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Ranking Graduate Programs Based on Research Productivity of Faculty: A Replication and Extension

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Abstract

In an analysis of publication rates in applied behavior analysis, Dixon, Reed, Smith, Belisle, and Jackson (2015a) argued the need to measure the research productivity of graduate programs as a means of informing prospective graduate students. The current study replicated and extended Dixon, et al. (2015a) by analyzing the number of publications and citations. The results suggest that there is a discrepancy between rankings by publication and by citation, and further analysis is required. We also recommend further areas of inquiry in the analysis of research productivity.

Keywords: citation rates, publication rates, scientist-practitioner

With over 250 Behavior Analyst Certification Board (BACB) Approved Course Sequences (ACS) around the world, prospective applicants to applied behavior analysis (ABA) graduate programs have many options. The competition among these graduate programs to recruit and retain students has reached a critical level. With over 5,000 candidates sitting for the Board Certified Behavior Analyst (BCBA) / Board Certified assistant Behavior Analyst (BCaBA) exams in 2014,

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programs are positioning themselves to attract this ever-growing population.

Unfortunately, there is no centralized source of objective measures to help guide potential students in their choices. Some measurements of quality might include the reputation of the faculty, graduation rates, BCBA examination passing rates, and the probability of post-graduation employment. While these somewhat generic data may be sufficient for many potential students, the profession of ABA, being grounded in the science of human behavior, is committed to investigating clinical applications of the science that are the basis of evidence-based practices published in peer-reviewed publications. The well-informed applicant is likely interested in identifying which institutions are committed to such research.

Several authors (Baer, Wolf, & Risley, 1968; Normand, 2008; Reid, 1992) have argued that the field of ABA is firmly founded on the scientist-practitioner model and this foundation should guide the field in its continuous search for generalizable principles of behavior. The model is essential to the field because it emphasizes "the role of careful evaluation of treatment" (Normand, 2008, p. 47). Without scientist-practitioners, who are continually refining and generalizing principles of behavior for clinical application, the principles themselves are less certain. While the advantages of a scientist-practitioner model to the science and application of behavioral principles seems self-evident, there are some (i.e., Malott, 1992) who have argued that the application of well-understood and empirically supported principles of behavior is sufficient for quality services. While others have begun to assess the current state of the scientist-practitioner model in ABA and the influence of research productivity on potential graduate students (see Shawler, Blair, Harper, & Dorsey, 2018), further research needs to be conducted in this area.

However, if one assumes that the field of ABA does value and embody the scientist-practitioner model, how might one quantify the efficacy of training models? One possible way to measure whether BCBAs are being trained as scientist-practitioners is to measure the research productivity of faculty and BCBA supervisors. In fact, the BACB Professional and Ethical Compliance Code (2014) stipulates that all independent researchers (i.e., scientist-practitioners) be directly trained to conduct research by faculty, supervisors, etc., who have demonstrated some amount of fluency with research. Without a quantitative measurement of such fluency, it seems difficult to determine what qualifies as effective and appropriate training in conducting research. And, if the BACB requires this level of supervision, then it would seem likely that potential graduate students and supervisees will become

more and more selective when it comes to which graduate program or supervisor(s) they ultimately choose.

Unfortunately, research productivity and the resultant impact of the research itself are difficult to quantitatively measure. Given the fact that some areas of study are inherently less productive than others, it has proven to be challenging to establish a consistent and universal measurement or analytical tool to quantify and ultimately rank the breadth and scope of impact of individual articles or studies, authors, and/or institutions. However, there are two accepted quantitative measures: number of publications and number of citations. But, the adequacy of both of these measures, taken in isolation in the absence of statistical manipulations, has been questioned (Hirsch, 2005).

In two reviews that attempted to analyze the impact of research on the field of behavior analysis, Hayes and Grundt (1996) and Shabani, Carr, Petursdottir, Esch, and Gillet (2014) reviewed behavior analytic journals, from 1974–2001. The reviews identified authors and institutions that were productive during that time. While the reviews established lists of prolific and influential researchers based on publication rates alone, the reviews did not analyze the impact of research on the field of behavior analysis (e.g., numbers of citations per researcher or institution).

In a study that further extended the conversation regarding research productivity and the quality of graduate training in ABA, Dixon et al. (2015a) asserted that research productivity as measured by the total number of published articles in behavior-analytic journals is a quality metric for analyzing graduate training programs. However, there were several limitations to the data that Dixon et al. (2015a) collected. First, the inclusion criteria (Dixon et al., 2015a, p. 9) excluded several institutions with high enrollment rates. There are several schools (see Part III of this study for a sample) at which prominent and very highly-regarded behavior analysts are faculty and are conducting research. However, given the inclusion criteria set by Dixon et al. (2015a), those publications were not included in their analysis.

Second, Dixon et al. (2015a) only searched in six journals (*Behavior Analysis in Practice* (BAP), *Journal of Applied Behavior Analysis* (JABA), *Journal of the Experimental Analysis of Behavior* (JEAB), *The Analysis of Verbal Behavior* (TAVB), *The Behavior Analyst* (TBA), *The Psychological Record* (TPR)), thus significantly limiting their results. Given that many behavior analysts, including current faculty, publish outside of these six journals, it would seem appropriate to expand on this list to include other journals, book chapters, and books. However, exactly how to expand, and what criteria to set for searches, remains unanswered. But, the fact that there are many high-quality, peer-reviewed

journals that publish single-subject research not on the list from Dixon et al. (2015a) is certain. Part II of the current study was an initial attempt to address this limitation.

Overall, using the total number of publications as a quantifiable metric of scientific impact seems lacking. Simply publishing a paper does not ensure that the research is valued by peers, or that the research adds to the base of knowledge in a given field of study. However, if a published study were cited often in other published research, it would seem likely that the original study had an impact on the field. Further, Kulkarni, Aziz, Shams and Busse (2009) concluded that citation counts can be used to measure the impact of articles, journals, and researchers, and are frequently a criterion when evaluating academic achievement.

Several studies have demonstrated that using citations as a primary point of data in the analysis of the impact of articles, journals, and authors can be appropriate (Naude, Luke, Reed, & Carr, 2005). Van Raan (2005) asserted, "Therefore, application of citation analysis to the entire work, the oeuvre of a group of researchers as a whole over a longer period of time, does yield in many situations a strong indicator of scientific performance" (p. 135). Previous research evaluated the use of citation trends in behavior-analytic journals. Carr and Britton (2003) evaluated both citation trends and impact factors in six behavior analytic journals between 1981–2000. However, this study examined the number of citations alone, without a comparison between the number of citations versus the number of publications.

Hirsch (2005) argued that a statistical index (i.e., an indirectly calculated numerical score that combines numbers of publication and citations of publications published in different journals and across years), as opposed to direct counts of citations and/or publications, is the preferred way of quantifying the impact of individual authors on a specific field. Hirsch stated that, "The publication record of an individual and the citation record are clearly data that contain useful information," however, he argued that those data in isolation are insufficient. While this index is not used in the current analysis, it provides further support for the use of citations as a way to quantify scientific impact. In fact, Google Scholar™ has begun to list the "h" index as a primary piece of data that can be used to measure a researcher's impact.

One significant limitation to any investigation that relies on a direct count of publications and citations is the accuracy of the measurement tool itself. But, given the current state of search technology, there is no flawless methodology to conduct a completely accurate analysis. However, given the results of several comparative studies

(e.g., Kulkarni et al., 2009; Naude et al., 2015), Google Scholar™ appears to result in the most accurate and inclusive search results, particularly when conducting citation analyses. However, some limitations with Google Scholar™ searches include inaccurate search results (e.g., incorrect author names attributed to specific journals), time-sensitive searching (i.e., publication and citation counts continually change), the inclusion of non-peer reviewed sources (e.g., theses), and the possible exclusion of proprietary databases (Harzing, 2008). These are significant limitations to Google Scholar™ and they should not be overlooked when interpreting the data from the current study. Another popular publication and citation tracking tool is ResearchGate. In certain cases (see method), ResearchGate was used to count the number of publications and citations in the current study.

Given the significant limitations that were identified in previous publication and citation analyses, and given the ongoing debate in the field of behavior analysis regarding the appropriate measurement tool and/or metric to adequately quantify research productivity and its impact on the quality of a graduate training program, further analyses were warranted. The purposes of the current investigation were to further extend Dixon et al. (2015a) to include publication and citation counts in all publications and to expand the investigation to include institutions that were not included in Dixon et al. (2015a).

Part I

Method

The same method that Dixon et al. (2015a) used in order to evaluate both the publication rate and impact of faculty teaching at institutions with behavior analysis programs was used for Part I. However, where Dixon et al. (2015a) searched only for the total number of publications, Part I of the current study extended their study by also searching for total number of citations by faculty. Part I of the current study used the same list of faculty as Dixon et al. (2015a).

Google Scholar™ was used to conduct searches for the total numbers of publications and citations for each faculty member in all years up to 2013 in the following journals: *Behavior Analysis in Practice* (BAP), *Journal of Applied Behavior Analysis* (JABA), *Journal of the Experimental Analysis of Behavior* (JEAB), *The Analysis of Verbal Behavior* (TAVB), *The Behavior Analyst* (TBA), *The Psychological Record* (TPR). The searches were conducted between 9/26/2015 and 11/5/2015 by three data collectors.

In order to ensure that the correct authors and publications were searched, an advanced search in Google Scholar™ was used which selected "Return Articles Authored By" and entered the faculty name (including middle initial if available) in quotations. The journal name was entered in the "Return Articles Published In" box. Finally, searches only through 2013 were selected in the second box of the "Return Articles Dated Between." The search in *The Behavior Analyst* returned several false positives (it returned articles also published in *The Behavior Analyst Today*). Therefore, the following string was used to search in *The Behavior Analyst*: "The Behavior Analyst" -"The Behavior Analyst Today."

Trial by trial interobserver agreement (IOA) was obtained for 30% of the faculty that were surveyed. IOA was accomplished by having a second search conducted for randomly selected faculty by an independent observer using the same procedure described above. Every value that was obtained from the second search (number of publication and number of citations for each journal) was compared to the corresponding value from the first search. If the values matched, that "trial" was scored as an agreement. If a value did not match, that trial was scored as a disagreement. The IOA was calculated utilizing the formula of total agreements divided by the total agreements plus disagreements multiplied by 100. Observers agreed in 97% of possible trials (range, 50% to 100%). Unlike assessing simultaneous agreement across observers for the presence of some environmental stimulus (e.g., a behavior) assessing agreement for publication and citation numbers is inherently inexact because the numbers will inevitably change over time as new articles are published and as previously published articles are cited in newly published articles. The secondary searches were conducted between 10/30/15 and 11/8/15.

Results

Dixon et al. (2015a) presented data from the following three analyses: number of publications by program, number of publications by faculty, correlational data between institution and whether the institution was accredited by the Association for Behavior Analysis International (ABAI) or whether the institution offered BCBA supervision. In addition, Dixon et al. (2015a) reported data on the number of publications by institution across journals. For the purposes of the current study, total and average number of publications and citations were determined by faculty and by institution. However, given that the current analysis was focused primarily on a comparison between total numbers of publications and citations, the data for which journals faculty were publishing in were not deemed to be necessary.

Table 1
Top ten institutions ranked by numbers of publications and citations found within top six journals in behavior analysis from Google Scholar™ search

Publications (Total)	Publications (Average per faculty)	Citations (Total)	Citations (Average per faculty)
University of Florida	University of Florida	University of Florida	University of Florida
University of Maryland—Baltimore County	Southern Illinois University	University of Maryland—Baltimore County	University of Nevada—Reno
Western New England University	California State University—Los Angeles	University of Nevada—Reno	University of Maryland—Baltimore County
University of Kansas	West Virginia University	Western New England University	Southern Illinois University
Southern Illinois University	University of Maryland—Baltimore County	University of Kansas	University of Houston—Clearlake
Western Michigan University	University of Houston—Clearlake	Southern Illinois University	California State University—Los Angeles
University of Nevada—Reno	University of Wisconsin—Milwaukee	University of North Texas	Western New England University
West Virginia University	University of Nevada—Reno	Western Michigan University	West Virginia University
University of Wisconsin—Milwaukee	Western New England University	University of Houston—Clearlake	Ohio State University
Florida Institute of Technology	Western Michigan University	Ohio State University	University of South Florida

Table 1 lists the different rankings of institutions according to the following analyses: total number of publications; average number of publications by faculty; total number of citations; average number of citations per faculty. While the rankings are similar, there are several differences to note. Using the ranking by total number of publications

as the primary source of data, the number of agreements (rank position) were calculated for the other three rankings. The average number of publications per faculty ranking agreed in only one position; the total number of citations ranking agreed in two positions; the average number of citations per faculty ranking agreed in two positions. Without considering the exact placement in the top ten ranking, the agreement totals were: the ranking for average number of publications per faculty agreed in eight out of ten possible opportunities; the ranking for total number of citations agreed in seven out of ten possible opportunities; the ranking for average number of citations per faculty agreed in seven out of ten possible opportunities.

Table 2 lists the rankings of individual authors by total number of publications and total number of citations. Using the ranking by total number of publications as the primary source of data, the number of agreements in the total number of citations by rank was one; without considering the exact placement in the top ten ranking, the agreement total was six out of ten opportunities.

Part II

Method

The same method was used for Part II as was used for Part I with the following changes. For all faculty without a naming discrepancy, Google Scholar™ was used to conduct searches for the total numbers of publications and citations for each faculty member in all years up to 2013 with no limitations on the search (e.g., all journals, books, book chapters etc.). If an author had a Google Scholar™ profile, the numbers returned for publications and citations were used. If an author did not have a Google Scholar™ profile, the reviewer counted the citations that were listed for each publication. The searches were conducted between 3/4/2016 and 4/2/2016 by three data collectors.

If the faculty member had a Google Scholar™ profile (*n*=64), the profile was checked to ensure that the profile was for the correct faculty. If the Google Scholar™ profile was not for the correct faculty (*n*=12), the faculty name was marked as a "discrepancy." If the faculty member did not have a middle initial listed, the middle initial was obtained via Google™ searches for the faculty name along with "BCBA" and/or the institution name for the specific faculty member. If the faculty member's middle initial was unable to be obtained, the name was marked as a discrepancy. For each discrepancy (*n*=62), a more detailed search was conducted. Every publication was reviewed

Table 2
Top ten faculty ranked by total numbers of publications and citations (in parentheses) found within the top six journals in behavior analysis from Google Scholar™ search

Publications	Citations
Brian A Iwata (163)	Brian A Iwata (13,410)
Kennon A Lattal (80)	Steven C Hayes (7,702)
Alan Poling (76)	A Charles Catania (4,620)
A Charles Catania (72)	Timothy R Vollmer (4,593)
Timothy R Vollmer (68)	Gregory Hanley (3,649)
Gregory Hanley (66)	Dorothea C Lerman (3,288)
Dorothea C Lerman (61)	Richard Smith (2,549)
Edward K Morris (58)	Nancy A. Neef (2,504)
Steven C Hayes (56)	Louis Hagopian (2,333)
Mark Dixon (54)	Raymond Miltenberger (2,078)

to determine if it was related to human behavior, and if it was, it was counted as a publication and its citations were tallied. All other publications were not counted. Some faculty names (n=5) were too common and could not be searched using Google Scholar™. For those faculty, ResearchGate was used to determine the total number of publications and citations.

Given that the numbers of publications and citations were much larger for Part II, thus increasing the likelihood of miscounts due to simple human error, total agreement per trial IOA was used. A second search was conducted for 33% of randomly selected faculty names. Every faculty name had two trials: number of publications and citations. The total agreement per trial was calculated by dividing the smaller number by the larger number and multiplying by 100. The overall total agreement for publications and citations were then calculated separately by obtaining an average of the trials. The overall agreement for number of publications was 99% (range, 53% to 100%). The overall agreement for number of citations was 99% (range, 86% to 100%). IOA data were collected between 3/4/2016 and 4/3/2016.

Results

Table 3 lists the different rankings of institutions according to the following analyses: total number of publications; average number of publications by faculty; total number of citations; average number

Table 3
Top ten institutions ranked by numbers of publications and citations found in all results from Google Scholar™ search (e.g., all journals, books, book chapters, etc.)

Publications (Total)	Publications (Average per faculty)	Citations (Total)	Citations (Average per faculty)
University of Kansas	University of Texas—Austin	University of Nevada—Reno	University of Florida
Western Michigan University	University of Florida	University of Kansas	University of Nevada—Reno
University of Nevada—Reno	University of Wisconsin—Milwaukee	University of Maryland—Baltimore County	University of Texas—Austin
University of Maryland—Baltimore County	University of Nevada—Reno	University of Florida	University of Georgia
University of Texas—Austin	Western Michigan University	Utah State University	Texas A&M University
Queens College	University of Kansas	Western Michigan University	University of Wisconsin—Milwaukee
University of Wisconsin—Milwaukee	University of Georgia	Western New England University	University of Maryland—Baltimore County
University of Florida	California State University—Los Angeles	University of Texas—Austin	Pennsylvania State University—Harrisburg
Utah State University	Pennsylvania State University—Harrisburg	University of Wisconsin—Milwaukee	University of Kansas
Western New England University	Queens College	Queens College	Utah State University

of citations per faculty. Like the results from Part I, while the rankings are similar, there are several differences to note. Using the ranking by total number of publications as the primary source of data, the number of agreements (rank position) were calculated for the other three rankings. The average number of publications ranking, the total

Table 4
Top ten faculty ranked by total numbers of publications and citations (in parentheses) found in all results from Google Scholar™ search (e.g., all journals, books, book chapters, etc.)

Publications	Citations
Steven C Hayes (469)	Steven C Hayes (46,898)
Mark O'Reilly (457)	Brian A Iwata (17,108)
Alan Poling (320)	Mark O'Reilly (10,687)
Douglas W Woods (286)	Charles R Greenwood (10,339)
Michael C Roberts (259)	A Charles Catania (8,938)
Brian A Iwata (239)	Timothy R Vollmer (6,610)
Peter Sturmey (234)	David L Gast (6,248)
A Charles Catania (203)	Douglas W Woods (5,902)
Charles R Greenwood (187)	Eric M. Vernberg (5,777)
Raymond G. Miltenberger (166)	Raymond G. Miltenberger (5,367)

number of citations, and the average number of citations, didn't agree in any position. Without considering the exact placement in the top 10 ranking, the agreement totals were: the ranking for average number of publications per faculty agreed in six out of ten possible opportunities; the ranking for total number of citations agreed in 10 out of 10 positions; the ranking for average number of citations per faculty agreed in seven out of ten positions.

Table 4 lists the rankings of individual authors by total number of publications and total number of citations. Using the ranking by total number of publications as the primary source of data, the number of agreements in the total number of citations by rank was one; without considering the exact placement in the top 10 ranking, the agreement total was seven out of ten opportunities.

The agreement of the results between Part I and Part II was determined in a similar way as within each Part. The results are presented in Table 5. There was poor agreement between Part I and Part II when calculating agreement according to the exact rank placement of particular institutions and faculty. There was better agreement when comparing the institutions and faculty from each top ten list regardless of their rank placement, however, the agreement was still fairly poor.

Table 5
Comparison of results from Parts I and II

	Top 10 rank order percent agreement (exact)	Top 10 rank order percent agreement (any order)
Publications (total)	0%	70%
Publications (average per faculty)	0%	50%
Citations (total)	0%	50%
Citations (average per faculty)	20%	30%
Publications (individual faculty)	10%	40%
Citations (individual faculty)	0%	50%

Part III

Method

Nine institutions that offer BACB ACS that were not included in the original list from Dixon et al. (2015a) were included in Part III. The nine institutions included in Part III were selected according to the authors' collective impression and knowledge of the programs. Formal inclusion criteria were not used. The names of the faculty that were listed on the institutions' websites were included in the study, with two exceptions. Faculty names were not posted online for Kaplan University or Nova Southern University. For these institutions, faculty names were acquired from the BACB. The same procedures used in Part II (including for faculty names with discrepancies) were used in Part III. Primary data were collected between 3/21/16 and 4/15/16. Interobserver agreement was obtained in the same way as in Part II. The overall agreement for number of publications was 96% (range, 33% to 100%). The overall agreement for number of citations was 86% (range, 0% to 100%). IOA data were collected between 3/18/17 and 3/19/17.

Table 6 lists the rank placement of the 10 institutions included in Part III had they been included in Part II. As one example, had Louisiana State University been included in Part II of the study, the institution would have ranked eighth in total publications and fifth in total citations. Table 7 lists the rank placement of the top 10 faculty by publications and by citations had they been included in Part II. As an example, had Louisiana State University been included in Part II of the study, Frank Gresham would have ranked sixth in total publications and second in total citations.

Table 6
Rank placement of 9 institutions relative to Part II (any publication—see Table 3)

	Rank			
Institution Name	Publications (Total)	Publications (Average per faculty)	Citations (Total)	Citations (Average per faculty)
Arizona State University	19	18	26	40
Central Michigan University	45	47	40	47
Elms College	72	72	62	63
Endicott College	14	29	12	27
Fitchburg State University	72	73	72	71
Kaplan University	39	63	39	58
Louisiana State University	8	5	5	3
Northeastern University	5	28	11	32
Nova Southeastern University	27	50	21	36

Table 7
Rank placement of the top 10 faculty of 10 institutions that were not included in Part II (any publication—see Table 4) by total numbers of citations and publications (in parentheses) relative to the results from Part II

Rank			
Publications		Citations	
5	Robert Volpe (289)	2	Frank M Gresham (17,841)
6	Frank M Gresham (269)	14	F. Charles Mace (4,250)
26	F. Charles Mace (101)	15	Michael F. Dorsey (4,055)
32	Michael P. Brady (86)	19	George H. Noell (3,622)
41	George H. Noell (75)	41	Karin Lifter (2,269)
45	Emanuel Mason (73)	46	Robert Volpe (1,885)
56	Mark L. Kelley (59)	51	Mark L. Kelley (1,736)
66	Jonathan Tarbox (52)	55	Michael P. Brady (1,609)
78	Mary Jane Weiss (43)	65	Mary Jane Weiss (1,227)
86	Edward Cumella (38)	79	Emanuel Mason (1,038)

Several reviewers noted that many publications found in Part III were books or book chapters and not journal articles and that many articles were not published in ABA journals. In addition, other fields publish at much higher rates than the field of behavior analysis, which also leads to higher numbers of citations. This discrepancy between publication and citation rates was clearly illustrated with the current data.

General Discussion

The value of the scientist-practitioner model to ABA is one that doesn't appear to be debatable. When presented with a novel problem behavior or skill deficit, systematically demonstrating that there is a functional relation between treatment and behavioral outcomes is immeasurably valuable. In applied settings, there are reasonable ethical limitations to this demonstration (e.g., withdrawing an effective treatment simply to prove that that treatment was responsible for the behavior change), however, whenever possible, applied behavior analysts can and should attempt to demonstrate these functional relations. However, the current state of training in graduate programs in ABA raises a question about how a practitioner might learn these essential skills (see Shawler et al., 2018).

Dixon et al. (2015a) stated that their data were "presented not to serve as the final word on research productivity and its disparity across BACB training programs, but rather as a starting point for critical discussions in our field" (p. 15). The current authors agree. The data presented in the current study are intended to contribute to that discussion by further analyzing the impact of research on the field of ABA. These critical discussions have begun with the presentation of objective data (i.e., counts of publications and citations). The data also support the recommendations made from previous citation analyses (Hirsch, 2005) that publication and citation counts are insufficient in isolation to adequately represent the impact of individual articles, authors, and/or institutions. In order to better understand how factors such as numbers of publications and citations can be used to objectively determine future information, further research on statistical indices of impact (e.g, "h" index) are recommended.

The results from Part I of this study suggest that when one expands an investigation of research productivity to include both total numbers of publications and citations, the exact rank order of institutions changes, but not significantly. One conclusion made from these results might be to assume that publication rates are sufficient to de-

termine the research productivity of an institution. However, it is clear that using a top 10 ranking system might not result in the most clarity for the consumer of such data. In addition, given that Part I excluded all but six journals from the analysis, and given that behavior analysts do publish in more than those six journals, the results should be considered to be very limited.

The results from Part II showed that there was significant disagreement between top 10 lists between Part I and Part II (Table 5). These results demonstrate that when all publications are included in search criteria, the top 10 rankings of institutions and faculty are very different. Given that many faculty are publishing in journals outside of the six journals included in Dixon et al. (2015a), these data suggest that searching in all journals, and including books and book chapters (often written based on published research), is recommended. It was noted by the reviewers in the current study that citation rates in ABA journals are generally much lower than citation rates in other journals. Therefore, the results from Parts I (and from Dixon et al., 2015a) and Part II of the current study would be expected to be very different.

Dixon et al. (2015a) stated that their "analyses focused on graduate-level behavior analysis university training programs located in the USA that offer a BACB-approved course sequence" (p. 9). Specifically, they included faculty at institutions with BACB-approved coursework sequences at institutions that listed "behavior analysis" or "applied behavior analysis" as the academic department, and/or programs that were listed in a pass rate analysis conducted by the BACB (BACB, 2015) and/or programs that were accredited by ABAI prior to 2015. The data presented from Part I of the current study extended the results from Dixon et al. (2015a), with the same list of faculty. However, the criteria undoubtedly excluded many authors from both publication and citation analyses, which resulted in data that are not reflective of the scope and influence of their research and publications. This limitation prompted the current authors to conduct Part III of this study.

The limited results from Part III of the current study add some interesting data to the discussion of ranking graduate programs. Two programs that have been approved by the BACB would have ranked in the top 10 lists for total publications and/or citations had they been included in the original analysis. While the inclusion criteria set by Dixon et al. (2015a) made sense for the purposes of their arguments, it seems that a more inclusive criteria would allow for a more comprehensive analysis of the impact of research across the field of behavior analysis. Future research should expand the list of faculty to include all faculty who are employed at institutions with BACB ACS. In addition, future research might look to include prominent behavior

analysts who are conducting research who are not affiliated with an academic institution.

A limitation to Dixon et al. (2015a) noted by Wilder, Lipschultz, Kelley, Rey, and Enderli (2015) was that the review only looked at studies that were published up to 2013. Wilder et al. (2015) argued that this limitation might favor more established programs and exclude newer programs. The current study did not address this concern, but there is no reason that future studies can't look at all articles without publication year constraints. Another limitation noted by Wilder et al. (2015) was that Dixon et al. (2015a) didn't exclude articles based on whether the publication included empirical research; however, the authors noted this exclusion criteria was then, in turn, a limitation to their own study. Again, this concern was not addressed in the current study, however, should be addressed by future investigators. Finally, given the different ways that research productivity and scientific impact can be measured and assessed, Wilder et al. (2015) suggested that the field of behavior analysis first determine, "which data are most meaningful to consumers and then routinely collect and report these data in our professional journals" (p. 157). The survey recently completed by Shawler et al. (2018) represents an initial step to further clarify the data that are important to potential graduate students.

In a review of critiques to Dixon et al. (2015a), Dixon, Reed, Smith, Belisle, and Jackson (2015b) made several conclusions and recommendations. The most important, according to the current authors, is that all future discussion regarding the quality of graduate programs must be supported by data. Without accurate data on research productivity (in whatever form is deemed the most appropriate), potential graduate students must rely on the reputation of faculty and/or institutions when making a decision regarding the quality of particular graduate training programs (see Shawler et al., 2018). The current authors agree, and strongly encourage the field of behavior analysis to continue to collect data on research productivity.

If the field of ABA agrees that publication and citation data are important, the BACB might consider requiring all faculty who teach courses in an ACS to update publication and citation data either via Google Scholar™ (or a similar tracking site), or directly on the BACB website (e.g., link back to Google Scholar™, or other approved tracking site). As potential applicants attempt to discriminate among a growing number of graduate programs in ABA, this type of one-click access to this data would conceivably be helpful. In addition, if the faculty included differential data on publications and citations in a given area of research, the potential applicant would have very detailed information about a given graduate program generally, and faculty mem-

ber specifically. A survey by Shawler et al. (2018) found that the research interests of a potential faculty member that a graduate student would apply to work with, was the most important factor when selecting a graduate school program. Also, considering the amount of time it took to complete the current study, it isn't reasonable to expect studies of this scope to be completed very often. Therefore, the data and rankings would most likely not be updated frequently, and requiring faculty to keep their own lists of publications and citations up to date would be a reasonable way to ensure that the data are easily accessible.

The primary limitation to this study is a technical one. As noted earlier, Google Scholar™ is a powerful and easy to use tool for conducting this type of review. However, it has fundamental limitations. One of the limitations is that it can result in inaccurate results (e.g., names, maiden names etc.) Another limitation is that there is no known way to ensure that any list of faculty is accurate at any given moment in time. The reviewers in this study noted that there were several faculty who were listed as affiliated with one university according to the source list, however, upon searching for the faculty name it was apparent that the faculty member was actually affiliated with a different institution. In order to provide up-to-date research productivity measures across institutions, lists of faculty and their affiliations must also be current. Given that the BACB sets the regulations for the qualifications of ACS program faculty, it would seem reasonable for the BACB to maintain such a list and make it public.

Dixon et al. (2015a), Wilder et al. (2015), and the current study provided very general data on numbers of publications and citations given a list of faculty and a corresponding institution. Given the very nature of these types of reviews, and the many limitations already noted, it would seem that further data collection and analysis are warranted. Future research should look at the following areas to expand and refine the analyses to date. First: future research productivity and impact analyses should include all faculty at all BACB ACS institutions, across all journals. Second: future research could analyze publications for a faculty if they were the first or second author on an article. Third: analyze the difference in publication and citation numbers across faculty with Master's versus Doctorate degrees. This information might be relevant to the field and might also be used to provide categorical information about who is actually conducting research. Fourth: analyze the influence of the most cited articles in behavior analysis on actual clinical practices. Fifth: analyze rates of publications and citations per faculty and institution according to periods of time. These types of data would provide both the field of ABA in general, and

potential graduate students specifically, with more relevant and current information about which faculty and which institutions are currently conducting research. Finally, the results from Shawler et al. (2018) should be replicated and extended to continue to survey researchers and practitioners in ABA to determine the current state of the scientist-practitioner model as well as how it relates to the selection of graduate schools.

The discussions and debates regarding the impact of research have been occurring for decades, however, a single agreed-upon quantitative measure and/or method of statistical analysis of the impact have not been determined. One of the reasons for this lack of clarity is that it is extremely difficult to operationally define the phenomenon of impact of scientific research. However, some components of that phenomenon appear to be measurable, including numbers of publications and numbers of citations. The results of the current research suggest that, while an analysis that includes counting citations is challenging and labor-intensive, simple counts of publications are insufficient. Finally, for research impact in any scientific field to be effectively assessed, the inclusion criteria for the assessment itself must also be appropriately defined and agreed-upon by each given field of study.

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