provided by these services are dynamic and update regularly. The metrics presented in this article were obtained in December 2019.

Findings

Journal Analysis

A summary of journals relevant to agricultural education researchers is provided in Table 2. The Scopus category is comprised of 26 different subject areas, with education falling under the general category of social sciences. Within the education category there were 1,040 publications with cite scores. The 2018 CiteScore™ for the *Journal of Applied Psychology* was 6.68; 351 documents published 2015-2017 that were cited 2,408 times in 2018. The CiteScore™ for the *Journal of Agricultural Education and Extension* for 2018 was 1.66; this is trending upwards from 2017(1.06) and 2016(1.17). The CiteScore™ for the *JIAEE* for 2018 was not reported; this is trending downwards from 2017(.05) and 2016(.07). The CiteScore™ for the *Journal of Extension* for 2018 was .33.

WOS is comprised of five subject areas; education and educational research is under the general category of social sciences. Within this area, there were 243 publications with Impact Factor Scores (Clarivate Analytics, 2018a). Ranks in category are shown in Table 2. The 2018 Impact Factor score for the *Journal of Applied Psychology* was 5.07 (Clarivate Analytics, 2018b). The 2018 Impact Factor score for *International Review of Research in Open and Distance Learning* was 1.83; *Distance Education* was 1.73 and *Journal of Agricultural Education and Extension* was 1.39 (Clarivate Analytics, 2018c).

The data in Table 2 show that many of the journals used by researchers in our discipline were not captured and indexed by Scopus or WOS. WOS indexes even fewer journals common to agricultural education than Scopus. The *Journal of Agricultural Education*, *Journal of Applied Communication*, *Journal of Leadership Education*, and *NACTA Journal* are examples of established journals without a Cite Score™, Ranks, or an Impact Factor. Previously, the *Journal of International Agricultural and Extension Education* was indexed in Scopus but lost coverage in 2017.

Table 2

Impact and Rankings of Journals Relevant to Agricultural Education

Relevant Journals	Cite Score™ 2018[1]	Rank	Impact Factor	Rank 2018[2]
Journal of Applied Psychology	6.68	4/216	5.07	9/82
International Review of Research in Open and Distance Learning	2.87	74/1040	1.83	83/243
Educational and Psychological Measurement	2.23	145/1040	2.05	33/105
Distance Education	2.19	148/1040	1.73	97/243
Journal of Agricultural Education and Extension	1.66	251/1040	1.39	129/243
Journal of Vocational Education and Training	1.13	429/1040	—	—
Applied Environmental Education & Communication	0.75	586/1040	—	—
American Journal of Distance Education	0.72	603/1040	—	—
Journal of Extension	0.33	829/1040	—	—
Career and Technical Education Research	—	—	—	—
Journal of International Agricultural and Extension Education	—	—	—	—
Journal of Research in Technical Careers	—	—	—	—
Journal of Agricultural Education	—	—	—	—
Journal of Applied Communication	—	—	—	—
Journal of Career and Technical Educating	—	—	—	—
Journal of Extension Systems	—	—	—	—
Journal of Human Sciences and Extension	—	—	—	—
Journal of Leadership Education	—	—	—	—
Journal of Southern Agricultural Education Research	—	—	—	—
NACTA Journal	—	—	—	—
Urban Agriculture & Regional Food Systems	—	—	—	—
High Cite/Impact Journals				
Review of Educational Research	12.31	1/1040	8.99	1/243
Educational Research Review	7.99	3/1040	5.02	5/243
Journal of Educational Psychology	5.81	7/1040	5.18	3/59
Educational Researcher	5.28	11/1040	3.39	9/243
Journal of Vocational Behavior	4.80	14/1040	3.39	14/82
Learning and Instruction	4.79	15/1040	3.92	6/243
Harvard Educational Review	4.53	18/1040	2.19	25/243
Journal of Teacher Education	4.34	21/1040	3.26	12/243
Metacognition and Learning	4.21	25/1040	2.75	26/243
American Educational Research Journal	4.14	26/1040	3.17	15/243

Note. Dashes are used when a journal does not have a Cite Score™, Rank, or Impact Factor. [1]Full details for each CiteScore™ are provided in the reference list; [2]Full details for each Impact Factor are provided in the reference list.

Researcher Analysis

The visibility of AAAE Fellows was explored using public databases and is summarized in Table 3. Only 7 AAAE Fellows (30.4%) had ORCID numbers. Almost half of the AAAE Fellows (47.8%) did not have a public profile on Google Scholar. Eight AAAE Fellows (34.8%) had research profiles with Google Scholar, Scopus, and ResearchGate. Google Scholar metrics (*h*-index and *i*10 index) were higher than Scopus metrics for AAAE Fellows, likely due to the broader inclusion of published research in Google Scholar. Considerable variation existed between AAAE Fellows in terms of their research visibility, as measured by the various metrics. Again, this may not represent the true breadth of their work, but rather visibility as captured through these metrics on the date in which we gathered data.

Table 3

Researcher Metrics for AAAE Fellows Inducted 2010-2019

Metric	Mean	*SD*	Range	Missing
Google *h*-index	17.25	5.83	8 to 26	11 (47.8%)
Google *i*10-index	33.08	20.94	8 to 72	11 (47.8%)
Scopus *h*-index	2.50	1.55	0 to 6	6 (26.1%)
RG[1] Score	9.12	4.74	0 to 19.75	6 (26.1%)

Note. $N = 23$.

Conclusions, Implications, and Recommendations

Journals

There is insufficient evidence to know if research published in agricultural education journals is reaching wide audiences, and thus extending the impacts of our work. Our results did confirm that some of the more common outlets for our research are not even listed in Scopus or WOS. These are benchmarks of quality used by the broader scientific community. Of the journals focused in an agricultural education context, only the *Journal of Agricultural Education and Extension* had both a 2018 Scopus CiteScore™ and a 2018 WOS Impact Factor. Additionally, the *Journal of Extension* had a 2018 Scopus CiteScore™.

So, what does this mean? First, we must think more holistically about the audiences for our work. Some might argue that our work is intended for practitioners. Others might argue our work is intended to inform our own practices. At a more fundamental level, others might say our work is intended to add to the body of knowledge. We propose that our research can do all three. However, contributing to the broader body of knowledge is at the core of the scientific method and one area in which both our journals and our researchers can stand to improve.

What is our *body of knowledge* and who contributes to it? As evidenced by the research we cite, our body of knowledge is bigger than a single professional society and transcends geographic locations (Edgar, 2010; Edgar et al., 2008; Radhakrishna et al., 1994; Radhakrishna, 1995; Swafford & Anderson, 2007). Consequently, our body of knowledge is bigger than the handful of journals in which most of us frequently publish. Our research should

be intimately linked with the broader scientific community. We often espouse how our research contributes to the body of knowledge. However, adding to the body of knowledge implies that our work is also contributing to the collective global understanding of the phenomena we study. This means our work must inform researchers within agricultural education and beyond. Herein lies the problem. If our journals do not have sufficient scientific reputation and are not discoverable by other researchers, the potential impacts of our research are limited to our own small discipline and by extension, our individual and collective contributions to the body of knowledge is limited. The gold standard for the scientific community is publishing in journals that are indexed and have a high impact factor. Although our journals will likely never reach the reputation of *Nature* and *Science*, we believe the research published in our journals has the potential to make broader impacts and we should pro-actively make this happen. This begins with some changes to our journals.

We offer recommendations for the editors and editorial boards of our journals to help increase the potential impact of our research. Our work needs to be publicly available and discoverable. Our journals should: (a) be hosted on stable web platforms, (b) give open-access to our work, (c) consistently register/update doi numbers for each article, and (d) consistently submit metadata to appropriate databases (i.e. ERIC, EBSCO, Directory of Open Access Journals, etc.). Our editors should register all agricultural education journals in Scopus if they are not already. Our editors and editorial boards should review the criteria for being indexed in WOS and then make the necessary structural and policy changes that would allow for registration. Once those are in place, our editors should submit our journals for review to be included in the *Emerging Sources Citations Index*. This is a precursor for inclusion in the *Social Sciences Citation Index*. Finally, our journals should include ORCID numbers for researchers on published articles.

Individual researchers can also help elevate the reputation of our journals. First, we should be advocates for all agricultural education journals when interacting with colleagues, graduate students, and especially in the broader scientific community. We cannot expect other disciplines to take our journals seriously if there is disagreement amongst ourselves about which journals have value, particularly if those disagreements are driven by subjective opinions rather than metric-based facts. Second, authors should cite research from indexed journals while being sure to include doi numbers or other identifiers to allow automated web searches to show links between our less-visible research with research consulted in the broader scientific community. Third, researchers in our field should publish some of their research in highly cited journals of our parent disciplines (see Table 2) and include citations to our other journals. An intermediate step might be publishing in the *Journal of Agricultural Education and Extension*, which has broad readership. Finally, elevating your reputation as an individual researcher will also add to the reputation of our journals. This is discussed further in the subsequent section.

Researchers

Our results are not generalizable to all researchers in agricultural education but do provide a basis for discussing steps we each should consider. We concluded that most AAAE Fellows are not proactively taking steps to make their research visible to the broader scientific

community. Individual researcher metrics (*h*-index, *i*10-index, RG Score) were quite variable. Google Scholar metrics tended to be the most generous, while Scopus tended to be the most restrictive, likely because these researchers have not published many articles in journals listed in Scopus. Future research should examine individual researcher motivations about where their scholarship is published.

Collectively, the reputations of individual researchers in a given discipline contribute to the reputation of that discipline in the broader scientific community. Although limitations do exist in most researcher metrics, including the inflation of *h*-index scores due to self-citations (López-Cózar et al., 2014), these metrics do contribute to the reputations of individual researchers and, by extension, the larger discipline. As leaders in our discipline, the lack of available metrics for AAAE Fellows has implications for the visibility of our research, especially if junior faculty and graduate students are modeling their research practices after these esteemed colleagues. If we wish to extend the impacts of our research, we must each take steps to promote our own work. AAAE Fellows could certainly model the way.

Based on the experiences of the authors, we offer the following recommendations for researchers to improve the visibility of their work in an ethical way. A first step is to obtain an ORCID number and then use that number in all future research publications. This will allow published research to be consistently linked back to the correct researcher. Within ORCID, individual researchers should also make sure all their published research shows in their profile. Next, researchers should publish research in a diversified portfolio of journals to maintain visibility within our discipline while creating new connections with researchers in related fields. Consider submitting some research to journals with a broader audience, especially journals listed in the *Emerging Sources Citations* and *Social Sciences Citation* indices. Then, create profiles in Google Scholar and ResearchGate. Be sure to invite coauthors when prompted to show connections with other researchers. A new NCAC-24 lab was recently created within ResearchGate by U.S. agricultural education administrators for agricultural education researchers to connect with one another. Finally, researchers should periodically review their research profiles for accuracy. Although much information will automatically link, errors and omissions can influence your metrics.

Agricultural education faculty who mentor graduate students have an added responsibility as they help novice researchers learn to be productive members of our scientific community. Helping our graduate students think about their research and our journals in the ways we have outlined in this article will make the next generation of agricultural education researchers that much better prepared to contribute to the broader scientific community. Journal metrics and researcher metrics should become standard discussion items between advisors and graduate students. Research methods courses should also include discussion of these topics.

Summary

We believe there is an unrealized opportunity to extend the impacts of our research. There is a growing global trend for using quantitative indicators to measure research impacts. In agricultural education, we are not currently well positioned to provide much evidence of our

impacts using metrics commonly understood by the broader scientific community. For this to occur, we must elevate the reputations of our journals and the reputations of our researchers. This is not to say that our journals and researchers are inadequate, rather we have not been intentional in working to share our research in the broader scientific community. We have a contribution to make. However, realizing this impact will take organizational and individual changes. Making these changes can occur now, by our own choices. Or, they can occur later with mandates from our respective universities.

References

The American Association of Agricultural Education. (n.d.). AAAE fellows. http://aaaeonline.org/AAAE-Fellows

Bowen, B. E., Rollins, T. J., Baggett, C. D., & Miller, J. P. (1990). Statistical procedures used in publishing agricultural education research. *Proceedings of the 44th Eastern Region Agricultural Education Research Meeting,* 64-71.

Clarivate Analytics. (2018a). *Incites journal citation reports*. http://jcr.clarivate.com/JCRJournalHomeAction.action?pg=JRNLHOME&year=2018&edition=SSCI&categories=HA&newApplicationFlag=Y

Clarivate Analytics. (2018b). *Journal impact factor*. https://jcr.clarivate.com/JCRJournalHomeAction.action?pg=JRNLHOME&categoryName=PSYCHOLOGY%2C%20APPLIED&year=2018&edition=SSCI&categories=NQ

Clarivate Analytics. (2018c). *Journal impact factor*. http://jcr.clarivate.com/JCRJournalHomeAction.action?pg=JRNLHOME&year=2018&edition=SSCI&categories=HA&newApplicationFlag=Y

Clarivate Analytics. (n.d.). *Web of science*. https://clarivate.com/webofsciencegroup/solutions/web-of-science/

CiteScore™. (2018). *American Educational Research*. Journal https://www.scopus.com/sourceid/29432

CiteScore™. (2018). *Applied Environmental Education & Communication*. https://www.scopus.com/sourceid/6500153246

CiteScore™. (2018). *American Journal of Distance Education*. https://www.scopus.com/sourceid/19700200806

CiteScore™. (2018). *Distance Education*. https://www.scopus.com/sourceid/200147108

CiteScore™. (2018). *Educational and Psychological Measurement*. https://www.scopus.com/sourceid/13563

CiteScore™. (2018). *Educational Research Review*. https://www.scopus.com/sourceid/4700152248

CiteScore™. (2018). *Educational Researcher*. https://www.scopus.com/sourceid/5800194481

CiteScore™. (2018). *Harvard Educational Review*. https://www.scopus.com/sourceid/29425

CiteScore™. (2018). *International Review of Research in Open and Distance Learning*. https://www.scopus.com/sourceid/17781

CiteScore™. (2018). *Journal of Agricultural Education and Extension*. https://www.scopus.com/sourceid/19700188305

CiteScore™. (2018). *Journal of Applied Psychology*. https://www.scopus.com/sourceid/15388

CiteScore™. (2018). *Journal of Educational Psychology*. https://www.scopus.com/sourceid/12808

CiteScore™. (2018). *Journal of Extension*. https://www.scopus.com/sourceid/12814

CiteScore™. (2018). *Journal of Teacher Education*. https://www.scopus.com/sourceid/13354

CiteScore™. (2018). *Journal of Vocational Behavior*. https://www.scopus.com/sourceid/12006

CiteScore™. (2018). *Journal of Vocational Education and Training*. https://www.scopus.com/sourceid/5700154786

CiteScore™. (2018). *Learning and Instruction*. https://www.scopus.com/sourceid/13455

CiteScore™. (2018). *Metacognition and Learning*. https://www.scopus.com/sourceid/4700152724

CiteScore™. (2018). *Review of Educational Research*. https://www.scopus.com/sourceid/16512

Connor, J. (2011, November 16). Google Scholar citations open to all. *Google*. http://googlescholar.blogspot.com/2011/11/google-scholar-citations-open-to-all.html

Crunkilton, J. R. (1988). Directing future research efforts in agricultural and extension education through a matrix. *Proceedings of the National Agricultural Education Research Meeting*, 324-346.

Dhamdhere, S. N. (2017). Cumulative citations index, *h*-index and *i*10-index (research metrics) of an educational institute: A case study. *International Journal of Library and Information Science, 10*(1), 1-9. https://doi:10.5897/IJLIS2017.0797

DOI. (2015). *DOI handbook*. https://doi.org/10.1000/182

Edgar, L. D. (2010). Citation structure: An analysis of the literature cited in the Journal of International Agricultural and Extension Education from 1997 to 2006. *Journal of International Agricultural and Extension Education, 17*(1), 31-43. https://doi.org/10.5191/jiaee.2010.17104

Edgar, L. D., Edgar, D. W., Briers, G. E., & Rutherford, T. A. (2008). Research themes, authors, and methodologies in the Journal of Agricultural Education: A ten year look. *Journal of Southern Agricultural Education Research, 58*(1).

Elsevier. (2017). *Journal metrics – FAQs*. https://journalmetrics.scopus.com/index.php/Faqs

Elsevier. (2020a). *About mendeley*. https://www.elsevier.com/solutions/mendeley

Elsevier. (2020b). *About scopus*. https://www.elsevier.com/en-gb/solutions/scopus

Enserink, M. (2008). Are you ready to become a number? *Science*, 323(5922), 1662-1664. www.jstor.org/stable/25471761.

Garfield, E. (1963). Citation indexes in sociological and historical research. *American Documentation, 14*, 289-291.

Garfield, E. (1994). *The Clarivate Analytics impact factor*. Clarivate. https://clarivate.com/webofsciencegroup/essays/impact-factor/

Google Scholar. (n.d.). *Top publications*. https://scholar.google.com/citations?view_op=top_venues

Harder, A., Goff, S., & Roberts, T. G. (2008). Research productivity in the Journal of Agricultural Education from 1996 to 2005. *Journal of Agricultural Education, 49*(2), 1–12. https://doi.org/10.5032/jae.2008.02001

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Science*, *102*(46), 16569-16572. https://doi: 10.1073/pnas.0507655102

López-Cózar, E. D., Robinson-García, N., & Torres-Salinas, D. (2014). The Google Scholar experiment: How to index false papers and manipulate bibliometric indicators. *Journal of the Association for Information Science and Technology, 65*(3), 446-454. https://doi: 10.1002/asi.23056

Mannebach, A. J., McKenna, P. G., & Pfau, G. (1984). An analysis of research methodology used in agricultural education, 1974-1982. *Proceedings of the 38th Eastern Region Agricultural Education Research Meeting*, 112-129.

Medina, M. S., & Draugalis, J. R. (2019). Exploring impact metrics beyond indices and citations for SOTL and applied education research. *American Journal of Pharmaceutical Education, 83*(3), 261-263. https://doi: 10.5688/ajpe7211

Radhakrishna, R. B. (1995). Core journals used by agricultural and extension educators. *Journal of Agricultural Education, 36*(4), 48-54. https://doi.org/10.5032/jae.1995.04048

Radhakrishna, R. B., Eaton, D., Conroy, C., & Jackson, G. (1994). An empirical analysis of the literature cited in the Journal of Agricultural Education. *Journal of Agricultural Education, 35*(1), 61-65. https://doi.org/10.5032/jae.1994.01061

Radhakrishna, R. B., & Jackson, G. B. (1995). Prolific authors in the *Journal of Agricultural Education*: A review of the eighties. *Journal of Agricultural Education, 36*(1), 55-63. https://doi.org/10.5032/jae.1995.01055

Radhakrishna, R. B., & Xu, W. (1997). A review of subject matter topics researched in agricultural and extension education. *Journal of Agricultural Education, 38*(3), 59-69. https://doi.org/10.5032/jae.1997.03059

ResearchGate. (n.d.). *RG score*. https://explore.researchgate.net/display/support/RG+Score

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Settle, Q., Teixeira, K. L., Bechtold, R., Shoulders, C. W., & King, A. E. H. (2019).

Coauthor network analysis of Journal of Agricultural Education articles from 2008-2017. *Southern Region Conference Proceedings of Paper Presentations*, 84-97.

Swafford, M., & Anderson, R. (2007). A two decade (1981-2000) analysis of the literature cited in the journal of agricultural education. *Journal of Agricultural Education, 48*(3), 37-45. https://doi.org/10.5032/jae.2007.03037

Thompson, D. F., Callen, E. C., & Nahata, M. C. (2009). New indices in scholarship assessment. *American Journal of Pharmaceutical Education, 73*(6), 1-5.

U.S. News and World Report. (2020). *Best global universities for agricultural sciences.* https://www.usnews.com/education/best-global-universities/agricultural-sciences

Utrecht University. (2017, August 11). *Research impact & visibility: Traditional and altmetrics*. https://libguides.library.uu.nl/researchimpact