Experimental Analysis of Behavior Readings Assigned by Accredited Master's Degree Programs in Behavior Analysis

Ellie Kazemi¹ · Tara A. Fahmie¹ · Sigmund Eldevik²

Published online: 12 November 2018

© Association for Behavior Analysis International 2018

Abstract

Although a foundation in the basic science of behavior represents a common goal of practitioners and educators of behavior analysis, the content covered in master's degree-level courses on the experimental analysis of behavior (EAB) can vary widely across university programs. The purpose of our study was to analyze the syllabi of master's degree programs accredited by the Association for Behavior Analysis International to develop a list of common readings and topics in EAB coursework that might be useful for curricular development. We identified the most frequently cited references, journals, and participant characteristics. We found commonalities among the syllabi with regard to the types of readings assigned and the topics covered. We discussed our findings in terms of current trends in EAB and quality graduate training in behavior analysis.

Keywords Basic science · Essential readings · Experimental analysis of behavior · Graduate training

Applied behavior analysis (ABA) is firmly rooted in the basic principles of the experimental analysis of behavior (EAB; Baer, Wolf, & Risley, 1968). Individuals who have successful histories in both recognize the importance of training in EAB for emerging practitioners of ABA. For instance, Sidman (2011) stated that “the scientist-practitioner who appreciates the relation between what he or she is doing and what basic experimenters do as a consequence will be able to apply therapeutic techniques more creatively and effectively” (p. 974). Training programs in ABA adopt this viewpoint when they require a separate course or extensive readings in EAB at the master's degree level. However, there is currently no standard or governing body that suggests curricular requirements for adequate training in EAB, despite its importance in behavior analysis.

At this time, graduate training programs in ABA primarily look to two governing boards for guidance during curricular

development: the Behavior Analyst Certification Board (BACB) and the Association for Behavior Analysis International (ABAI) Accreditation Board. The BACB publishes task lists through a process called a job analysis, which involves hosting focused group meetings with subject matter experts who develop the initial list. Then, the BACB verifies the content through large-scale surveys of Board Certified Behavior Analysts before publishing each revision of the task list (BACB, 2017). However, graduate programs can cover the BACB task list items in their coursework with peripheral exposure to EAB. The ABAI Accreditation Board, on the other hand, provides a bit more direction for curricular development in EAB in that it requires 45 h of basic behavior analysis at the master's degree level. According to the *ABAI Accreditation Handbook*, the overarching purpose of the required content is “to develop competence in understanding how principles of behavior are discovered and described in the context of basic research” (ABAI, 2017, Section 9-9-107). However, the ABAI Accreditation Board also provides a great deal of flexibility regarding what content meets this requirement at this time.

One way to address the potential challenge with curricular choices is to survey the syllabi of EAB coursework from graduate programs that are ABAI accredited and have therefore successfully integrated 45 h of basic behavior analysis at the master's degree level. Such a survey would identify a list of common readings assigned by instructors,

✉ Ellie Kazemi
ellie.kazemi@csun.edu

¹ Psychology Department, California State University, Northridge, 18111 Nordhoff St, Northridge, CA 91330-8255, USA

² Department of Behavioral Science, Oslo and Akershus University College of Applied Sciences, Oslo, Norway

reveal trends in categories of EAB research assigned to master's students, and potentially provide guidance to programs that wish to adjust and align curricula toward a minimum common core of EAB readings. Such an approach was used recently by Pastrana et al. (2016), who conducted an analysis of syllabi from the BACB-approved course sequences with certification exam pass rates of 80% or above in 2014. Assigned readings were categorized into eight content areas, and results revealed several books (e.g., Bailey & Burch, 2011; Cooper, Heron, & Heward, 2007) and articles (e.g., Baer et al., 1968; Iwata, Dorsey, Slifer, Bauman, & Richman, 1994) that were required across many courses of the 20 participating institutions. Though the BACB does not require a separate course in EAB, some of the readings contained in the syllabi, especially in the area of “concepts and principles of behavior analysis,” may have been aligned with an EAB emphasis.

A related analysis was conducted by Saville, Beal, and Buskist (2002), who surveyed the editorial boards of the *Journal of the Experimental Analysis of Behavior (JEAB)* and the *Journal of Applied Behavior Analysis (JABA)* to create an “essential reading list” for graduate training in behavior analysis. Both the *JEAB* and *JABA* editorial boards recognized Skinner's writings, as well as research-methods texts (e.g., Johnston & Pennypacker, 1993; Sidman, 1960), as “essential” (listed by at least 25% of participants of the survey), supporting the aforementioned viewpoint described by Sidman (2011). Although this analysis had a heavier emphasis on EAB compared to the one conducted by Pastrana et al. (2016), it is unclear whether the nominations of editorial board members align with the curricular decisions being made by current training programs. Thus, one way to extend the analyses of both Pastrana et al. (2016) and Saville et al. (2002) is to survey the syllabi of programs that explicitly incorporate EAB into a curriculum for emerging scientist-practitioners. The ABAI Accreditation Board provides one such outlet.

Thus, the purpose of the current analysis was threefold. First, we compiled a list of assigned readings in EAB coursework within ABAI-accredited master's degree training programs. Second, we used this list to assess EAB topics that were commonly addressed through the readings. Third, we identified various characteristics (e.g., type of primary source, proportion of studies that involved human participants) of our sample.

Method

Selection Procedures

Training Programs We obtained a complete list of accredited master's degree programs (ABAI, 2015). Subsequently, we reviewed the website for each program to identify (a) the e-mail address of a correspondent and (b) the course numbers

for potential courses meeting the “Basic Behavior Analysis” (i.e., EAB) requirement of the ABAI Accreditation Board. All of the potential EAB courses we identified in the initial web search were subsequently confirmed by the program correspondent (typically the program coordinator, director, or instructor of the EAB course). Thus, each EAB course was self-identified or confirmed by the accredited programs themselves.

Syllabi Identification Two research assistants e-mailed the correspondent of each program, explained the nature of the project, and requested access to the most recent syllabus or reading list for the course(s) that met the requirement. In the e-mail, recipients were informed that identifying information (i.e., the name of the faculty and the university) would not be published and that the study was deemed exempt by California State University of Northridge's institutional review board.

Reading Lists We developed a database of the titles of books, chapters, and journals, as well as the names of all authors, for all assigned readings. To do this, the research assistants obtained the e-mailed attachments, independently cited the readings from the syllabi/lists by adhering to the formatting requirements of the *Publication Manual of the American Psychological Association* (6th ed.; APA, 2010, hereafter *APA Manual*), and then entered all citations into an Excel file. The first and second author compared the two Excel files and noted any discrepancies between the reading lists. The first author subsequently reviewed all discrepancies and referenced the syllabi to create the final Excel document used in the analysis. The second author then entered five (31%) randomly sampled syllabi (146 references; 33.33%) on a separate Excel file and assessed her agreement with the first author's reading list. Agreement was calculated by dividing the number of matching readings by the number of total readings per syllabus. Agreement was 100% across all sampled syllabi.

Coding Procedures

Required, Suggested, and Exposure Readings When extracting references from syllabi and reading lists, we encountered three distinct categories of instructor assignment: required, suggested, and exposure. We coded a reading as *required* if the author of the syllabus specifically titled it as such or if the reading did not meet one of the definitions for the other two categories. That is, we defaulted to coding a reading as required when not otherwise indicated. In addition, all readings sent as a “reading list” were coded as required when a syllabus was not obtained. We coded a reading as *suggested* if the author of the syllabus titled it “suggested,” “recommended,” or “optional.” We coded a reading as *exposure* if the author of the syllabus specified that some,

but not all, students in the class were required to read the reference. Examples of this latter category were when the instructor required a reading for a subgroup of students (e.g., discussion leaders) or for a specific assignment for which students could have selected readings from a pool of references.

Titles, Authors, and Classifications We gave each first author of a reference a unique code number to identify his or her frequency of first-authored publications. Then, we identified the number of times that author appeared in any authorship position other than as first author. We classified readings as *empirical*, *review*, *conceptual*, *comment/editorial* (replies and editorials), *book* (chapters or whole books), and *other* (e.g., symposium presentations/videos). We used the descriptions outlined in the *APA Manual* to identify the different types of articles (APA, 2010). We coded a reading as *empirical* if it was a report of original research and consisted of method, results, and discussion sections that were based on the collection and analysis of data. We coded a reading as a literature *review* if it was referenced as such in the title or if the authors had provided a summary and critical evaluations of a body of research that had already been published. We identified all articles in which the authors drew on existing literature to advance theory or understanding of a concept as *conceptual*. We then categorized the subject pools in each *empirical* article as human or nonhuman (i.e., *animal*) subjects. We further divided the human category into participants who were *typically developing* (no particular clinical diagnosis was mentioned; these were usually college students), *atypically developing* (diagnosis of developmental disabilities, including autism, was mentioned by the authors), *other atypical* populations (e.g., participants who presented with obesity, delinquency, gambling, smoking, or other health problems, such as visual impairment), and *both atypical and typical* populations (e.g., authors compared atypically to typically developing children, or individuals with gambling problems to individuals without).

Topics We assigned all readings an EAB topic area based on the following features of the reference: title, abstract, keywords, and content. The basis for each topic area was a behavioral principle (e.g., punishment), theory (e.g., relational frame), or distinct application (e.g., self-control). When an article applied to our understanding of the field or behavior in general, we classified the reading as *general*. Also, if a citation was an entire book, we coded the topic as *general*. However, if the citation was a select chapter from a book, we coded the topic addressed in the chapter. A few topic areas were a combination of keywords that naturally co-occurred in the readings (e.g., *choice/behavioral economics/self-control*). For these areas, creating more distinct topics by isolating the keywords would have resulted in a reading being assigned

more than one topic area with equal weight. Instead, we assigned each reading a single topic area to avoid the subjectivity of weighting co-occurring topics. For example, we coded the chapter titled “The Translational Utility of Behavioral Economics: The Experimental Analysis of Consumption and Choice” by Hursh, Madden, Spiga, DeLeon, and Francisco (2013) as *choice/behavioral economics/self-control*.

Interrater Agreement For all categories other than the topic area, a graduate research assistant coded the information from all of the syllabi and discussed with the first author the coding for any reading that was unclear to him (this was less than 2% of the readings). The first author then randomly selected an average of 35% of the readings across the categories and independently coded them. Interrater agreement was 100% and calculated by dividing the number of matching categories by the number of total categories. For the topic area, we assessed agreement on the assignments of a topic area to each reading by comparing the original assignment done by the second author to that done independently by the third author on 35% of the readings. We computed the percentage of agreement by dividing the number of agreements with the number of agreements and disagreements and multiplying by 100. Agreement for the topic area category was 87%.

Results

We obtained syllabi from 14 of the 20 (70%) accredited master’s degree programs listed on the ABAI website; 6 of the 20 programs (i.e., 30%) were not included in the analysis because they either did not respond to our request within 6 months (three programs) or because they reported that their course was under construction and could not be shared publicly (three programs). In an effort to obtain as many syllabi as possible, we sent at least two follow-up e-mails to various individuals affiliated with the program following the first correspondence. Two programs self-identified that they had two different EAB courses required at the master’s degree level that met the ABAI accreditation requirements and provided us with syllabi for both, which led to 16 distinct EAB courses across 14 programs.

We identified a total of 438 references in the 16 EAB coursework syllabi from the 14 ABAI-approved training programs. Of the 438 references, 238 (54.3%) were assigned only once; an additional 30 were assigned more than once (range = 2–5) across courses, which yielded 268 distinct references. When applicable, we removed overlapping readings in syllabi that were submitted by the same training program. Of the 438 references, 399 (91.1%) were required, 15 (3.4%) were suggested as supplemental, and 24 (5.5%) were readings to which some, but not all, of the students were

exposed through group projects or assignments. We found a wide range ($M = 27.38$, $Mdn = 24$, $SD = 26.37$, range = 1–89) in the number of readings assigned per syllabus. We found that the six syllabi with low citation counts (i.e., six syllabi had less than 10 readings) all referenced a book (except one that was written by the course instructor); four of these six syllabi referenced Pierce and Cheney (2013).

Most Frequently Assigned Readings in EAB

Across syllabi, 12 (75%) referenced at least one book, with a range of one to six books, and various numbers of chapters were assigned from each book. Across references, 374 (85.4%) were journal articles, with a total of 63 different journals represented. Of those journals, 41 (65.1%) were cited just once, 6 (9.5%) were cited twice, and 16 (25.4%) were cited more than twice. The top five most cited journals were *JEAB* (42.3%), *JABA* (22.3%), *The Behavior Analyst* (7.2%), *Behavior and Social Issues* (2.4%), and *The Psychological Record* (2.1%).

Table 1 lists the references that were cited at least three or more times. We found that Catania's (2013) *Learning* was the most cited book, followed by Pierce and Cheney's *Behavior Analysis and Learning* (2013) and the *APA Handbook of Behavior Analysis* edited by Madden (2012). It is important to note that only chapters from the *APA Handbook* were assigned, whereas the whole book was assigned with the other two texts. The five most cited articles were Hursh (1984) on behavioral economics; Azrin, Holz, and Hake (1963) on fixed-ratio punishment; Laraway, Snycerski, Michael, and Poling (2003) on motivating operations; Hackenberg (2009) on token reinforcement; and Rachlin and Green (1972) on commitment, choice, and self-control.

We also wondered whether any first authors were frequently represented in the syllabi but would not have made it to the most cited reference list (Table 1) because they

contributed a variety of publications. Therefore, we counted the number of times an author was cited. We also identified authors' prevalence across syllabi and programs to account for the likelihood that one course may have assigned many publications from the same author. Not surprisingly, the most frequently cited first author was Skinner. He was represented in a little less than half of the syllabi (i.e., seven syllabi in six different graduate programs) and cited between one and six times in each syllabus. The next five most referenced authors were Catania, Nevin, Poling, Hayes, and Lattal, listed in order of the highest number of first-authored publications cited.

Most Frequently Assigned Topics in EAB Coursework

Table 2 contains a complete overview of the topic areas represented, the source types, and the makeup of participants for empirical readings. We identified 25 distinct topic areas across the 438 readings. Three training programs solely assigned a general book (e.g., Catania's *Learning*, 2013, or Pierce & Cheney's *Behavior Analysis and Learning*, 2013). Three other programs that had assigned less than five different sources supplemented a general book with topic areas that were not covered by the two most cited textbooks. The supplemental readings covered areas such as motivating operations; higher cognition (e.g., animal model of interpersonal communication, creativity, problem solving); biology, physiology, and neuroscience; drugs and behavioral pharmacology; and relational frame theory (RFT) and acceptance and commitment therapy (ACT; see Table 2).

The three most frequently assigned topics were *choice/behavioral economics/self-control* (15.5% of the readings), *general topics addressing more than one principle or referring to the history of the profession* (15.1%), and *operant conditioning/reinforcement (includes extinction)* (7.5%). The three least frequently assigned topics were *operant-respondent interactions* (0.2%), *law of effect* (0.2%), and *habituation* (0.5%). We classified 224 (51%) of the readings as *empirical*, 52 (12%) as *review*, 47 (11%) as *conceptual*, 60 (14%) as *chapter/book*, 53 (12%) as *comment/editorial* (which included replies and editorials), and 2 (0.005%) as *other* (e.g., symposium presentations/videos). Of the 224 readings that were *empirical* in nature, 82 (37%) were with nonhuman animals (e.g., pigeons, rats). Of the 142 remaining articles that involved human participants, 56 (25%) were with *typically developing* individuals, 46 (21%) were with *atypically developing* individuals (e.g., individuals with autism), 24 (11%) included *both atypical and typical* participants, and 16 (7%) included *other atypical* populations (e.g., individuals with gambling problems). Table 3 summarizes the three most assigned readings in each of these eight topic areas containing over 20 references. Our primary variable was the number of times the reading was assigned. However, often, readings were assigned only once. In such

Table 1 Common readings in EAB, as indicated by the frequency (N) of citation across syllabi

Readings	N	R	S	E
Catania (2007)	5	4	1	0
Pierce and Cheney (2013)	4	4	0	0
Madden (2012)	4	4	0	0
Hursh (1984)	4	3	1	0
Azrin et al. (1963)	3	3	0	0
Laraway et al. (2003)	3	2	1	0
Hackenberg (2009)	3	3	0	0
Rachlin and Green (1972)	3	1	1	1

Readings were coded as either required (R), suggested (S), or exposure (E)

Table 2 The number of readings and source type (Top) and the type of participants in empirical papers (Bottom) across all of the topic areas

Source Type (438 readings)	Choice/Behavioral Economics/Self-control	General/History/Book/Book reviews	Reinforcement and Extinction	Stimulus control	Relational Frame Theory/ACT	Response properties	Schedules of Sr	Assessment/Treatment of problem behavior	Punishment	Equivalence	Verbal Behavior	Token/Conditioned Sr	Drug/Behavioral Pharmacology	Higher Cognition	Motivating operations	Biologiy/Neurology/Neuroscience	Respondent conditioning	Rule Governance	Ethics/Social issues	Shaping	Avoidance	Chaining	Habituation	Law of Effect	Operant-respondent interactions	Total	Percentage
Empirical	44	1	17	25	13	12	13	20	15	11	10	5	6	6	3	0	2	7	2	4	3	3	2	0	0	224	51
Review	8	5	3	0	6	6	2	1	2	1	1	1	7	2	0	5	3	0	0	0	0	0	0	0	0	52	12
Conceptual	6	7	6	2	1	4	2	0	1	1	1	1	4	0	1	4	1	0	2	1	1	0	0	1	0	47	11
Chapter/book	4	34	4	0	5	2	3	0	1	0	1	0	0	2	0	1	2	0	0	0	0	0	0	0	1	60	14
Comment/Editorial	6	19	3	1	1	2	3	0	0	2	1	0	0	3	3	5	2	0	1	1	0	0	0	0	0	53	12
Other (video/symposia)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	2	0
Total	68	66	33	28	26	26	23	21	19	15	14	13	12	12	12	10	10	7	6	6	4	3	2	1	1	438	100
Percentage	15.5	15.1	7.5	6.4	5.9	5.9	5.3	4.8	4.3	3.4	3.2	3.0	2.7	2.7	2.7	2.3	2.3	1.6	1.4	1.4	0.9	0.7	0.5	0.2	0.2	100.0	
Participants (224 empirical papers)																											
Animal	16	1	9	15	0	5	6	0	9	0	2	3	5	3	0	0	1	0	1	3	1	0	2	0	0	82	37
Typical	12	0	1	5	9	1	2	0	2	9	4	0	1	0	0	0	1	7	1	0	0	0	0	0	0	56	25
Atypical Development	7	0	2	2	0	5	2	15	1	1	4	0	0	0	3	0	0	0	0	1	0	3	0	0	0	46	21
Other atypical	2	0	2	1	4	0	1	4	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	16	7
Both Atypical and Typical	7	0	3	2	0	1	2	0	3	0	0	1	0	3	0	0	0	0	0	0	2	0	0	0	0	24	11
Total	44	1	17	25	13	12	13	19	15	11	10	5	6	6	3	0	2	7	2	4	3	3	2	0	0	224	100
Percentage	19.6	0.4	7.6	11.2	5.8	5.4	5.8	8.5	6.7	4.9	4.5	2.2	2.7	2.7	1.3	0.0	0.9	3.1	0.9	1.8	1.3	1.3	0.9	0.0	0.0	99.6	

Table 3 The top three readings in each of the top topic areas assigned. The primary variable was the number of times assigned. In case of a tie, we used the number of times cited on Google Scholar

Topic area Readings	Number of readings (percentage of total)	Assigned	Cited*
Choice/Behavioral Economics/Self-control	68 (15.5%)		
Hursh (1984)		3	552
Mazur & Logue (1978)		2	338
Rachlin & Green (1972)		1	1228
General/History/Book/Book reviews	66 (15.1%)		
Catania (2007)		5	55
Skinner (1974)		1	7437
Skinner (1938)		1	1626
Operant conditioning/Reinforcement (includes extinction)	33 (7.5%)		
Perone (2003)		2	115
Breland & Breland (1961)		1	1472
Skinner (1953)		1	793
Stimulus control /Discrimination /Generalization	28 (6.4%)		
Lattal & Doepke (2001)		2	48
Sidman & Tailby (1982)		1	1786
Terrace (1963)		1	859
Response properties (includes response variability, resistance to extinction momentum, strength, etc.)	26 (5.9%)		
Hernstein (1961)		1	2330
Dewey (1896)		1	2138
Nevin (1974)		1	415
ACT/RFT	26 (5.9%)		
Hayes, Barnes-Holmes, & Roche (2001)		1	2428
Bach & Hayes (2002)		1	1013
Hayes (2004)		1	560
Schedules of Sr (includes NCR and superstitious behavior)	23 (5.3%)		
Fleshler & Hoffinan (1962)		1	1019
Zeiler (1977)		1	323
Falk (1966)		1	209
Assessment/Treatment of problem behavior	21 (4.8%)		
Lesieur & Blume (1987)		1	2898
Carr & Durand (1985)		1	2160
Iwata, Dorsey, Slifer, Bauman, & Richman (1994)		1	1969

*Retrieved from Google Scholar, January 14, 2018

cases, or when there was a tie, we used the number of times the reading was cited on Google Scholar to determine our ranking.

Discussion

Currently, governing boards provide some direction regarding course content to graduate training programs in behavior analysis, but there is no consensus or specific task list for EAB coursework. In this article, we set out to compile a list of commonly assigned readings in EAB

based on syllabi from ABAI-accredited master's degree programs. We chose to reach out to accredited programs only because an EAB course was required for accreditation and we wanted to see if there was convergent content for the course across programs. We were able to obtain syllabi from 70% of the 20 accredited programs. Even though we hoped that using accredited programs would enable us to identify core readings from model programs that other universities may wish to emulate, the scarcity of accredited programs and our small sample size bring the generality of our results into question and limit our interpretations.

Furthermore, there was much variability among the sample of syllabi with regard to the total number of assigned readings, which means syllabi with higher reading counts are more represented in our data. Therefore, similar to Pastrana et al. (2016), who only included 20 institutions with BACB verified course sequences in their analyses, we advise readers looking to develop syllabi or curricula to utilize our findings as one resource among more comprehensive strategies for selecting content and assigned readings. Currently there is no objective method to determine what should and should not be taught in an EAB course; therefore, our findings are just descriptive and not prescriptive. Last, we did not summarize the training and experience of instructors of EAB courses to ensure their anonymity as per our human subjects committee protocol. Therefore, there may be variability in their expertise, which would influence our findings.

Notwithstanding the aforementioned limitations that readers should consider during interpretation of our results, we found a few commonalities across courses that may be helpful to individuals interested in EAB training and faculty developing EAB coursework for behavior analysis graduate programming. First, we learned that the majority of faculty assigned at least one book, and certain books on learning (i.e., Catania, 2007; Pierce & Cheney, 2013) were more frequently cited than others. Also, select chapters (e.g., Pavlovian conditioning, operant variability) from the relatively new *APA Handbook of Behavior Analysis* were commonly assigned. We noticed that, in addition to the textbooks, faculty assigned journal articles, and articles from *JEAB* made up nearly half of the sample of assigned journal articles. The most frequently assigned articles covered topics in behavioral economics, choice, punishment, motivating operations, and token economies. We also provided the most cited references among the top eight EAB areas.

Although we found the content of the reading lists to be quite variable across programs, we were able to identify 25 common focal topics. Comparing our list of topics to the table of contents of the two most cited books (i.e., Catania, 2007; Pierce & Cheney, 2013), we did not find any topic in EAB that was missing per se. We note some topics were less frequently assigned (e.g., operant-respondent interactions or habituation), but this finding may be because these topics are covered in other coursework. We did notice, however, that instructors often assigned topics that are either applied (e.g., assessment and treatment of problem behavior, ethics) or subspecialties (e.g., stimulus equivalence, RFT, behavioral neuroscience) in behavior analysis.

The additional applied content is not surprising given the fact that most master's-level graduate programs have an applied focus, and it is likely that EAB courses within those programs have adapted to the needs of their students. Given the nature of our analyses, it is difficult to ascertain if the applied readings reflect a blurring of distinctions between

ABA and EAB or if they are a result of the faculties' efforts to relate the outcomes of EAB research to practice. The applied focus of the programs also may be responsible for the higher selection of empirical research conducted with human subjects. A brief search of *JEAB* revealed that an average of 50% of the experiments published in 2017 involved nonhuman animals compared to 37% of the experiments in our reading list. However, this finding is to be taken with caution because we did not differentiate between human-operant and applied research. Additionally, there is some evidence that human-operant research (also referred to as experimental analysis of human behavior) may be on the rise and likely to be published in journals outside of *JEAB* (see Dymond & Critchfield, 2002). Our findings may also be indicative of general approaches to EAB training or citation trends in the field (see, e.g., Critchfield et al., 2000).

Alternatively, it is possible that the list of readings and the frequency of the assigned topic areas reflect the faculty expertise and hiring trends as universities struggle to maintain animal laboratories. The prevalence of the subspecialties and the diversity in the readings that were assigned are most likely reflective of the wide range of faculty expertise (e.g., stimulus equivalence, RFT, behavioral economics) and the differences between university programs that contributed to our sample. Thus, we find this outcome neither surprising nor problematic given the breadth of topics in the basic science of behavior. However, with such breadth, if the accreditation board deems training in EAB as quintessential for behavior analysts, it is clear that university programs will need more focused standards and clear directions regarding the EAB content that should be covered in such coursework.

In addition to the topics, we wanted to determine if particular authors were cited more frequently and to assess the degree to which emerging behavior analysts were required to read original work from Skinner, the founder of behavior analysis (Morris, Smith, & Altus, 2005). We found the most frequently cited authors to be Skinner, Catania, Nevin, Poling, Hayes, and Lattal. Skinner was the most frequently cited first author across syllabi, but his writings were assigned in fewer than half of the courses. No single reference from Skinner was frequently cited (Table 1), a finding that stands in contrast with the essential reading list produced by *JEAB* editors (Saville et al., 2002). However, these two analyses differed in both mission and method. That is, there is a difference between asking scholars to nominate essential readings in behavior analysis (as was done by Saville et al., 2002) and analyzing actual readings assigned in EAB syllabi (as was done in the current analysis).

It is more likely that the results of our study are influenced by both student outcomes and other curricular requirements given the nature of our data collection. For example, the achievement of, or feedback from, master's-level students may have influenced faculty selection of Skinner's writing

over time. Alternatively, programs may be assigning Skinner's work earlier in their course sequence (perhaps in a course that meets the ABAI's "Principles of Behavior" requirement). Although the nature of our study does not help in answering some of these questions, our results shed light on an important issue in curricular development. Ultimately, the question is, does reading Skinner's original work enhance practice of behavior analysis by strengthening the scientist in the scientist-practitioner? Is it the case that every behavior analyst should have read some original work by Skinner? If it is the case, which particular works should be required? Is, for example, reading *About Behaviorism* (Skinner, 1974) sufficient, or can it be considered equivalent to reading *The Behavior of Organisms* (Skinner, 1938) or *Science and Human Behavior* (Skinner, 1953)? Or, is the implied expectation of reading the work of Skinner, from the senior scholars in our field, more about preserving the history of the field (in which case, it would be a more appropriate requirement in a course on the history of behavior analysis)? The answers to these questions are unknown, which has the advantage of allowing faculty academic freedom but the disadvantage of resulting in highly variable graduate training in EAB.

With the success of the BACB's credentialing efforts and the increased demand for practitioners with credentials, there has been a concomitant increase in graduate degree training programs in ABA. The proliferation of graduate training programs has spurred a debate on the content of training and how to evaluate the quality of graduate training programs for emerging behavior analysts (Dixon, Reed, Smith, Belisle, & Jackson, 2015; see also Volume 8, Issue 2, of *Behavior Analysis in Practice* for a commentary). One of the primary debates among behavior analysts is how graduate training can help preserve the scientist in the scientist-practitioner model. Some behavior analysts have advocated that graduate training should train emerging behavior analysts to be better applied researchers (Reid, 1992) and that the quality of graduate training should be measured based on research productivity (Dixon et al., 2015). Such advocates are in line with the long-standing tradition in ABA and the "Boulder model" of scientist-practitioner training, which emphasizes graduate training in research methodology (see Kelley et al., 2015, for a more in-depth discussion of this model). The traditional view in ABA is that pioneers of behavior analysis (e.g., Azrin, Carr, Baer) were all well versed in basic research and research methodology. Others, however, have argued that the training of behavior analysts should focus more on clinical skills and be modeled after how physicians are trained (Pritchard & Wine, 2015). Yet, other behavior analysts have purported that graduate training in the basic science and philosophy of behaviorism is necessary (Schlinger, 2015; Sidman, 2011) for

practitioners to be able to defend the science and think analytically. Although the objective of our study was simply to identify common readings in EAB coursework in ABAI-accredited graduate programs, we realize that our research questions and results have some bearing on the topic of graduate training in behavior analysis.

At this time, only the ABAI requires coursework in EAB. The BACB's task list and content areas can be covered without coursework in EAB. It is important to note here that the BACB and ABAI are functionally different from each other and have different missions. The BACB's mission is to "protect consumers of behavior analysis services worldwide by systematically establishing, promoting, and disseminating professional standards" (BACB, 2018b). The ABAI's mission, however, is "to establish and implement standards for the accreditation of educational programs in behavior analysis. . . to encourage, support, and recognize exemplary training of behavior scientists and scientist-practitioners" (ABAI Accreditation Board, 2018). Until recently, the BACB verified a course series by reviewing syllabi and determining that the courses met the requirements for a BACB credential (Shook & Johnston, 2011), whereas ABAI conducted a comprehensive review of multiple aspects of a program's environment. In fact, Carr and Nosik (2015) explained that BACB approval was designed to reduce the response effort associated with the application process for certification and should not be used to characterize quality of educational training. The BACB approval, then, mainstreamed the credentialing process and enabled practitioners to identify universities with verified course sequences that met the BACB's educational requirements. Alternatively, to this date, ABAI accreditation is completely voluntary and does not affect a practitioner's credentialing process. It is possible that even though the BACB does not require coursework in basic science, some BACB verified course sequences may incorporate just as many EAB readings as ABAI-accredited programs currently do. It is important to note that both the BACB and ABAI announced recently that the management of the verified course sequence system will be transferred from the BACB to ABAI on December 1, 2018 (BACB, 2018a). It is unclear how this transfer will affect the course sequences or the aforementioned distinctions between accreditation and verified course sequences.

As proponents of the inclusion of EAB coursework in behavior analysis graduate training, however, we are in agreement with Critchfield (2015) in that the logical next step in the development of our profession is to supplement the quality control the certification process provides and that doing so will increase consumer protection. Also, practitioners of behavior analysis would be more in line with other credentialed human service providers (e.g., licensed clinical psychologists and clinical social workers) if the BACB and ABAI aligned such that the educational requirements for the

credential to practice was restricted to, or highly influenced by, accreditation in graduate training (Kazemi & Shapiro, 2013). Such alignment would not only increase quality control of graduate training in behavior analysis but also increase the likelihood that university curricular committees would deem allocating resources to behavior analysis graduate programs for adoption of the ABAI requirements as warranted. In this study, we aimed to provide a resource to faculty voluntarily looking to develop EAB coursework or to incorporate EAB content into their graduate curricula. We hope that our findings shed some light on the breadth of the content in EAB and the need for more specific guidelines on what such a graduate course should include for standardization across programs. Furthermore, we hope our findings are useful when used with a collection of resources for coursework development and not interpreted as prescriptive, given the fact that instructors have their own contingencies and needs when developing an EAB course.

Acknowledgements We thank the faculty who contributed their course syllabi to our analysis and Timothy Hackenberg for his comments on a previous version of this manuscript.

Funding This study was not funded by a granting agency.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

- American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.
- Association for Behavior Analysis International. (2015). *List of ABAI accredited programs*. Retrieved from <https://www.abainternational.org/accreditation/accredited-programs.aspx>
- Association for Behavior Analysis International. (2017, September). ABAI accreditation handbook. Retrieved from https://baab.abainternational.org/media/110571/abai_accreditation_board_accreditation_handbook.pdf
- Association for Behavior Analysis International Accreditation Board. (2018, January). About the behavior analysis accreditation board. Retrieved from <https://baab.abainternational.org/about.aspx>
- Azrin, N. H., Holz, W. C., & Hake, D. F. (1963). Fixed-ratio punishment. *Journal of the Experimental Analysis of Behavior*, 6(2), 141–148. <https://doi.org/10.1901/jeab.1963.6-141>.
- Bach, P., & Hayes, S. (2002). The use of acceptance and commitment therapy to prevent the rehospitalization of psychotic patients: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 70(5), 1129–1139. <https://doi.org/10.1037/0022>.
- Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, 1, 91–97. <https://doi.org/10.1901/jaba.1968.1-91>.
- Bailey, J., & Burch, M. (2011). *Ethics for behavior analysts* (2nd expanded ed.). New York, NY: Routledge/Taylor & Francis.
- Behavior Analyst Certification Board. (2017, January). *Introducing the BCBA/BCaBA task list* (5th ed.). Retrieved from <https://www.bacb.com/wp-content/uploads/170113-newsletter.pdf>
- Behavior Analyst Certification Board. (2018a). *Verified course sequences*. Retrieved from <https://www.bacb.com/verified-course-sequences/>
- Behavior Analyst Certification Board. (2018b). *About the BACB*. Retrieved from <https://www.bacb.com/about/>
- Breland, K., & Breland, M. (1961). The misbehavior of organisms. *American Psychologist*, 16, 681–684. <https://doi.org/10.1037/h0040090>.
- Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, 18(2), 111–126. <https://doi.org/10.1901/jaba.1985.18-111>.
- Carr, J. E., & Nosik, M. R. (2015). On the complexity of correlating a graduate program's experiences with the success of its graduates: A response to Dixon et al. (2015). *Behavior Analysis in Practice*, 8(2), 163–164. <https://doi.org/10.1007/s40617-015-0091-y>.
- Catania, A. C. (2007). *Learning* (interim 4th ed.). Cornwall-on-Hudson, NY: Sloan.
- Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan.
- Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.
- Critchfield, T. S. (2015). What counts as high-quality practitioner training in applied behavior analysis? *Behavior Analysis in Practice*, 8(1), 3–6. <https://doi.org/10.1007/s40617-015-0049-0>.
- Critchfield, T. S., Buskist, W., Saville, B., Crockett, J., Sherburne, T., & Keel, K. (2000). Sources cited most frequently in the experimental analysis of human behavior. *The Behavior Analyst*, 23, 255–266.
- Dewey, J. (1896). The reflex arc concept in psychology. *Psychological Review*, 3(4), 357–370.
- Dixon, M. R., Reed, D. D., Smith, T., Belisle, J., & Jackson, R. E. (2015). Top 10 responses to the commentaries on Dixon, Reed, Smith et al. (2015). *Behavior Analysis in Practice*, 8(2), 165–169. <https://doi.org/10.1007/s40617-015-0094-8>.
- Dymond, S., & Critchfield, T. S. (2002). A legacy of growth: Human operant research in *The Psychological Record* (1980–1999). *The Psychological Record*, 52, 99–106.
- Falk, J. (1966). Schedule-induced polydipsia as a function of fixed interval length. *Journal of the Experimental Analysis of Behavior*, 9, 37–39. <https://doi.org/10.1901/jeab.1966.9-37>.
- Fleshler, M., & Hoffman, H. S. (1962). A progression for generating variable-interval schedules. *Journal of the Experimental Analysis of Behavior*, 5, 529–530. <https://doi.org/10.1901/jeab.1962.5-529>.
- Hackenberg, T. D. (2009). Token reinforcement: A review and analysis. *Journal of the Experimental Analysis of Behavior*, 91(2), 257–286. <https://doi.org/10.1901/jeab.2009.91-25719794838>.
- Hayes, S. C. (2004). Acceptance and commitment therapy and the new behavior therapies: Mindfulness, acceptance and relationship. In S. C. Hayes, V. M. Follette, & M. Linehan (Eds.), *Mindfulness and acceptance: Expanding the cognitive behavioral tradition* (pp. 1–29). New York, NY: Guilford.

- Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition*. New York, NY: Kluwer Academic/Plenum Publishers.
- Herrnstein, R. J. (1961). Relative and absolute strength of responses as a function of frequency of reinforcement. *Journal of the Experimental Analysis of Behavior*, 4, 267–272. <https://doi.org/10.1901/jeab.1961.4-267>.
- Hursh, S. R. (1984). Behavioral economics. *Journal of the Experimental Analysis of Behavior*, 42, 435–452. <https://doi.org/10.1901/jeab.1984.42-435>.
- Hursh, S. R., Madden, G. J., Spiga, R., DeLeon, I. G., & Francisco, M. T. (2013). The translational utility of behavioral economics: The experimental analysis of consumption and choice. In G. J. Madden, W. V. Dube, T. Hackenberg, G. P. Hanley, & K. A. Lattal (Eds.), *APA handbooks in psychology: APA handbook of behavior analysis: Vol. 1, Methods and principles* (pp. 191–224). Washington, DC: American Psychological Association.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, 27(2), 197–209. <https://doi.org/10.1901/jaba.1994.27-1978063622>.
- Johnston, J. M., & Pennypacker, H. S. (1993). *Strategies and tactics of behavioral research* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Kazemi, E., & Shapiro, M. (2013). A review of board standards across behavioral health professions: Where does the BCBA credential stand? *Behavior Analysis in Practice*, 6(2), 18–29. <https://doi.org/10.1007/BF03391799>.
- Kelley, D. P., III, Wilder, D. A., Carr, J. E., Rey, C., Green, N., & Lipschultz, J. (2015). Research productivity among practitioners in behavior analysis: Recommendations from the prolific. *Behavior Analysis in Practice*, 8(2), 201–206. <https://doi.org/10.1007/s40617-015-0064-1>.
- Laraway, S., Snyckerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis*, 36, 407–414.
- Lattal, K. A., & Doepke, K. J. (2001). Correspondence as conditional stimulus control: Insights from experiments with pigeons. *Journal of Applied Behavior Analysis*, 34, 127–144. <https://doi.org/10.1901/jaba.2001.34-127>.
- Lesieur, H. R., & Blume, S. B. (1987). South oaks gambling screen (SOGS): Instrument for the identification of pathological gamblers. *Journal of Psychiatry*, 144(9), 1184–1188. <https://doi.org/10.1901/jeab.1988.50-187>.
- Madden, G. J. (Ed.). (2012). *APA handbook of behavior analysis (Vols. 1–6)*. Washington, DC: American Psychological Association.
- Mazur, J. E., & Logue, A. W. (1978). Choice in a “self-control” paradigm: Effects of a fading procedure. *Journal of the Experimental Analysis of Behavior*, 30, 11–17. <https://doi.org/10.1901/jeab.1978.30-11>.
- Morris, E. K., Smith, N. G., & Altus, D. E. (2005). B. F. Skinner’s contributions to applied behavior analysis. *The Behavior Analyst*, 28, 99–131.
- Nevin, J. A. (1974). Response strength in multiple schedules. *Journal of the Experimental Analysis of Behavior*, 21, 389–408. <https://doi.org/10.1901/jeab.1974.21-389>.
- Pastrana, S. J., Frewing, T. M., Grow, L. L., Nosik, M. R., Turner, M., & Carr, J. E. (2016, September). Frequently assigned readings in behavior analysis graduate training programs. *Behavior Analysis in Practice*, 1–7. <https://doi.org/10.1007/s40617-016-0137-9>.
- Perone, M. (2003). Negative effects of positive reinforcement. *The Behavior Analyst*, 26(1), 1–14.
- Pierce, D. W., & Cheney, C. D. (2013). *Behavior analysis and learning* (5th ed.). Philadelphia, PA: Psychology Press.
- Pritchard, J. K., & Wine, B. (2015). Icing on the cake: The role of research in practitioner training. *Behavior Analysis in Practice*, 8(2), 140–141. <https://doi.org/10.1007/s40617-015-0074-z>.
- Rachlin, H., & Green, L. (1972). Commitment, choice and self-control. *Journal of the Experimental Analysis of Behavior*, 17(1), 15–22. <https://doi.org/10.1901/jeab.1972.17-1516811561>.
- Reid, D. H. (1992). The need to train more behavior analysts to be better applied researchers. *Journal of Applied Behavior Analysis*, 25(1), 97–99. <https://doi.org/10.1901/jaba.1992.25-9716795780>.
- Saville, B. K., Beal, S. A., & Buskist, W. (2002). Essential readings for graduate students in behavior analysis: A survey of the JEAB and JABA boards of editors. *The Behavior Analyst*, 25, 29–35.
- Schlinger Jr., H. D. (2015). Training graduate students to effectively disseminate behavior analysis and to counter misrepresentations. *Behavior Analysis in Practice*, 8(1), 110–112. <https://doi.org/10.1007/s40617-014-0028-x>.
- Shook, G. L., & Johnston, J. M. (2011). Training and professional certification. In W. W. Fisher, C. C. Piazza, & H. S. Roane (Eds.), *Handbook of applied behavior analysis* (pp. 498–510). New York, NY: Guilford Press.
- Sidman, M. (1960). *Tactics of scientific research: Evaluating experimental data in psychology*. New York, NY: Basic Books.
- Sidman, M. (2011). Can an understanding of basic research facilitate the effectiveness of practitioners? Reflections and personal perspectives. *Journal of Applied Behavior Analysis*, 44, 973–991. <https://doi.org/10.1901/jaba.2011.44-973>.
- Sidman, M., & Tailby, W. (1982). Conditional discrimination vs. matching-to-sample: An expansion of testing paradigm. *Journal of the Experimental Analysis of Behavior*, 37, 5–22. <https://doi.org/10.1901/jeab.1982.37-5>.
- Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. New York, NY: Appleton-Century-Crofts.
- Skinner, B. F. (1953). Operant behavior. In *Science and human behavior* (pp. 59–90). New York, NY: Free Press.
- Skinner, B. F. (1974). *About behaviorism*. New York, NY: Vintage.
- Terrace, H. S. (1963). Discrimination learning with and without “errors”. *Journal of the Experimental Analysis of Behavior*, 6, 1–27. <https://doi.org/10.1901/jeab.1963.6-1>.
- Zeiler, M. (1977). Schedules of reinforcement: The controlling variables. In W. K. Honig & J. E. R. Staddon (Eds.), *Handbook of operant conditioning* (pp. 201–230). Upper Saddle River, NJ: Prentice Hall.