Behavior Analysis in Practice (2023) 16:437–449
https://doi.org/10.1007/s40617-022-00751-3

DISCUSSION AND REVIEW PAPER

Current Dimensions of Applied Behavior Analysis in Mainland China: A Review of 20 Years of Research

Weihe Huang[1] · **Gabrielle T. Lee**[2] · **Xiaofan Zhang**[3]

Accepted: 4 October 2022 / Published online: 3 November 2022

Abstract

In the West, the field of applied behavior analysis (ABA) evolved over 7 decades from the experimental analysis of behavior. In this evolutionary process, seven dimensions of ABA emerged: applied, behavioral, analytic, technological, conceptual, effective, and generality. In contrast, ABA was introduced into mainland China only about 20 years ago as a direct result of the rise in autism diagnosis in that country, and only since then has it become an area of research there. The purpose of this study is to critically evaluate ABA research published in China by focusing on its seven dimensions. The results of our review reveal that the level of acceptance of and interest in the seven ABA dimensions varies across the studies sampled. Recommendations for the future development of ABA research in China are offered.

Keywords Applied behavior analysis · China · Culturo-behavioral analysis · Seven dimensions · Research

In the West, the field of applied behavior analysis (ABA) evolved from the experimental analysis of behavior. Seminal articles by Baer et al. (1968, 1987) articulated the emerging discipline's guiding principles and specified the following seven dimensions as key features of ABA: applied, behavioral, analytic, technological, conceptual, effective, and generality (Cooper et al., 2020). The applied dimension is defined by two components: the subject matter of a study must be socially important, and the goals for intervention should be validated by others besides the therapist and the individual being treated. The behavioral dimension requires that the target behavior in a study be observable and measurable. The analytic dimension requires a study to have a specific design and to demonstrate a strong experimental control. The technological dimension holds that a study must describe intervention procedures in detail so they can be replicated, and the study should have intervention integrity checks. The conceptual dimension is defined by contextual explanations for the outcomes offered in a study, explanations which must be related to basic principles of behavior analysis. The effective dimension requires that interventions make a difference in participants' lives and be supported by social validity data. Finally, the generality dimension means that meaningful generalization and maintenance of learned behaviors occurs.

It is essential to acknowledge that the science of applied behavior analysis by definition is progressive and allows for continuing development (Leaf et al., 2016). Thus, the seven dimensions should be viewed as guides rather than rigid rules for ABA research and practice. In his later work, for example, Risley (2002) reminded us that "Wolf and I intended that article to be heuristic . . . rather than definitive" (p. 269) In the same spirit, Baer later revealed his thinking process about a more concise conceptualization of generative principles of applied behavior analysis (Baer, 2002). To expand on the notion that the subject of a study must be socially important, Wolf subsequently delineated three levels of social validity (Wolf, 1978) whereas Schwartz and Baer (1991) proposed that social validity should include the participation of both direct and indirect

This article is based on an invited speech presented by the lead author at the Annual Convention for the Association of Behavior Analysis International in 2020. The authors thank Dr. Lin Du at Teachers College of Columbia University for reviewing an early draft of this article and providing the authors with valuable feedback.

✉ Gabrielle T. Lee
glee329@uwo.ca

[1] Creative Human Learning, Walnut Creek, CA, USA

[2] Faculty of Education, Western University, 1137 Western Road, London, ON, Canada

[3] Wuhan Linjie Rehabilitation Medical Center, Wuhan, China

consumers. Other researchers have cautioned that unintended outcomes might occur if the aforementioned seven dimensions are viewed as intractable. Fawcett (1991), for example, rightly argued that studying a narrow range of questions with methodological precision would only serve part of the discipline's purpose and large-scale community research might involve some new value criteria. Critchfield and Reed (2017) took a historical approach in arguing for "the fuzzy concept of applied behavior analysis research" (p. 123). The social importance referred to in the two iconic articles, according to Critchfield and Reed, primarily concerns topics or problems rather than methods, and the seven dimensions should be thought of as general parameters with many possible features rather than as a rigid structure that could become a bottleneck preventing broad social problems from being fully investigated within a behavior analytic framework. An important conclusion stemming from these insights is that the defining features of ABA involve a dynamic process; articulated dimensions should be congruent with scientific developments and particular societal conditions.

In the West, practice and research have continued to progress both methodologically and conceptually since the articulation of ABA as a formal branch of the discipline in 1968. In China, although scholarly interest in behaviorism and Skinnerian behaviorism dates to the 1980s, systematic dissemination of ABA did not happen until the beginning of the 21st century (Huang, 2001). From a culturo-behavior perspective, cultural practices are generated by social contingencies and maintained by their outcomes. Two cultural contingencies likely obstructed the earlier acceptance of behavior analysis in China. One of these variables can be characterized as a contrast between moralistic and evolutionary views of the world. In the Chinese elite culture that favors Confucianism, a moralistic view with a focus on the distinction between human and nonhuman animals has always been dominant. Confucianism differs from naturalistic views of the world that focus on biological evolution and are favored by the Western academic world (Zhu, 2021). Many contemporary Chinese scholars are highly skeptical of Skinnerian animal research models and have predominantly rejected the notion that behavioral laws can be applied to both human and nonhuman subjects. A second cultural variable is associated with a thought pattern that differs from the Western analytical tradition. In Chinese culture, the notion of synthesis has been a key feature of thought patterns for more than 2,000 years. As a result, traditional scholars have attended to the big picture rather than to analysis of detail (Li & Chen, 1988). One result of these cultural and historical influences is that at the end of the last century, behaviorism in general and applied behavior analysis in particular were generally ignored in China. Further, it is likely that these cultural variables affected the dissemination of ABA in China.

The status of behavior analysis in China started to rise around the year 2000 when ABA, for several reasons, began to be valued by researchers and professionals in that country. In the West, academics and scholars had already started using behavioral principles established by experimental lab studies to address social, political, and educational issues and had been promoting ABA as early as the 1950s and 1960s. In China, however, ABA was not systematically introduced until around the year 2000 when parents of children with autism and practitioners began to demand effective practices and therapies for autism (Clark & Zhou, 2005) and were able to access information about effective autism interventions (e.g., Lovaas, 1987). This development coincided with an increase in the diagnosis of individuals with autism in China and corresponding public health needs for effective treatments for this population. Like American parents of children with autism (Maurice, 1993), Chinese parents also started to advocate for ABA-based treatments. This movement resulted in (1) private agencies, often organized by parents of children with autism, starting to offer behavioral interventions (Zhou et al., 2014); (2) some medical doctors obtaining and sharing their ABA knowledge with parents (Huang et al., 2013); and (3) quasi-governmental organizations advocating and promoting ABA-based interventions for autism (Sun et al., 2013). Dissemination of information by international scholars during this period contributed to the movement. Renowned scholars and behavior analysts such as Joseph Morrow, Maria Malott, William Heward, and Ivar Lovaas, for example, held seminars and workshops in China. In 2000, the Society for the Advancement of Behavior Analysis provided a grant to an international scholar (the first author) to teach ABA courses at East China Normal University in Shanghai, China. Based on his teaching materials, the first ABA book in Mandarin, *Behavioral Intervention for Children with Autism and Developmental Disorders* (Huang, 2003), was published in China. In 2005, ABAI's 3rd International Conference was held in Beijing, China. Over the following years, ABA research emerged and continued to flourish in China, accelerating the dissemination of ABA. Researchers and professionals in the field of special education began to use single-case experimental designs to conduct research evaluating the efficacy of ABA-based intervention strategies (Du, 2001; Kennedy, 2014).

From 2010 to 2019, several significant events occurred in the dissemination of ABA in China. Several essential ABA books—*Applied Behavior Analysis,* 2nd ed. (Cooper et al., 2007/2012), *Verbal Behavior Milestones Assessment and Placement Program,* 2nd ed. (Sundberg, 2014/2017), and *Ethics for Behavior Analysts,* 3rd ed. (Bailey & Burch, 2016/2018)—were translated into Chinese and published in China. In 2013, behavior scholars Robert Koegel and Lynn Koegel presented workshops on pivotal response teaching in several Chinese cities, and a book on the application of pivotal

response teaching written in Chinese was published the next year (Li, 2014). From 2014 to 2019, seven Chinese universities and organizations offered BCBA or BCaBA verified course sequences in China. By the end of 2021, seven BCBA-Ds, 313 BCBAs, 486 BCaBAs, and 155 RBTs were available in the country, with many located in Hong Kong but not in mainland China (Behavior Analyst Certification Board, 2022).

On the demand side, it was estimated in 2020 that the total population of Chinese with autism was approximately 13 million individuals in mainland China (Zhou et al., 2020). This means that most individuals with autism were being served by behavioral practitioners who were not certified and may well have had limited knowledge and skill relating to ABA (Liu et al., 2016). Efforts to improve and sustain Chinese ABA practitioners' knowledge and skills, therefore, continued. Westemeier et al. (2020) implemented an organizational behavior management (OBM) intervention—the Consultant Workshop Model— to provide ABA supervisors and managers with a performance management system and evaluated its impact on ABA knowledge and skills among first-line practitioners. Results indicated that Chinese practitioners' knowledge and skills increased in many important aspects, offering hope that with further dissemination efforts the status of ABA in China could change for the better.

The decade between 2010 and 2019 witnessed the emergence of ABA research published in Chinese academic journals. Readers of these journals include academic researchers, professionals, educators, schoolteachers, and practitioners working with individuals with exceptionalities. Because research plays an important role in the guiding of practice, it is important to evaluate the quality of ABA-based studies published in Chinese journals. The seven dimensions of ABA research can serve as an outline for identifying strengths and weaknesses of ABA research in China and provide a general picture that can lead to further improvements in research quality and to sustainable impacts in Chinese society.

The purpose of this article is to evaluate the quality of Chinese language ABA studies with a focus on the extent to which the seven dimensions of ABA are addressed in research conducted and published in mainland China. Regions outside of mainland China, such as Hong Kong and Macau that have different academic governing bodies and histories of ABA development, are not included in this study. Based on our findings, we will also make recommendations for the future development of ABA research and practice in China.

Method

Inclusion and Exclusion Criteria

The intent of the present study was to evaluate the current level of ABA research conducted by Chinese scholars in Mainland China. Studies that met three criteria were selected for inclusion. These studies (1) employed an experimental design involving human participants and ABA interventions; (2) were published in the Chinese language; and (3) were conducted in mainland China. The studies were excluded if they (1) were review or conceptual articles; (2) used an eclectic treatment package; or (3) were published in English and involved Western scholars. This third exclusion criterion was included because there were some articles on ABA in China published in English and the authors of those articles included both Chinese scholars and Western scholars.

Search Procedure

To identify Chinese language ABA publications, a literature search was conducted in 2019 by the first author who was assisted by a behavior analyst in China. The database for the search was Guizhou Digital Library, a platform including two major Chinese databases: 中国知网 (China National Knowledge Infrastructure) and 维普论文检测系统(VIP Paper Check System). The search terms used to identify potential articles for review were "应用(applied) (OR) 行为(behavior) (OR) 分析(analysis)." This search function generated a list of all articles that included any combination of these words. The process yielded 116 records of potentially relevant articles. The titles of articles, the names of journals, and the affiliation of the author(s) of these articles were read to initially evaluate the appropriateness of the article for inclusion. Of the 116 records, 82 were excluded because, for instance, the titles or journals indicated the topics of study related to other disciplines than ABA. As an example, an article about "behavior analysis of electric powers" suggested that the article was a study of energy behavior in electricity systems rather than a study of human behavior. The screening process yielded a total of 34 full-text articles that were retrieved for study. These 34 articles were again reviewed and evaluated according to our inclusion and exclusion criteria. In the end, a total of 12 articles remained.

In the spring of 2020, two independent behavior analysts in China separately conducted additional searches of literature in order to expand the pool of articles we had recovered on ABA in China. They were aware of our inclusion and exclusion criteria, and they had access to the articles identified during the first round of search efforts. With a combination of manual checking of references from selected articles from the 2019 search and searching the China National Knowledge Infrastructure again using the same search terms, these analysts were able to identify six additional articles that were a good fit for this study. Thus, the total number of studies identified for the current review was 18.

Scoring of Seven Dimensions

The seven dimensions of ABA described by Baer et al. (1968, 1987) informed the selection of ABA indicators in the evaluation of each study. Each dimension was scored for two components: a score of 2 was recorded if a study included both components for that dimension, 1 if it included one of the two components, and 0 if both components were missing. Table 1 summarizes this set of scoring criteria, including the names of the dimensions, their defining components, and scoring criteria with examples for each of the seven dimensions.

The set of criteria outlined in Table 1 was used as the primary method of data analysis. For each study, the total possible score across seven dimensions was 14 (2 per dimension x 7 dimensions = 14); for each dimension, the total possible score across 18 studies was 36 (2 per dimension x 18 = 36). Percentages for each study and each dimension were calculated by dividing recorded scores by the total possible score and multiplying by 100.

We also analyzed the selected studies using one defining component for each dimension rather than two. The rationale for giving points for partial indications was to acknowledge that the seven dimensions of ABA research may be viewed as fluid parameters and with variable features that will vary across studies (Critchfield & Reed, 2017). For each dimension, the total possible score across 18 studies was 18 (1 per dimension x 18 = 18). Percentages were calculated for each dimension.

Interscorer Agreement

Point-to-point interscorer agreements for each item in the seven dimensions were obtained for 50% of the articles reviewed. Two assessors discussed the definitions of the seven dimensions and examples of scoring for each item before evaluation. The second assessor randomly selected nine articles and independently evaluated the seven dimensions for each article. The average agreement on scoring was 98.4% with a range from 93% to 100%.

Table 1 Defining components and examples for scoring of seven dimensions

Dimension	
Defining Component	Examples
Applied	
a. The subject matter is socially important	The goal of the study was to improve quality of life for individuals with autism
b. The goal(s) of intervention should be affirmed by others	Participants' parents had specific concerns
Behavioral	
a. Target behaviors must be observable	The study provided an operational definition for the target behavior
b. Target behaviors must be measurable	The study utilized an objective measurement
Analytic	
a. The study employs a specific design that allows examination of a functional relation	Single case designs; group designs
b. The study demonstrates experimental control	AB designs or between-group designs without randomization were considered lack of experimental control
Technological	
a. The study's intervention procedures are described in sufficient detail	The study included descriptions of the procedure (e.g., discrete trials teaching)
b. Procedural fidelity must be measured	The study reported procedural integrity
Conceptual	
a. Contextual explanations for the outcomes are provided	Environmental variables affecting outcome behaviors were analyzed
b. Explanations are related to basic behavior principles	Relevant behavior principles (e.g., three-term contingency) were utilized as explanatory variables
Effective	
a. The study must assess the result of intervention	Improvement was reported with qualitative or quantitative data
b. Social validity must be measured	Data for social validity or consumer satisfaction were reported
Generality	
a. Generalization is programmed or evaluated	The study procedure included generalization (e.g., multiple exemplars) or evaluated generalization after treatment
b. Maintenance is evaluated	The study reported data for maintenance
Scoring	2 = included both a and b reported, 1 = included either a or b, 0 = included neither a nor b

Results

Table 2 summarizes the scores of the 18 articles that had been identified for inclusion in our review: Deng et al., 2019; Ding et al., 2015; Du & Zhu, 2015; Hu et al., 2015; Huang et al., 2018; Liu, 2018; Liu & Liu, 2010; Ma, 2017; Tian, 2020; Wang et al., 2020; Xie et al., 2008; Xiong et al., 2010; Xuan et al., 2019; Yang et al., 2016; Zhang, 2020; Zhang & Xia, 2016; Zhu, 2013; and Zhu, 2018. The majority of the studies (12 studies, 66%) had been published in the 5 years between 2016 and the first month of 2020. Five studies (27%) had been published between 2010 and 2015, and one study (5%) had been published prior to 2010. Our data indicated that ABA research had emerged in China around the year 2010 and increased rapidly in the following years.

As shown in Table 2, the total score for each study ranged from 1 to 11 with an average of 5.8 (total possible score for each study = 14). Only three studies obtained a score of more than 10 (or 70% of the total possible score), and four studies scored between 7 and 9 (50%–70% of the total possible score). Over 60% of the articles (11 of 18) scored lower than 7 (50% of the total possible score) indicating an overall low coverage of the seven ABA dimensions.

Figure 1 shows the percentage of dimension scores across 18 studies. Percentage scores for each dimension was calculated by dividing each dimension's score across 18 studies by total possible scores (36) and multiplying by 100. The average percentage of dimension scores for all studies was 42% with a range from 14% (generality) to 67% (applied). Across all 18 studies, scores were relatively higher on the applied and behavioral dimensions (67% and 56% respectively) than on the other five dimensions, all of which fall below 50% (effective 47%; analytic 42%; conceptual 36%; technological 31%; generality 14%).

Applying less strict criteria—that is, including one defining component rather than two in all dimensions in the study—generated another quality indicator: 100% for the applied dimension, 89% for the behavioral dimension, 61% for the analytic and technological dimensions, 56% for the conceptual dimension, 89% for the effective dimension, and 17% for the generality dimension. The average dimension score was 67.6% across 18 studies.

Discussion

The intent of the present study was to critically review and evaluate ABA research published in China by using seven classic dimensions of ABA as evaluative criteria. For this purpose, the discussion session starts with a deeper look at the summary chart displayed in Fig. 1 and analyzes Chinese ABA literature by each dimension.

Applied

The applied dimension in ABA speaks to the importance of the problem forming the focus of a study. Twelve of the 18 studies selected for inclusion (67%) involved participants with autism who had skill deficits or behavioral difficulties. Three other studies involved participants with hearing impairments, cerebral palsy, or learning disabilities. The remaining three studies addressed issues concerning general education, mining safety, and environmental protection using ABA methods. Of 18 studies, however, only 5 reported efforts to acquire input from others on selecting the goals for intervention. Indeed, data in this dimension indicate that few researchers consulted with others in their circle of support when identifying target behaviors and establishing treatment goals for participants.

Addressing autism intervention is socially significant (National Autism Center, 2010). Researchers in China should be credited for responding to demands from parents and evaluating ABA-based interventions for individuals with autism in an attempt to become part of a solution. As research in ABA-based intervention for autism and other disabilities starts to grow, the diversity of ABA research is expected to increase as more and more researchers apply ABA methods to address social, political, or environmental issues.

Data in this dimension indicated that few researchers consulted with others in the circle of support when identifying target behaviors and establishing treatment goals for participants. Also from a social validity perspective, research proposals should be reviewed by professional peers. However, ethical approval was either not mentioned in the articles, or research ethics review committees did not exist in many universities in China (Zhang et al., 2014). Therefore, one relevant issue in the research process is a general lack of research ethics review to ensure ethical guidelines are followed during research.

Behavioral

Of the 18 studies reviewed, 4 provided observable and measurable operational definitions for the target behaviors. The definition of joint attention provided by Liu and Liu (2010) serves as a good example of an operational definition. The target behavior, joint attention, was characterized as involving initiative joint attention and responsive joint attention, and the behavioral characteristics for each type were specified (e.g., initiative joint attention includes the child's eye contact, gaze shift, pointing to a toy, showing his or her toys, pointing to parents). In contrast, 12 studies provided only a loose description of the target behaviors and 2 studies did not define target behaviors at all. As an example, one study reported that "through an interview with parents and teachers plus observations, it was found

Table 2 Summary of ABA research published in China

	Applied	Behavioral	Analytic	Technological	Conceptual	Effective	Generality	Total (%)
Tian (2020)								
Score/Item Description	1/ASD; no referral	1/standardized measure; targets not observable	2/group design (n=60); randomized control	1/5-step; no IC	0	1/statistical significance; no SV	0	6(43%)
Zhang (2020)								
Score/Item Description	1/deaf; no referral	2/tantrum defined; frequency	1/changing criterion (n=1); no control	1/reinforcement; no IC	2/explanation; 3-term contingency	1/tantrum reduced; no SV	0	8(57%)
Wang et al. (2020)								
Score/Item Description	1/ASD; no referral	1/SIB defined observable; not measurable	0/design not described (n=1); no control	0/ DTT, PRT procedures not described; no IC	1/explanation; no principles	1/ASD symptoms improved; no SV	0	4(29%)
Xuan et al. (2019)								
Score/Item Description	2/LD; teacher concern	1/study behavior not observable; duration (hr)	1/AB design (n=1); no control	1/antecedent-based procedure + behavior contract; no IC	2/explanation; 3-term contingency	1/study hr increased; no SV	0	8(57%)
Deng et al. (2019)								
Score/Item Description	2/ASD; parent, teacher concern	1/quiet behavior defined measurable; not observable	2/multiple probe across settings (n=1); exp. control	1/Stimulus control + DRO; no IC	2/explanation; FA	1/quiet time increased	1/generalized to home	10(71%)
Zhu (2013)								
Score/Item Description	1/ASD; no referral	1/food acceptance defined measurable; not observable	0/ n=1	1/DTT described; no IC	1/explanation; no principle	1/food acceptance increased; no SV	0	5(36%)
Zhu (2018)								
Score/Item Description	1/ASD; no referral	1/targets defined observable; not measurable	0/ (n=1)	1/DTT; DRO; DRA procedures described; no IC	1/explanation; no principle	1/targets improved; no SV	0	5(36%)
Ma (2017)								
Score/Item Description	1/ASD; no referral	0/biting not defined	0/ (n=1)	0	0	0	0	1(7%)
Liu (2018)								
Score/Item Description	1/typical; no referral	0/disruptive behavior not defined	0/ (n=1)	1/DRO, token economy procedures described; no IC	0	1/disruptive behavior decreased; no SV	0	3(21%)
Huang et al. (2018)								
Score/Item Description	1/ASD; no referral	1/development measure; behavior not observable	1/time series group design (n=80); no control	0/DTT procedure not described; no IC	0	1/ statistical significance; no SV	0	4(29%)

Table 2 (continued)

	Applied	Behavioral	Analytic	Technological	Conceptual	Effective	Generality	Total (%)
Yang et al. (2016)								
Score/Item Description	2/miners' safety; supervisor concern	1/standardized measure; targets not defined observable	0/(*n*=300)	1/behavior management procedures described; no IC	0	1/unsafe behavior decreased; no SV	0	5(36%)
Zhang and Xia (2016)								
Score/Item Description	2/eating disorder; doctor referral	2/defined and measured by a scale	2/group design (*n*=15); randomized control	0	0	Score: 1 Statistical significance; no SV	0	7(50%)
Hu et al. (2015)								
Score/Item Description	2/ASD; parent concern	1/theory of mind skills not observable; standardized measure used	2/multiple probe across participants (*n*=3); exp control	1/manualized procedure; no IC	1/explanation; no principle	2/targets improved; parent validated	2/generalization programmed; maintenance demonstrated	11(79%)
Du and Zhu (2015)								
Score/Item Description	1/CP; no referral	1/standardized measure; not observable	0/ (*n*=76)	0	0	1 targets improved; no SV	0	3(21%)
Ding et al. (2015)								
Score/Item Description	1/ASD S = 66	1/standardized measurement; targets not observable	1/time series group design (*n*=66); no control	0	0	0	0	3(21%)
Liu and Liu (2010)								
Score/Item Description	2/ASD; parent concern	2/joint attention defined; standardized measure	1/multiple baseline across participants (*n*=3); no control	1/DTT + NET described; no IC	1/explanation; no principle	1/joint attention increased; no SV	2/generalized; maintained	10(71%)
Xiong et al. (2010)								
Score/Item Description	1/ASD; no referral	1/standardized measurement, targets not observable	1/time series group design (*n*=76)	0	1/explanation; no principle	1/statistical significance; no SV	0	5(36%)
Xie et al. (2008)								
Score/Item Description	1/typical; no referral	2/littering behavior and amount of trash observable; measurable	1/ABA design; no control	1/prompt described; no IC	1/explanation; no principle	1/littering behavior and amount of trash reduced	0	7(50%)
Total (%)*	24 (67%)	20 (56%)	15 (42%)	11 (31%)	13 (36%)	17 (47%)	5 (14%)	

ASD autism spectrum disorder, *CP* cerebral palsy, *DRA* differential reinforcement of alternative behavior. *DRO* differential reinforcement of other behavior, *DTT* discrete trial teaching, *IC* integrity check, *LD* learning disability, *NET* natural environment teaching, *PRT* pivotal response training, *SV* social validity

*Percentage of scores for each dimension across 18 studies was calculated by dividing each dimension's score across 18 studies by total possible scores (36) and multiplying 100

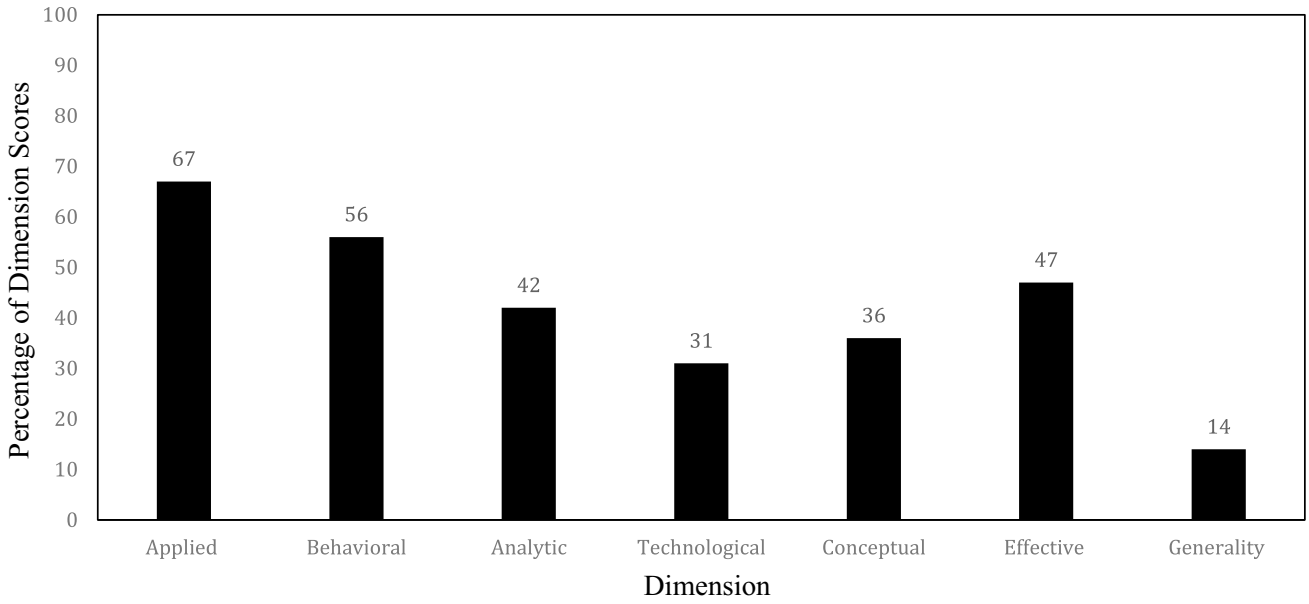

Fig. 1 Percentage scores for seven dimensions across 18 studies

that the child was displaying behavior of biting hands" (Ma, 2017) but the study provided no further information about the topography or intensity of biting behavior or how it was measured.

Closely related to the observable feature of target behaviors is their measurability. Several studies employed direct behavioral observation that functioned as the basis of measurement. Deng et al. (2019), for example, used duration to measure the participants' target behavior and Zhang (2020) measured the frequency of tantrum behavior. In general, however, the use of behavioral measurements was uncommon in ABA research possibly because of the dominance of group research methods or a lack of understanding of behavior measurement systems. Seven studies (39%) used standardized instruments such as ASD screening instruments or developmental assessments to measure dependent variables. Xiong et al. (2010) used an autism behavior checklist to obtain quantitative data on dependent variables. One problem with the use of standardized instruments to gather outcome data is that many of the scales are not sensitive to behavior changes. Another problematic issue was that some studies did not clearly describe measurements and reported improvement of target behaviors in subjective terms.

Analytic

The analytic dimension requires that a study specify an experimental design and include an experimental control. Six of 18 studies used single-subject designs. Of these six, three used multiple-probe/multiple-baseline designs. One study used a changing criteria design. Three studies adopted A-B or some type of reversal designs (e.g., A-B-A). Five studies used between- or within-group comparison designs. Of these five studies, two used a randomized controlled group design and three used a time-series design.

Some strengths concerning research methodology should be acknowledged. Multiple baseline/probe designs do not require researchers to withdraw a successful treatment while controlling threats to internal validity (Barlow & Hersen, 1984). Group designs such as randomized controlled group studies are generally considered to have good experimental control over threats to internal validity (Ray, 2000). Unfortunately, most of the studies we reviewed either did not specify a design or used a design with a weak experimental control.

Technological

The technological dimension concerns whether or not the procedures used in a study are described in sufficient detail to be replicable. Eleven of the 18 studies did indeed describe their interventions in some detail. The other seven studies provided no descriptions of their procedures, some only mentioning the name of the intervention (e.g., discrete trial teaching, pivotal response teaching). In general, information about treatment integrity was lacking across all the studies we reviewed. None of the studies reported procedural integrity or described procedures for assessing treatment fidelity or for the training of treatment implementers.

The methodological problems that exist here are significant. Descriptions of treatment procedures were not sufficiently detailed for replication; simply naming them is inadequate. Discrete trial teaching, for example, can vary in implementation, and these variations can result in different outcomes (Baer et al., 1987). Insufficient description of procedural details not only impedes replication of effective treatments but also makes it impossible to accurately interpret data thus threatening the validity of a study and limiting the impact of the research. As Baer et al. (1987) have pointed out, the behavior of professionals, just like the behavior of participants, should be monitored and assessed to ensure adherence to treatment procedures.

Conceptual

One of the theoretical questions the conceptual dimension asks is whether an experimental study offers any contextual explanations for outcomes. If such explanations exist, a follow-up question concerns whether they are derived from basic behavior principles. Of the 18 studies reviewed, 10 provided contextual explanations as to why the intervention worked. Three of the 10 studies further offered a conceptual explanation by relating changes to basic behavior principles such as three-term contingencies. One such example is the study by Deng et al. (2019), which reported not only the effectiveness of the intervention but also attributed the improvement to environmental impacts on the learner's behavior and a contingent relationship between discriminative stimulus, the target behavior, and the function of different reinforcement procedures.

Eight studies described procedures without providing contextual and behavioral explanations as to why these procedures worked. If researchers claim to use an ABA approach without identifying the relevant behavior principles or theories from which their treatments derive, the procedures could be simply a collection of unknown variables that may not align with outcome variables. Yang et al. (2016), for example, claimed to adopt an ABA approach to building a treatment model for reducing intentional unsafe behavior in a coal mine. This model consisted of three categories with four or five components in each category. Although unsafe behavior was reduced after implementing the model, the researchers admitted that the mechanism concerning why the model worked was unknown (Yang et al., 2016). A contextually and behaviorally oriented organizational behavior management approach could have been a potential solution to this issue. It is possible that these researchers simply replicated components of procedures from various other studies without a deep understanding of the theoretical background of those procedures; an alternative explanation is that these researchers may simply have limited knowledge of ABA.

Effective

The effective dimension asks questions about whether the interventions implemented in a study have led to desirable behavioral changes and whether these changes are significant. Sixteen of 18 studies reported positive results of ABA interventions, with 6 studies using statistical methods to demonstrate the significance of positive outcomes. One study reported mixed results: Ding et al. (2015) investigated the impact of a 3-month ABA intervention on the quality of life for 66 children with autism. Except in one domain, no significant changes were reported in these children's postintervention scores on a standardized measurement.

Despite significant improvements in behaviors reported by many researchers, social validity data such as consumer satisfaction are absent in these studies. Only one study (Hu et al., 2015) tried to validate the results of their interventions in the form of parent feedback. Indeed, social validity concerning participants' or their significant others' views of the acceptability of treatment procedures and satisfaction of outcomes is often omitted in ABA research published in China. Another methodological concern is that none of the reviewed studies reported interobserver agreement (IOA) data. Because we do not know whether the data presented are recorded consistently across different observers, the credibility of the data is questionable.

Generality

The generality dimension concerns the generalization and maintenance of learned skills or behavioral changes. Most of the studies reviewed failed to address generalization-related issues. Only 3 of the 18 studies described changes such as generalization of learned skills from a center environment to a home environment. Of these three studies, one described the procedures that actively programmed for generalization. Two of the 18 studies reported follow-up data. In both cases, positive maintenance occurred. There was a clear pattern that ABA studies conducted in China tended to neglect the gathering of data on generalization and maintenance. In fact, Chinese researchers' average score on the generality dimension was the lowest among the seven dimensions. The lack of data and awareness of generality severely limits the significance of these studies.

It is beyond the scope of this review to comprehensively analyze the reasons underlying the aforementioned features of ABA research in China. As a seed for future discussion, the following points are offered based on our findings and our understanding of Chinese culture. First, Chinese scholars have increasingly felt compelled to respond to the societal outcry for autism treatment. A fundamental focus of the Confucian value system is deep care for social issues (Yang, 1994). This tradition might help explain why

Chinese ABA researchers' highest score among seven dimensions lies on the applied dimension, which requires the subject matter of scientific research to be socially important. Considered from a perspective of culturo-behavioral analysis, the acceptance of ABA was greatly influenced by social and contextual conditions in China and to the rise in number of autism diagnoses at the beginning of the 21st century. Parents of children with autism who promote ABA in China had pragmatic goals in mind and, therefore, information on ABA in China is primarily related to autism rather than to other issues. ABA for autism is certainly socially important and Chinese scholars eventually turned their attention to this morally significant domain. Second, Chinese scholars influenced by traditional synthetic approaches to the world tend to be interested in general patterns or big pictures. Some might be insensitive to the analytic dimension, which requires detailed procedural descriptions to ensure accurate and reliable implementation and stringent experimental control to demonstrate functional relations. This cultural variable possibly accounts for low scores in the technological and analytical dimensions in the Chinese literature on ABA. Third, although ABA research is emerging and has increased rapidly in recent years, the seven dimensions of ABA are often not considered and planned for quality assurance of research. This could be attributed to a lack of overall understanding of ABA and its seven dimensions. An astonishing example is that even though many ABA books were being translated from English into Chinese at the time of the present review, no Chinese translation of the two classic articles on the seven dimensions exists to date.

It is imperative for ABA researchers in China to be knowledgeable about ABA and to use the seven dimensions as general guidelines for research planning. As efforts to disseminate ABA continue in China, we expect to see ABA research not only increase in quantity but also improve in quality in coming years. International behavioral scholars and Chinese scholars are encouraged to engage in dialogues about the philosophical underpinnings and theoretical approaches of behaviorism and Chinese culture to enhance mutual understanding and, more important, better integrate behavioral methodology in social science research among Chinese scholarly communities.

Limitations

Several limitations exist in this study and the results should be interpreted with caution. First, the studies reviewed include ABA studies published only in Chinese journals; ABA studies conducted in China by Chinese and Western scholars but published in English in international journals are not included in this study. Studies conducted in areas outside of mainland China, such as Hong Kong, are not included because these geographical areas maintain separate databases. The results of our evaluation, therefore, do not apply to ABA research conducted outside of mainland China nor does it apply to research not published in Chinese journals. The intent of the current study was to help improve ABA research in mainland China by critically evaluating the current level of Chinese scholarship on ABA. The findings cannot be generalized to ABA research published in English or to research conducted by Western scholars. Second, information about the Chinese journals in which the studies were published was not considered in our evaluation. Journal quality, ranking, peer review process, and acceptance criteria, for example, were not evaluated. The length of the studies we reviewed ranged from one to eight pages, which may indicate a journal's word or page limit, and may mean that, to meet acceptance criteria, authors may have had to omit content such as theoretical explanations or procedural details. It is also important to note that single-case designs commonly used in ABA research are not well-known within Chinese scholarly communities, and editors/reviewers may not possess the expertise to review these studies. Third, a comprehensive and exhaustive search for ABA publications in China was limited by the authors' limited access to Chinese databases. Some published ABA studies may have been inadvertently missed. Because our priority in the literature search process was primarily to identify as many studies as possible, IOA data were not collected in the literature search process. Our evaluation criteria in the seven dimensions are not meant to provide comprehensive quality indicators for research (e.g., Kratochwill et al., 2010) but to provide an initial step to guide ABA research conducted in China at this stage. Finally, we conducted a criterion-based review of a group of studies from China; we did not conduct a similar review and analysis of literature from other regions or languages, and it is not clear what an analysis of for example American English or Brazilian Portuguese studies would yield and how they would compare to this sample.

Conclusions and Recommendations

The ABA communities within and outside of China have made great strides toward conducting and disseminating ABA research over the last 2 decades, and such efforts are ongoing and becoming increasingly comprehensive. The development of ABA research and practice in China is still in an early stage in terms of quantity and quality. Quality research is important in guiding practitioners' practices and providing quality services in applied settings. Considering China's cultural background and social contingencies, and rather than simply providing research-specific suggestions, we offer the following recommendations for building solid foundations for facilitating quality research and practice. First, university-based ABA programs are urgently needed. They are essential to the improvement of ABA research and

practice in China. Existing problems with ABA research, for example, could be improved greatly if training in research methods were to become accessible to ABA researchers and professionals through courses offered in Chinese universities. To support this process, seminal articles in ABA such as those by Baer et al. (1968, 1987) should be translated into Chinese and incorporated into research training for ABA studies. Second, although some efforts have been made to introduce single-subject designs into China (Du, 2001; Kennedy, 2014), few Chinese scholars and journal editors understand their importance and applications, making studies that use single-subject designs difficult to publish in Chinese journals. Such publication bias inevitably limits researchers' motivation to submit manuscripts to Chinese journals and, more important, lessens their opportunities to reach a large Chinese audience that does not read English and that has limited access to international journals. Single-subject designs should be promoted to provide researchers with powerful and practical tools, particularly for research populations with great heterogeneity. Third, the current review was not a comparative analysis. Perhaps the methodology and findings from the current review will be useful in the assessment of research parameters in other regions of the world. For example, researchers who are interested in the status of Chinese ABA literature in the international community could use the same assessment criteria to evaluate English articles on ABA conducted in the same period to allow a meaningful comparison. Finally, understanding Chinese cultural variables is relevant not only for behavioral practitioners in China but also for practitioners working with Chinese families in Western countries. Chinese American parents influenced by Confucianism, for example, might feel uncomfortable with a behavior analyst using Skinnerian experimental analytical terms to explain the behaviors of their child. Practitioners with a sense of diversity should use culturally sensitive languages in communicating with their clients.

Applied behavior analysis is part of a set of interrelated sciences that help solve social problems. In order for ABA to make significant contributions to this web of sciences and to be relevant in a society, its disciplinary boundaries must be clearly defined by (1) identification of a unique subject matter; (2) a focus on this subject matter over time; and (3) establishment of boundary conditions between this discipline and other closely related disciplines (Hayes & Fryling, 2009). The historical development of ABA embodies this logic, a logic that is applicable to any scientific discipline. Baer et al. (1968) defined seven ABA dimensions in their seminal article, for example, and they later (Baer et al., 1987) characterized the power of those dimensions as providing a "disciplinary matrix" for ABA. It is because this disciplinary matrix or boundary was clearly defined at its onset that ABA as a scientific discipline has been able to make tremendous contributions to science in general and has achieved an admirable status in many countries. It is also because of this logic and context that we primarily employed the set of seven standards recommended by Baer et al. (1968) in evaluating Chinese language ABA publications. The Chinese ABA studies we reviewed demonstrated a relatively strong emphasis on the applied and behavioral dimensions. At this early stage, however, such an emphasis may not be sufficient to establish ABA as a separate discipline from other academic disciplines in Chinese research communities that also study human behavior. Our examination of Chinese ABA studies and Chinese cultural variables provides preliminary support for our optimistic view that, with collegial feedback such as that reported in this article, the seven dimensions of ABA could be readily incorporated into the Chinese context. In turn, some characteristics of Chinese culture such as the Chinese traditional holistic approach to human behavior can enrich ABA as an academic discipline that has so far been influenced primarily by Western cultures. Hayes and Fryling (2009) have observed that "as the disciplinary sciences develop there is a growing interest in interdisciplinary science" (p. 5). In other words, meaningful developments in the sciences and the application of scientific findings to solving societal problems depend not only on analysis but also on synthesis.

In conclusion, research that helps generate positive outcomes are more likely to survive and thrive (Mattaini & Cihon, 2019). Chinese behavioral researchers and professionals, although learning from the successful experiences of behavior analysts and scientists in other countries, need to continue improving ABA research and practice within China's social and cultural context. With continuous growth and improvement, we expect ABA to flourish across mainland China in the coming years and look forward to greater progress in research and practice in the Chinese behavioral community.

Declarations

Conflicts of interest The authors declare that there is no conflict of interest.

References

Baer, D. M. (2002). A small matter of proof. In W. J. O'Donohue, D. A. Henderson, S. C. Hayes, J. E. Fisher, & L. J. Hayes (Eds.), *A history of the behavioral therapies: Founders' personal histories* (pp. 253–265). Context Press.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*(1), 91–97. https://doi.org/10.1901/jaba.1968.1-91

Baer, D. M., Wolf, M. M., & Risley, T. R. (1987). Some still-current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 20*(4), 313–327. https://doi.org/10.1901/jaba.1987.20-313

Bailey, J. S., & Burch, M. R. (2018). *Ethics for behavior analysts* (3rd ed.) (SEEK Education, Trans.). Huaxia Publishing House. (Original work published 2016)

Barlow, D. H., & Hersen, M. (1984). *Single case experimental designs: Strategies for studying behavior change* (2nd ed.). Pergamon Press.

Behavior Analyst Certification Board. (2022). Retrieved July 10, 2022, from https://www.bacb.com/services/o.php?page=101135

Clark, E., & Zhou, Z. (2005). Autism in China: From acupuncture to applied behavior analysis. *Psychology in the Schools, 42*(3), 285–295. https://doi.org/10.1002/pits.20079

Cooper, J. O., Heron, T. E., & Heward, W. L. (2012). *Applied behavior analysis* (2nd ed.). (SEEK Education, Trans.). Wuhan University Press. (Original work published 2007)

Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). *Applied behavior analysis* (3rd ed.). Pearson.

Critchfield, T. S., & Reed, D. D. (2017). The fuzzy concept of applied behavior analysis research. *The Behavior Analyst, 40*, 123–159. https://doi.org/10.1007/s40614-017-0093-x

Deng, X. Y., Guo, D. H., Chen, M. L., & Wang, L. H. (2019). Qián shì kòng zhì hé qū bié xìng qiáng huà qí tā xíng wéi zēng jiā gū dú zhèng ér tóng ān jìng jiē shòu tā rén cān yǔ huó dòng de gè àn yán jiū. [Effects of using antecedent stimulus control and DRO for a child with autism to increase the duration of quietly accept others to joint activities]. *Chinese & Foreign Medical Research, 17*(2), 177–180.

Ding, D. W., Zhong, Y., Cheng, X. N., & Jiang, S. J. (2015). Yīng yòng xíng wéi fēn xī xùn liàn duì gū dú zhèng ér tóng shēng cún zhì liáng de yǐng xiǎng. [Effectiveness of applied behavior analysis training on the quality of life in children with autism]. *Chinese. Journal of Clinical Psychology, 23*(3), 564–566.

Du, X. X. (2001). Dan yi bei shi yan jiu zai te shu jiao yu zhong de yun yong. [Application of single subject research in special education]. *Chinese. Journal of Special Education, 29*(1), 8–10.

Du, X. Y., & Zhu, D. J. (2015). Yīng yòng xíng wéi fēn xī zài ér tóng nǎo tān kāng fù zhōng de yīng yòng. [Application of applied behavior analysis to the rehabilitation for children with cerebral palsy]. *Inner Mongolia Medical Journal, 6*, 12–13.

Fawcett, S. B. (1991). Some values guiding community research and action. *Journal of Applied Behavior Analysis, 24*(4), 621–636.

Hayes, L. J., & Fryling, M. J. (2009). Guest Editorial: Interdisciplinary Science in Interbehavioral *Perspective*. *Behavior and Social Issues, 18*, 5–9. https://doi.org/10.5210/bsi.v18i1.2753

Hu, M. J., Xu, S., Xu, J. C., & Feng, H. (2015). Yīng yòng xíng wéi fēn xī duì zì bì zhèng ér tóng xīn lǐ lǐ lùn néng lì jiào xué chéng xiào de gè àn yán jiū. [A case study on teaching the ability of theory of mind for children with autism based on applied behavior analysis]. *Journal of Modern Special Education (Higher Education), 7*, 44–51.

Huang, W. (2001). Xian dai xing wei xin li xue dui you er zi bi zheng de zhi liao ji qi xiao guo. [The effectiveness of current behavioral treatment for children with autism]. *Chinese Journal of Behavior Medicine Science, 10*, 380–382.

Huang, W. (2003). *Er tong zi bi zheng ji qi ta fa zhan xing zhang ai de xing wei gan yu:Jia zhang he zhuan ye ren yun de zhi dao shou ce.* [Behavioral intervention for children with autism and developmental disorders: A handbook for parents and professionals]. East China Normal University Press.

Huang, A. X., Jia, M., & Wheeler, J. J. (2013). Children with autism in the People's Republic of China: Diagnosis, legal issues, and educational services. *Journal of Autism & Developmental Disorders, 43*(9), 1991–2001. https://doi.org/10.1007/s10803-012-1722-6

Huang, C. M., Du, H. H., Wei, M. X., Wu, L. N., Li, S., & Lai, C. J. (2018). Jié gòu huà jiào xué lián hé yīng yòng xíng wéi fēn xī duì gū dú zhèng ér tóng de xiào guǒ. [Effects of treating children with autism with structured teaching and applied behavior analysis]. *Shenzhen Journal of Integrated Traditional Chinese & Western Medicine, 28*(10), 14–16.

Kennedy, C. H. (2014). *Single-case designs for educational research*. Pearson Press. (X.-M. Wei, M. Chen, X.-J. Yang, & L. Tian, Trans.). Huaxia Publishing House. (Original work published 2004)

Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). *Single-case design technical documentation*. Retrieved July 10, 2022, from https://ies.ed.gov/ncee/wwc/Document/229

Leaf, J. B., Leaf, R., McEachin, J., Taubman, M., Ala'i-Rosales, S., Ross, R. K., Smith, T., & Weiss, M. J. (2016). Applied behavior is a science and, therefore, progressive. *Journal of Autism and Developmental Disorders, 46*, 720–731. https://doi.org/10.1007/s10803-015-2591-6

Li, D. (2014). *Gu du zheng gan yu de guan jian xing ji neng xun lian fa.* [Pivotal response treatments for autism]. Beijing University Press.

Li, Z. L. & Chen, W. P. (1988). Zhong xi zhe xue bi jiao mian mian guan. [Comparisons of Chinese and Western philosophies]. East China Normal University Press.

Liu, C. L. (2018). Yīng yòng xíng wéi fēn xī zài xīn lǐ kè táng jiào xué zhōng de yīng yòng. [Application of applied behavior analysis in the psychological education classroom]. *Mental Health Education in Elementary & Secondary Schools, 358*, 27–33.

Liu, H., & Liu, L. H. (2010). Fù mǔ shí shī gū dú zhèng ér tóng gòng tóng zhù yì lì gān yù de xiào guǒ yán jiū. [On the effectiveness of parent-performed interventions on joint attention for children with autism. *Chinese Journal of Special Education, 2*, 36–41.

Liu, Y., Li, J., Zheng, Q., Zaroff, C. M., Hall, B. J., Li, X., & Hao, Y. (2016). Knowledge, attitudes, and perceptions of autism spectrum disorder in a stratified sampling of preschool teachers in China. *BMC Psychiatry, 16*, 142. https://doi.org/10.1186/s12888-016-0845-2

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting & Clinical Psychology, 55*(1), 3–9.

Ma, Y. (2017). Gū dú zhèng ér tóng bù liáng xíng wéi gān yù de gè àn yán jiū. [Intervention for problem behavior of a child with autism: A case study]. *Modern Vocational Education, 27*, 60.

Mattaini, M. A., & Cihon, T. M. (2019). Editorial: A new beginning and a new commitment. *Behavior and Social Issues, 28*(1), 1–7.

Maurice, C. (1993). *Let me hear your voice*. Random House.

National Autism Center. (2010). *An educator's manual to evidence-based practice and autism* (2nd ed.). National Autism Center. Retrieved July 10, 2022, from https://www.nationalautismcenter.org/resources/for-educators/

Ray, W. J. (2000). *Methods toward a science of behavior and experience* (4th ed.). Wadsworth.

Risley, T. R. (2002). Do good, take data. In W. J. O'Donohue, D. A. Henderson, S. C. Hayes, J. E. Fisher, & L. J. Hayes (Eds.), *A history of the behavioral therapies: Founders' personal histories* (pp. 267–287). Context Press.

Schwartz, I. S., & Baer, D. M. (1991). Social validity assessments: Is current practice state of the art? *Journal of Applied Behavior Analysis, 24*(2), 189–204.

Sun, X., Allison, C., Auyeung, B., Matthews, F. E., Murray, S., Baron-Cohen, S., & Brayne, C. (2013). Service provision for autism in mainland China: A service providers' perspective. *Research in Developmental Disabilities, 34*(1), 440–451. https://doi.org/10.1016/j.ridd.2012.08.010

Sundberg, M. L. (2017). *VB-MAPP: Verbal behavior milestones assessment and placement program* (2nd ed.; W. Huang & D. Li, Trans.). Peking University Medical Science. (Original work published 2014)

Tian, P. (2020). Yīng yòng xíng wéi fēn xī zài zì bì zhèng ér tóng kāng fù xùn liàn zhōng de yīng yòng. [Application of applied behavior

analysis to rehabilitation training of children with autism]. *China Health Nutrition, 30*(3), 91.

Wang, H. L., Wang, N., & Zhang, Y. (2020). Yīng yòng xíng wéi fēn xī (ABA) liáo fǎ duì gū dú zhèng ér tóng gān yù xiào guǒ de gè àn yán jiū. [Effectiveness of applied behavior analysis (ABA) treatment for children with autism: A case study]. *Journal of Jiamusi Professional College, 206*(1), 267–268.

Westemeier, S., Huang, W., & Li, D. (2020). Using a consultant workshop model to improve performance management in Chinese autism agencies: A preliminary study. *Journal of Organizational Behavior Management, 40*(1–2), 93–107. https://doi.org/10.1080/01608061.2020.1749213

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis, 11*(2), 203–214.

Xie, S. Y., Ye, H. P., Chen, L., & Hu, J. (2008). Xíng wéi fēn xī fǎ zài sàn luàn lā jī guǎn lǐ zhōng de yīng yòng yán jiū. [A study on the application of behavior analysis methods into the management of scattered litters]. *Journal of Huazhong Normal University, 42*(4), 641–645.

Xiong, N. N., Ji, C. Y., Bo, H. L., Wang, X. Q., Shi, J. L., Chen, Y. H., Chao, Y., Chen, Y., & Li, Y. (2010). Gū dú zhèng ér tóng lín chuáng zhèng zhuàng jí mǔ qīn xīn lǐ zhuàng kuàng de xíng wéi xíng wéi fēn xī gān yù xiào guǒ. [The effectiveness of applied behavior analysis intervention on clinical symptoms of children with autism and psychological condition of their mothers]. *Chinese*. *Journal of Rehabilitation Medicine, 25*(10), 970–973.

Xuan, Y. N., Ren, L., & Dai, M. J. (2019). Yīng yòng xíng wéi fēn xī gān yù " xué xí kùn nán xíng " xué shēng de gè àn yán jiū. [A case study on the intervention of behavioral analysis on students with learning difficulties]. *Journal of Hebei North University (Social Science Edition), 35*(1), 110–113.

Yang, G. R. (1994). *Shan de li chen: Ru jia jia zhi ti xi de li shi yan hua ji qi xian dai zhuan huan [The journey of virtue: The historical evolution of Confucian value system and its contemporary transformation]*. Shanghai People's Press.

Yang, J. L., Shu, J. Z., Feng, G. R., & Kuang, L. X. (2016). ABC fēn xī fǎ zài méi kuàng yì xiàng xìng bù ān quán xíng wéi guǎn lǐ zhōng de yīng yòng. [Application of ABC behavior analysis in coal mine intentional unsafe behavior management]. *China Safety Science Journal, 26*(5), 140–145.

Zhang, Y. J. (2020). Yīng yòng xíng wéi fēn xī fǔ zhù lóng shēng kòng zhì qíng xù de gè àn. [Using applied behavior analysis to help students who are deaf regulate emotions: A case study]. *Mental Health Education in Primary & Middle Schools, 424*(5), 41–44.

Zhang, A. X., & Xia, W. (2016). Yīng yòng xíng wéi fēn xī duì zì bì zhèng ér tóng yǐn shí zhàng ài de zhì liáo. [Applied behavior analysis treatment for eating disorders among children with autism]. *Frontiers of Medicine, 34*, 185–186.

Zhang, X., Zhang, W., & Zhao, Y. (2014). *The Chinese ethical review system and its compliance mechanisms*. TRUST Equitable Research Partnerships. Retrieved July 10, 2022, from http://trust-project.eu/wp-content/uploads/2016/03/Chinese-Ethics-Review-System.pdf

Zhou, W.-Z., Ye, A. Y., Sun, Z.-K., Tian, H. H., Pu, T. Z., Wu, Y.-Y., Wang, D.-D., Zhao, M.-Z., Lu, S.-J., Yang, C.-H., & Wei, L. (2014). Statistical analysis of twenty years (1993 to 2012) of data from mainland China's first intervention center for children with autism spectrum disorder. *Molecular Autism, 5*, 52. https://doi.org/10.1186/2040-2392-5-52

Zhou, H., Xu, X., Yan, W., Zou, X., Wu, L., Luo, X., Li, T., Huang, Y., Guan, H., Chen, X., Mao, M., Xia, K., Zhang, L., Li, E., Ge, X., Zhang, L., Li, C., Zhang, X., Zhou, Y., Ding, D., Shih, A., Fombonne, E., Zheng, Y., Han, J., LATENT-NHC Study Team. (2020). Prevalence of autism spectrum disorder in China: A nationwide multi-center population-based study among children aged 6 to 12 years. *Neuroscience Bulletin*, *36*(9), 961–971. https://doi.org/10.1007/s12264-020-00530-6

Zhu, D. Y. (2013). Yīng yòng xíng wéi fēn xī fāng fǎ jiǎo zhèng zì bì zhèng ér tóng piān shí. [Using applied behavior analysis to modify picky eating of a child with autism]. *Social Welfare, 7*, 41–42.

Zhu, Y. M. (2018). Yīng yòng xíng wéi fēn xī lǐ lùn zhǐ dǎo xià de gū dú zhèng xué shēng jiào yù shí jiàn. [Applied behavior analysis oriented educational practice for a student with autism]. *Mental Health Education in Elementary & Secondary Schools, 362*, 47–54.

Zhu, Y. T. (2021). *A panoramic history of traditional Chinese ethics*. Springer.